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Key Potential and Barrier Factors for Promotion of Environmentally Sustainable Buildings

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Abstract: The world's interest is growing in green development to improve the climate and help countries move toward a low-carbon economy. Still, the slow green and sustainable development movement is a concern for many countries due to barriers to environmental sustainability development. Therefore, Architects and stakeholders should focus on environmentally sustainable buildings. This paper aims to reveal the potential and barriers to promoting environmentally sustainable buildings. The meanings of sustainability were investigated and its Key Performance Indicators, and 121 papers from reputable scholarly journals and conferences were studied through searching, screening, and classifying. The explored literature revealed stakeholders' perceptions towards sustainable buildings and the barriers to environmental sustainability development; this led to the conclusion of the key potential and barrier factors to promote environmentally sustainable buildings. A theoretical framework was proposed to tailor these success factors to architectural practices. This framework can mitigate the barriers to adopting environmental sustainability when validated in further research.

Keywords: sustainable buildings; environmental sustainability; key performance indicators of sustainability; barriers; stakeholders' perceptions.

1. Introduction

With the continuous growth of the world, the need for environmentally sustainable buildings during this period for the whole world is vital[1] since the world's interest is growing towards sustainability to improve the climate and help countries move toward a low-carbon economy[2]. Sustainable buildings are designed and operated so that materials are used and reused productively and sustainably throughout their life cycle. Furthermore, sustainable architecture aims to create and innovate a healthy artificial environment based on ecological design and resource efficiency[3]. In this way, sustainable buildings can significantly contribute to the environment and thus to society, satisfying both current and future generations[4]. Moreover, there is a similarity between buildings and living creatures: they can be healthy, breathe, get sick (sick building syndrome), develop pathologies (building pathology), and die. Sometimes buildings give the impression that they are happy or suffering. Therefore, Hippocrates' "first, do not harm" should also apply to buildings. An ill building will make the inhabitants sick as well[5].

Some studies tried to investigate the meaning of sustainability in architecture, and some reached common considerations while addressing this topic [7]. However, researchers considered features of sustainable building are connected with three primary objectives social, economic, and environmental[7]; researchers added the "technical" aspect, including flexibility and adaptability optimization, as a new indicator of the three leading pillars of sustainability [3], despite that other perceptions claim that sustainable design in the architecture field cannot be defined with mathematical objectivity[5]; sustainable buildings are more than a technological add-on[8], they are not an assembly of materials, technologies, and systems[5], it requires an architectural idea and a concept that fulfills the Vitruvian Triad: stability, utility, beauty[5], sustainable architecture performance should not assume that incorporating technological innovations equal green[9].
Sant Chansomsak et al.[7] tried to understand and enhance the meanings of sustainable architecture by studying and analyzing two case studies from developed and developing countries. They reached out to more in-depth definitions of the relationship between sustainability and architecture, including Architecture about Sustainability, Architecture for Sustainability, and Architecture as Sustainability as the following:

- Architecture about sustainability usually includes sustainable elements or strategies.
- Architecture for sustainability applies sustainability as the project's goal and uses sustainable techniques as the basic design.
- Architecture as sustainability includes processes from preliminary design, design, construction, operation, renovation, and demolition to creating new projects.

It is significant to speak of architecture about sustainability and for sustainability simultaneously. Stakeholders should aim to create at least architecture for sustainability and not just add terms about sustainability into conventional practices[7]. Therefore, sustainable practices in building construction will reduce harmful impacts on the environment [10]. Architectural design based on environmental conservation is the only option to maintain quality of life and avoid long-term ecological damage[8].
This paper discusses the meaning of sustainability with a deep investigation into the meaning of sustainability in architecture, trying to understand sustainability pillars with a concentration on Environmental Sustainability and related aspects. While technical aspects were valued in sustainable buildings, the stakeholders' perceptions played a crucial role in overcoming barriers to environmental sustainability adoption. This paper reviews stakeholders' perceptions and the obstacles that sustainable buildings faces in various countries, aiming to reveal the potential and barriers to promoting environmentally sustainable buildings.

2. Method

This paper combines academic papers and conference proceedings by searching for keywords, original content, and data from official websites. This paper mainly depends on several databases such as Web of Science and Scopus. This study used the database and keyword searches to identify relevant and recent environmental sustainability articles. The method of this paper consists of three steps. The first was searching the extant literature for the keywords "Sustainable Buildings; Environmental Sustainability; Environmental Performance; Key Performance Indicators of Sustainability; Barriers; Stakeholders' Perceptions", and the research questions including what is environmental sustainability? To what extent do the stakeholders support the adoption of sustainable buildings? What are the barriers to environmental suitability development in various countries? How to overcome these barriers? How do the stakeholders perceive sustainability? And how to promote environmental sustainability?. A group of 121 potential studies has been identified and screened to determine their relevance. A set of predetermined rules provides a basis for including or excluding certain studies. Considering that the research is specific to the architectural field, The researcher is not biased toward personal opinions, the strength and relevance of keyword research., diversity of sources, and the recentness of the search. Forty-eight research papers were studied closely, notes were taken for fourteen papers, and fifty-nine were excluded due to irrelevancy.

The following step involves gathering and extracting applicable information from each primary study included in the sample and deciding what is relevant to the problem of interest and recorded mainly depending on the initial research questions. These data illustrate the meaning of sustainability and its key performance indicators, focusing on environmental performance and exploring the stakeholders' potential and barriers to adopting sustainable practices, including stakeholders' perception of environmental sustainability.

As a final step, the explored literature research revealed the interactions between stakeholders' potentials and barriers to adopting sustainable practices; this led to the conclusion of the key potential and barrier factors to promote environmentally sustainable buildings in the predesign and design phase. Hence, a theoretical framework was proposed to tailor these success factors into architectural practices.

3. Key Performance Indicators of Sustainability "KPIs."

Sustainability has three pillars: environmental, economic, and social, called the triple bottom line. The social, economic, and political structures that trigger building-making need to be reformed so that designers can use their skills to provide natural sound environments in the broadest sense[5]. Therefore, all these dimensions should be considered and addressed sufficiently to make a sustainable product. Identifying the significant indicators of all the sustainability dimensions that can be used to assess the sustainability performance of new and existing buildings is essential to enhance the possibility of producing sustainable buildings. A building is considered a sustainable product only when all environmental, economic, and social sustainability aspects are considered and addressed throughout its life cycle. Over seventy evaluation and classification tools based on sustainability indicators have been developed[11], focusing on environmental characteristics[11]. They deal with the environmental aspect of sustainability as the key focus; thus, they do not consider socio-cultural and economic dimensions, which is a limitation.

Based on the studying of eight reviewed and published scientific papers using the keywords of economic, social, and environmental sustainability indicators, Key performance indicators of sustainability were listed according to their frequency in sources, as shown in Table 1.

Table 1. Key performance indicators of sustainability "KPIs."

Environmental	Citation	Social	Citation	Economic	Citation
Water conservation	[4][11] [12][13] [14] [15]	Daylight/visual comfort	[4][11][16] [15]	Maintenance cost	[4] [14] [16] [15]
Recycling of water	[4][11] [15]	Innovation/design of the building	[4] [12]	Fire prevention	[4]
Reduction of water pollution	[4][11] [14] [15]	Ventilation	[4] [16]	Early project planning cost	[4] [14][15]
Reduction of air pollution	[4][14] [17]	Indoor air quality	[4] [11] [12] [16] [15]	Operation cost	[4] [11][14] [16] [15]
Reduction of solid waste/waste management	[4][11] [13][14] [17]	Level of awareness of sustainability	[4]	Adaptability to utilization change/flexibility	[4] [11][12]
Ecology	[4] [13]	Quality of living	[4] [17]	Renovation cost	[4] [14]
Usage of biodegradable/ recycled/renewable material	[4][11] [12][13] [14][15]	Health, comfort, and well-being of occupants	[4] [11] [12] [13][16][17]	Cover against environmental risks	[4]
Low GHG emissions	[4][11] [12] [17]	Acoustic comfort	[4] [15]	Provision of local employment	[4]
Usage of green/ renewable energy	[4][11] [12][13]	Barrier-free construction	[4]	Initial cost	[4][11][17]
Avoiding bio-sensitive area	[4]	Participation of residents/public perception	[4] [13]	Return on investment	[4][11][16] [17]
Avoiding disaster-sensitive area	[4]	Incorporation of safety features	[4] [11] [13] [14][16] [17]	Construction time	[4]
Noise reduction	[4][11] [14]	Conservation of cultural monument/ cultural heritage integration	[4][11] [12] [13][14][16]	Marketability	[4] [14]
Amount of borrowed soil/soil use rate	[4] [17]	Prevention of electromagnetic pollution/ materials toxicity	[4] [16]	Price for sale or rental	[4]
Amount of concrete usage	[4]	Security within building	[4] [17]	Design and construction time	[11]
Vertical green planting usage	[4]	Entertainment features	[4]	Integration of supply chains	[11]

Project development area ratio	[4]	Fair sharing of benefits	[4]	Building manageability	[12]
Usage of green-certified items	[4]	Solvent-free paintings	[4]	Direct cost	[13][14] [16]
Climate change/atmosphere consideration	[13]	Aesthetic options and beauty of the building	[11] [12] [16]	Indirect cost	[13][14] [16]
Transport and accessibility /alternative transportation	[11] [12] [13]	Functionality/ and physical space usability	[11][12] [16]	Bureaucracy	[16]
Energy performance and efficiency strategies	[11] [13] [17]	User acceptance and satisfaction	[11] [17]		
		Neighborhood accessibility and amenities	[11][14] [16]		
		Thermal comfort/ hydrothermal comfort	[16] [15]		

The previous table shows that water conservation, green/ renewable energy usage, "biodegradable/ recycled/renewable" material, solid waste/waste management reduction, and low GHG emissions are the most common environmental sustainability factors. At the same time, the most frequent social indicators are conservation of cultural monument/ cultural heritage integration, indoor air quality, health, comfort, and well-being of occupants, incorporation of safety features, daylight/visual comfort, neighborhood accessibility and amenities, and aesthetic options and beauty of the building. Moreover, the indicators of economic items are not widely explored in the papers, but the most frequent indicators are maintenance cost, operation cost, adaptability to utilization change/flexibility, return on investment, early project planning cost, and indirect cost.

However, different approaches and requirements of sustainability assessment models are based primarily on criteria and indicators, lópez et al.[18] investigated the challenges of applying these approaches in general practice, and proposed some requirements for the implementation of the indicator system as follows:

- All stakeholders need to reach a consensus on the identification and selection of indicators and on how they will be assessed and controlled throughout the project life cycle PLC
- Sensitivity ranges must be set for different indicators, considering regional variations.
- Public administrators, private promoters, and developers must adopt sustainability as a critical requirement in project specifications.

From this conclusion, the sustainability assessment approaches need to be tailored to fit the stakeholders' perceptions, regional variations, and governance.

4. Environmental Performance "EP"

The environmental performance involves a combination of factors that can be measured to understand a building's, project's, product's, or process's environmental impact during construction, use, and disposal. The factors involved often indicate how many resources a building consumes over its life cycle and how its materials can be recycled or reused. [19]. Another definition states that "environmental performance is the commitment of organizations to preserve and protect the natural environment with its multidimensional characteristics, such as maintaining the quality of water, air, and soil" [20]. In addition, environmental performance refers to the impact of an industry's activities and products on the natural environment, such as resource consumption, waste generation, and emissions[20].

From the Key performance of sustainability, factors that can be used to measure environmental performance include:
Source of materials, use of materials, Energy source, Energy consumption, Water source, Water consumption, Flexibility, durability and resilience, Pollution and waste processing, Transport, Landscape and ecology, Deconstruction, disposal, and some broader measures, including aspects of personal, social, and economic welfare[19]–[23]. These measures match with the sustainability key performances index in table 1.1 but are limited to environmental sustainability with slight attempts of several researchers to introduce other factors to sustainability.

In addition, based on prior research, Nikos Papamanlois [22] classified the main environmental factors affecting the building into internal and external factors. The internal factors include indoor temperature, humidity, air quality, and noise, whereas the external factors are metrological, air pollution, noise, and soil moisture. According to Nikos, internal and external factors influence energy and environmental behavior, indoor environmental quality, and structural damage[22].

4.1 EP in Architecture Practice

Several kinds of environmental approaches can be applied to the building design concept. There is a challenge to achieving sustainable building design and considering the design's environmental conditions and architectural and socio-economic aspects. Buildings' environmental influences are mostly variable by their very nature. This assumption creates a need for diverse solutions in environmental design that can facilitate building performance. In recent years, research efforts have been devoted to developing new assessment methods and improving existing methods for measuring the environmental performance of buildings. Comparative analysis usually comes with these efforts. Among the existing GB assessment methods, LEED, CASBEE, DGNB, BREEAM, Green Star, Green Mark, ESGB, GBL, Ecoeffect, Eco profile, ESCALE, HK-BEAM, BEAM Plus, GB Tool, and SB Tool are commonly used and compared to each other[24], besides the local rating system of Egypt, "the Green Pyramid." These comparisons, analyses, and gaps in the assessment methods can be found in these references from 1998 to 2022 [24]–[38].

However, attempts to optimize the environmental performance only (emphasizing technical aspects) instead of searching for equilibrium with other elements, such as architectural building quality (aesthetical), socio-cultural and economic aspects, represent a risk to the architecture quality [30]. Finding such an equilibrium between environmental performance and architecture will promote the concept of environmental sustainability in architecture.

The attempt to link the environmental performance of the building with several main goals is familiar, but it has several different forms, and many have tried to use and improve it. Some of them set goals for sustainability [17], and sustainability indicators emerge. Others use categories, set criteria for each category, and then identify indicators for each criterion[24] familiar with well-known environmental assessment methods. These indicators are easily converted into architectural practice and then measured and reviewed with the primary goals or categories.

5. Perceptions Towards Environmentally Sustainable Buildings

Scholarly contributions to green buildings emphasize efficiency and high technology to solve environmental problems[39]. Even though architects perceive green buildings differently from other stakeholders and the public, more work needs to be done on the stakeholders' perception of environmentally sustainable buildings.

Environmentally sustainable building studies focused on analyzing and comparing technical solutions related to certification standards, energy efficiency, water performance, and indoor environmental quality. There is low participation among stakeholders, especially occupants participating in developing sustainable buildings in many countries[40]. Stephen Poon[9] assumes that there is thus a need to re-examine perceptions of green building technology as architecture's ends rather than means and that sustainable architecture performance should not take that incorporating technological innovations equals green. Table 2 shows the map of stakeholder perceptions toward environmentally sustainable buildings based on the selected references.

Row 1: represents the targeted stakeholders whom eight selected papers aimed to examine their perceptions towards green buildings through interviewing or questionnaires

Row 2: state the factors that affect the stakeholders' perceptions, which influence the personal perception.

Row 3: state the improved areas in the existing green buildings extracted from post-occupancy surveys from the literature.

Row 4: the considerations recommended by the stakeholders to be taken to improve sustainable development.

Row 5: state the areas that need more attention and further improvement.

Row 6: the common challenges and questions that previous research couldn't answer.

From the perceptions, the potential value of green architecture is influenced by the social perceptions of innovations by incorporating what stakeholders might view as realistic solutions for construction and material use, energy savings, usage diversity, and reduced maintenance, thus highlighting the importance of stakeholder engagement. Also, the stakeholders need to be aware of the benefits of participating in green building development; these benefits are not limited to what the GB already affords. Still, some areas need to be enhanced, like the incentive program for the owner to encourage them to adopt environmental sustainability.

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Table 2. stakeholder perceptions map

1	**Targeted**	Building users	architects	developers	Decision makers	Policymakers		
2	**Factors affecting**	degree of belief in sustainability [48]		degree of green certification [48]	the congruity of design with the existing schema of similar conventional buildings [48]		users' personal experience in the building [48]	
3	**Improved areas**	social benefits to stakeholders [9]	firm's approach and commitment towards sustainability [1]		stakeholder engagement [9]	aesthetic-based designs [9]	government regulatory [1]	incentive programs [1]
4	**Considerations**	Sustainable architecture performance should not assume that incorporating technological innovations equal green. [9]	There is thus a need to re-examine perceptions of green building technology as architecture's ends rather than means. [9]	The respondents consider green buildings as a key weapon against the climate change [49]	Green building can fetch higher resale value and it is good for value retention of the property, across all stakeholders. [49]	To build a fuller picture of opportunities and challenges for working towards sustainable practice in construction, use of qualitative approaches (including the value of focus discussions with Client groups) should be explored in future work. [1]	The main reason behind sustainable implementation in construction practices is due to the fulfillment of legal requirements as well as the environmental responsibilities [51]	Both environmental perceptions and physiological pathways drive occupant health in green and conventional buildings. [50]
5	**areas need improvement**	social benefits to stakeholders [9]	stakeholder engagement [9]	firm's approach and commitment towards sustainability [1]	aesthetic-based designs [9]	government regulatory [1]	incentive programs [1]	

6	**Challenges**	Pertinent questions on functionality, resource utilization and design construction processes [9]	How to incorporate perception scores into rating tools? [47]	Adoption of sustainable practice. [1]

6. Barriers Towards Environmental Sustainability Development

The spread of environmentally sustainable development and the adaptation of sustainability technologies are hindered by specific barriers, such as complexity, limited understanding of sustainability, and high costs [3], [52]–[54]. From the literature review, the researcher classified these barriers into five main categories; process-related, policy and market, financial and economic, information, promotion, and education, and managerial and organizational barriers. Each category has a set of obstacles with twenty-three prime barriers to adopting sustainability, as shown in table 3.

Table 3. Barriers Towards Environmental Sustainability Development

CATEGORY	PROCESS-RELATED BARRIERS	POLICY AND MARKET BARRIERS	FINANCIAL AND ECONOMIC BARRIERS	INFORMATION, PROMOTION, AND EDUCATION BARRIERS	MANAGERIAL AND ORGANIZATIONAL BARRIERS
BARRIERS	Lack of measurable requirements/ outputs, and performance gaps	The absence of mandatory technical standards as well as the lack of penalties in case of code violations.	Quantification of benefits	Definition of green and sustainable buildings /clarity	Risk and uncertainties
SOURCE	[44]	[10], [41]–[43]	[42], [44], [45]	[42], [44]	[43], [44]
BARRIERS	Lack of communication among project team members	Outdated building codes that do not adopt the triple line approach of sustainability	Funding issues	Lack of knowledge and awareness	Lack of commitments from the administrative leaders
SOURCE	[44]	[41]	[42]–[45]	[40]–[45]	[44]
BARRIERS	The complexity of certification processes	Underdeveloped market	Split incentives and appropriability	Lack of professional qualification, appropriate educated and trained technical staff/team	Personal resistance to change
SOURCE	[41]	[41]	[41], [44]	[40]–[45]	[44], [45]
BARRIERS	Unreasonable design	Lack of active government participation	Lack of incentive		Lack of communication between the public and administration
SOURCE	[40]	[42], [43], [45]	[42]–[45]		[44]

BARRIERS	Realization of the goals	How to persuade the users/lack of interest	The high costs of green technologies		On-time completion of the project
SOURCE	[40]	[10], [40], [42]	[10], [41], [43], [45], [46]		[10], [42]

The most cited barriers from the study were 1- Information, promotion, and education, 2- Policy and market barriers, and 3- Economic financial with approximately the same weight as the first two categories. However, policy, market, and economic obstacles remain the main obstacles to sustainable development; the education barriers are also vital. Owing to the lack of "professional qualification", "appropriate educated" and "trained technical staff", "knowledge and awareness", and "knowledge base of local green or sustainable buildings", the "information", "promotion", and "education-related" barriers could be noticed widely in the developing countries in Asia, Africa, and the Middle East, see figure 1. The "process-related" and "managerial and organizational" barriers seem to appear in developed countries that already have systems and trials to go green and sustainable but face obstacles related to the process of the organizational framework. The process and organizational barriers appear during the phases of

- **Predesign** "personal resistance to change, lack of commitments from the administrative leaders, risk and uncertainties."
- **Design phase** "realization of the goals, lack of measurable requirements, and the complexity of certification processes,"
- **Execution** "lack of communication among project team members, on-time completion of the project."
- **Operation phase** "performance gaps, lack of measurable outputs, unreasonable design."

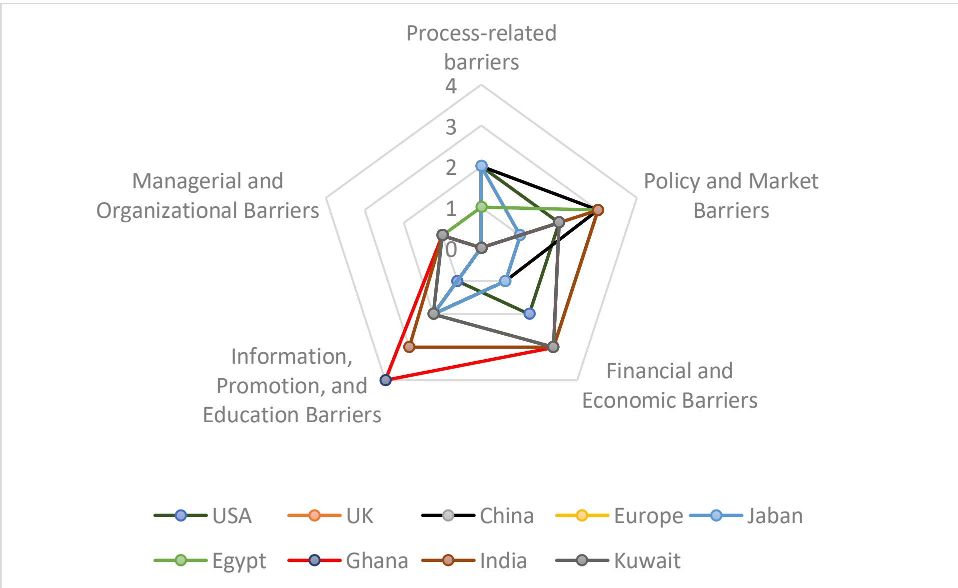

Figure 1. Barriers to the adoption of sustainability by country

Sustainable development stakeholders should be well defined and involved in such projects to mitigate these obstacles. The government may be able to drive change through new regulations, and incentive programs alongside client awareness are essential and can formulate an innovative approach toward building environmental sustainability. Acar E. et al. l [39] claim that adopting and implementing sustainable development requires understanding the interactions between individual, organization, intro-organization, and country-level factors. The decision-maker is the primary beneficiary of such knowledge of these interactions. These illustrations of the interaction's levels agree with emphasizing the country's role in green development. It should be considered a significant factor.

7. Environmentally Sustainable Buildings Promotion

Based on the interactions between the stakeholder perception map and the barriers towards environmental sustainability development, key success factors to promote environmentally sustainable buildings in the predesign and design phase were highlighted as follows "excluding the financial and economic aspects as a limitation to this research":

- Fill the gap between architectural practices and the environmental performance of the building.
- Define the targeted stakeholder for each project without excluding any party, including the building user.
- Emphasize Stakeholders' engagement in all project life cycles.
- Consider the functionality and aesthetics of the building besides the sustainability technologies.
- Consider regional variations and conditions for each project while selecting and applying the sustainability indicators.
- Incorporate stakeholders' perceptions score into rating tools.
- Maximize the role of government participation.
- Realization of the sustainability goals

To convert these points to architectural practices, the Author proposed a framework, as shown in Fig 2, considering tailoring the requirements for each project " type, region, stakeholders, and goals."

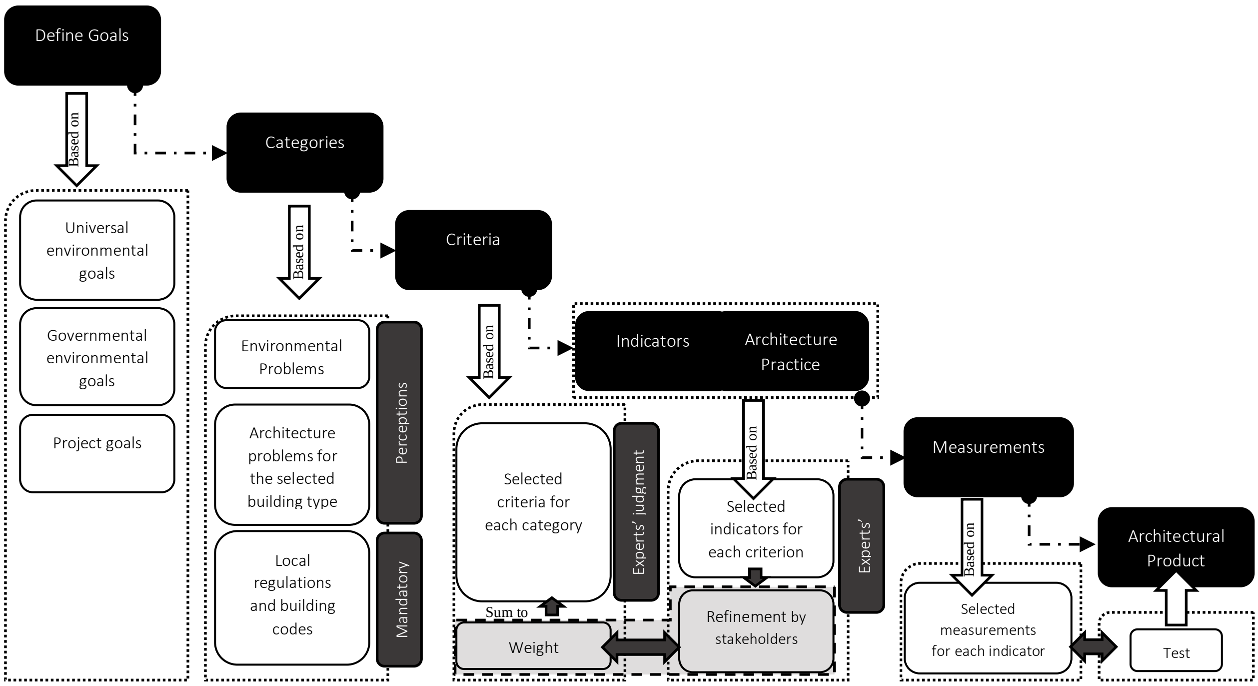

Figure 2. Tailoring the environmental sustainability of buildings- framework

This framework suggests that for each project typology in a particular region, a tailored tool should be developed to promote the environmental sustainability of that typology. The framework could be generalized for all the same building types within the same region but have some parameters that could be changed for each project separately. This framework serves as a nucleus for anyone who wants to build an environmental assessment tool to promote environmentally sustainable buildings that consider the participation of government, users, and all stakeholders.

This framework mechanism is as follows: Define goals for each project type according to the universal and governmental environmental goal for the country level and adjust it to the project goal "changing parameter" that will mitigate the problem of realization of the goals. These goals could be divided into categories driven by environmental issues, architecture problems for the selected building type, and local regulations and building codes. Here the role of stakeholders starts to begin and be effective. These defined problems come from the stakeholders' perceptions based on user experience and other stakeholders' engagement alongside the commitment to the local regulation and building codes. Such as combination will consider the functionality and aesthetics of the building besides the sustainability technologies and maximize the role of government participation.

Each category consists of selected criteria tailored by the experts and divided into indicators. These indicators translate the criteria into architectural elements and practices that will help the gap between architectural practices and the environmental performance of the building. The indicator goes to the refinement phase. When stakeholders show and evaluate indicators, some remain priorities with relative weights, while others have been removed. The weighted indicators summation formulates the total sum of criteria weight. Define measures for each indicator to mitigate barriers to measuring outputs and requirements. Finally, all parameters and metrics need to be tested and verified before creating the final architectural product.

Any organization, government, and individual in any country can take this framework and turn it into a tool that makes it easier for him to convert environmental goals into architectural practices whose success in achieving them can be measured. This tool will enable the designer from the beginning to know what is required for the project's success from an environmental and design point of view, considering all the building requirements. At the same time, it will make it easier for governments to include such tools in reviewing building licenses and issuing permits for environmentally sustainable buildings.

8. Conclusion

This paper highlighted the meaning of sustainability in architecture and studied the environmental sustainability of buildings, showing that to promote the sustainability practice:

- The sustainable development goals presented at high levels worldwide should be customized for the country and project levels to be realized and translated to architectural practices through a series of processes.
- All stakeholders should participate in creating the building, starting from the predesign phase to the operation phase of the building.
- Stakeholder perceptions should be incorporated into rating tools to evaluate the building from the technical perspective and the stakeholders, including the user perspectives.
- The designer should not neglect the building's aesthetics and primary function.
- A framework of sustainability and rating tools for sustainability in general and

environmental sustainability should be tailored for each building typology in a particular region concerning the local regulation and building codes.

- Social benefits to the stakeholders should be highlighted.
- The government's role should be emphasized.
- The government could embed the sustainability practice into an obligatory permit system, as the national strategies reflected in building codes and legislation controlling the construction markets directly affect decision-making.

The paper categorized the sustainability barriers into 1- process-related, 2- policy and market, 3- financial and economic, 4- information, promotion, and education, and 5- managerial and organizational barriers. Also, this study contributes to the existing sustainability knowledge by representing a proposed framework to promote environmental sustainability based on the interactions between stakeholder perceptions and barriers to adopting sustainability in various countries. When verified in further research, this framework can mitigate the obstacles to adopting environmental sustainability and be a nucleus of a governmental permit system. Nevertheless, the proposed framework excluded the financial and economic barriers from the analysis as it concentrates on the architectural-related processes. The research results are limited to the design phase of the building and don't include the building life cycle. Therefore, future research could add attention to tailoring a comprehensive life cycle framework considering the financial barriers and how to mitigate them.

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