

Urban Regeneration A Strategy of Nature-based Sustainable Developments: A Case Of Nabih Saleh Neighborhood Public Spaces

^{1st} Balqees Akram Mohd Akram
Research assistance, University of Bahrain, College of Engineering Department of Architecture and Interior Design
Sakhir, Bahrain
bakram@uob.edu.bh
ORCID: 0009-0002-6447-285

^{2nd} Dalia H. Eldardiry
Associate Professor, Department of Interior Design, College of Design, Imam Abdulrahman Bin Faisal University
Dammam, Saudi Arabia
deldardiry@iau.edu.sa
ORCID: 0000-0002-0317-2743

^{3rd} Islam Hamdi Elghonaimy
Professor, University of Bahrain, College of Engineering, Department of Architecture and Interior Design
Sakhir, Bahrain
eelghonaimy@uob.edu.bh
ORCID: 0000-0002-1044-249X

Abstract—This study examines the significance of regenerative strategies in urban sustainability development projects in Bahrain, highlighting the considerable need for efficient, sustainable development approaches. The research employs a case study methodology, concentrating on Nabih Saleh Island, which has valuable characteristics and deserves a unique method of developing its urban spaces. The objective is to assess the current situation of Nabih Saleh, to propose regenerative strategies, and to evaluate them against SBT International. Unfortunately, the study site experiences a decline and a loss of its unique character. Research reveals that locals are discontented with the existing situation, underscoring the need for reform. Through the assessment, it has been confirmed that the strategies implemented in the schematic design of Nabih Saleh are aligned with criteria of the SBTool. This research illustrates that regenerative solutions are essential for attaining sustainable urban development in Bahrain. The findings highlight the need for creative strategies to rejuvenate declining neighborhoods and improve community welfare.

Keywords—sustainability, regenerative sustainability, SBT International, urban sustainability, urban development

I. INTRODUCTION

Urban regions are dynamic and multi-faceted places that include a wide variety of natural and man-made features, as well as flora and fauna, and altered habitats for human habitation [1]. Nevertheless, inhabitants are confronted with the problem of urban environmental degradation as a consequence of rising urbanization. The term "urbanization" refers to the process by which people move from rural regions, where farming is the main economic activity, to cities, where businesses and service providers predominate [2]. Based on present patterns, it is projected that out of a total global population of 8.1 billion, about 5 billion would live in urban areas by 2030 [3]. In 2016, 55% of the global population resided in urban areas; by 2050, that number is predicted to rise to 68%, according to the UN (World Urbanization Prospects). These numbers put the world's worries into perspective and show that urban regeneration is a key strategy for reaching sustainable city growth [4]. Cities with significant problems are where sustainable development concerns are most pressing right now. However, in the future, all cities will need to be built on sustainable principles because they consume more resources and produce more waste than any other part of the planet [5].

City dwellers have long been in the habit of carelessly

using resources and disposing of trash, and the inevitable chaotic development of cities is a direct result of this trend [6]. Environmental degradation, biodiversity loss, societal dysfunction, resource shortages, and accelerated anthropogenic climate change are just a few of the complicated concerns that have arisen as a consequence [7] [8] [9]. Our reliance on man-made structures is becoming more and more untenable as our cities continue to grow and be complex [8]. A definition of sustainable development based on 27 principles was put out in the 1992 Rio Declaration on Environment and Development, which highlighted the interconnected and integrated character of our planet's environment. For instance, principle four states that environmental protection cannot be considered in isolation in order to achieve sustainable development [10]. These principles both highlighted human responsibility for sustainable development and provided important guidance for its practice. Conservation of the environment is given the same importance to growth according to this philosophy. The Rio Declaration offers a great starting point for alternative methods that try to define sustainable development and help bring up relevant standards and systems [11]. The eight Millennium Development Goals (MDGs) were established at the Millennium Summit in 2000 in response to this landmark proclamation. But many MDGs are hard to reach due to poor coordination across social, economic, and environmental concerns and a lack of involvement from social organizations on the ground development [10]. Thus, seventeen Sustainable Development Goals (SDGs) were born in 2015 as a result of the 2012 Rio + 20 conference's emphasis on seven areas of essential attention. Numerous goals spanning economic, social, and environmental domains make up the SDGs. Creating sustainable, long-lasting, welcoming, and secure urban areas is one of them [12]. When it comes to improving urban environments over the long term, sustainability is only a stopping place, according to a plethora of research [13].

Therefore, regenerative design is becoming more prevalent in sustainability thinking and practice. This approach tries to fix problems that have already been created by past practices rather than trying to maintain the status quo [14]. A process is considered "regenerative" if it can "fix, recreate, or revitalize" its own energy, air, water, or matter sources [15]. Furthermore, regenerative urban planning is seen as a way to provide hope for the future by aiming to achieve the revival of life itself via the replacement of the current linear system with a cyclical one [16]. In a similar

vein, regeneration entails putting the ecosystem back to its original condition via planned development by fixing the harm that humans have caused [16]. There has been a consistent upsurge in studies devoted to regenerative urban architecture in the last few years. Implementations of regenerative design at the urban scale are difficult to come by, despite the fact that these studies in diverse regions provide inspiration and insights into the practice of regenerative urban design [17].

This research shows the importance of regenerative strategies in sustainable development as whole and apply the strategies in the regeneration of project of Nabih Saleh. The study evaluates the success of strategies and to what extent the strategies help achieve the sustainability by implementing the SBT. This research gathered the appropriate SBT Strategies analyzing a large body of literature on the topics of sustainability, and urban regenerative design [5].

II. LITERATURE REVIEW

This section will discuss sustainability within the urban environment. The regenerative aspect of sustainability are the most important components of sustainable urban developments. Understanding and analyzing the regenerative aspect in urban development is needed. This section addresses sustainability its aspects as and regenerative sustainable developments in Bahrain.

A. Regenerative urban sustainability

As per Dale & Newman, urban regeneration is often viewed as a means to establish "incubation zones" for sustainable development [18]. Regenerative development and design is a major advancement in sustainability. Sustainable or green design focuses on minimizing environmental and human health harm and utilizing resources more effectively to halt the destruction of earth's natural systems. The design and construction of buildings, human settlements, and practically all other human activities should be more deeply connected, entire systems, according to regenerative built environment advocates. Regenerative techniques aim to reverse the degeneration of Earth's natural systems and develop human systems that can co-evolve with them to increase life and resilience. Regenerative development and design, inspired by natural living systems' self-healing and self-organizing abilities, is becoming a tool. This discipline is changing how sustainability advocates plan for the built environment and the role of architecture [19].

The regenerative aspect recognizes that people are "nature" and that purposeful interaction increases evolutionary potential. Nature benefits from us. Humans must establish a conscious and holistic connection with nature that is mutually beneficial and cognizant of evolutionary potential to preserve ecological health. It is a deliberate realization that ecosystem health depends on human health and human health on ecology. Design teaches us about our interactions with environment and others, making us more or less conscious and ecologically capable. The ultimate purpose of design is human brains, not artefacts, structures, or landscapes [20]. One area that is being looked at as a potential avenue for this goal's realization is regenerative development and design. The area takes its cues from the remarkable abilities of biological systems to repair and organize themselves. For sustainability advocates, this area is reshaping not just the built environment but also the function of architecture itself. This approach is typically implemented in projects that have a long-term perspective, aim to benefit both citizens and the city, and

primarily impact the area designated for the project, or plot. Sustainability principles, which are in charge of creating plans and urban policies for revitalizing cities and localities, provide financial backing for these endeavors [5].

Based on research conducted at the national and European levels, this study aims to establish the current best practices for urban regeneration initiatives. Since sustainability indicators are essential tools for urban analysis, the process of creating best practices will revolve on their use in the creation of sustainable urban development policies, plans, programs, and activities [21]. While indicators are the backbone of sustainability measurement, picking the right ones for each situation is crucial [5].

B. Principles of Regenerative Sustainability

In a world where everyone may enjoy the benefits of a healthy, diverse, and equitable ecosystem—one that makes good use of all its resources—regenerative design and sustainable development work towards this end. There has been improvement in quantifying the construction industry's negative effects on the environment within the last decade [15].

Based on their research, Regenesi and Lyle came up with these four principles. They provide essential components for developing regenerative strategies. Within the framework provided by the four premises, which function as a system to integrate and align means and motive, regenerative practices may include techniques and approaches from different ecological design systems. In a regenerative project, the first two determine and mold the motivation and motives. The latter two concern the project's execution in a way that keeps the process focused on producing a regenerative outcome and guarantees that the project's goals and methods remain aligned [19].

1) Place and Potential

Grasping and conceptualizing the proper connection to place. To determine if a certain area has the capacity to achieve improved health and viability due to human intervention, it is necessary to have a thorough familiarity with the area's evolutionary processes [19].

2) The Ability to Regenerate

Regenerative development and design focus on the performance of the human context—the unique socio-ecological system or "place" in which the building is simply among many interconnected and interacting aspects and dynamics. The built environment's intended contribution to the larger living context's regenerative capacity—its ability to realize and express more of its full potential as a source of increasingly healthy life for all its constituent members and for the larger systems it is a part of and depends on—is used to set regenerative goals and measure performance.

- Locally based and tailored
- Evolving, which goes beyond restorative approaches that focus on enhancing systemic function at the present moment to include the ability to continuously enhance performance over time and in response to changing environmental circumstances.
- Exceeds just functional performance targets. Understanding "human aspiration and will as the ultimate sustaining source of our activities," they tackle the intangible and qualitative aspects that

determine the level of care and quality that people bring to their environment and its ability to survive [21].

- Keep the processes that physical structures allow for front and center

3) Collaborating With Place

Transforming one's position from "builder of systems we control" to "gardener," forming an intimate relationship with a site and its natural processes, is essential for regenerative project implementation [19].

4) Harmonisation in Progress

In order to monitor dynamic, comprehensive, and ever-changing processes, regenerative methods need indicators and metrics that might stimulate a process of steadily improving pattern harmony between natural and human systems [23]. You can't just construct an object in a vacuum; you also have to fix the environment around and within it. Only then can the vast universe at that location become more cohesive and complete, and the object you're making finds its place in the natural world's intricate web [19].

The diagram in Fig. 1 illustrates of the elements of regenerative development [19].

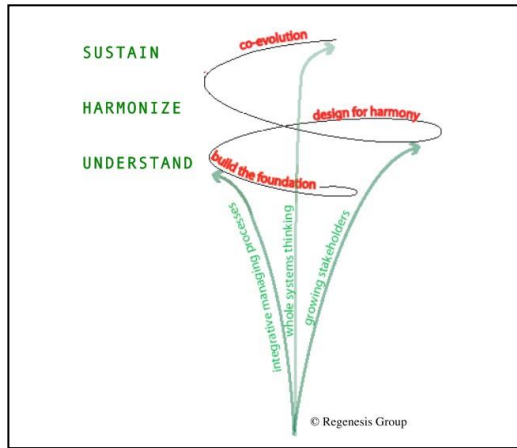


Fig. 1. Three-step Strategy of Achieving Regenerative Design [19]

C. Regenerative sustainable development in context to Bahrain

In order to meet the rising need for housing caused by the country's fast population expansion, the government of Bahrain has launched a number of programs since the 1960s. A new urban environment emerged gradually, one that aimed to provide the modern Bahraini family with the perfect house by including a variety of experimental housing designs. The vibrant street urban character of historic Bahraini communities, according to Shubbar & Furlan, was a key factor in the development of some notable neighborhoods [24]. Accessibility and great social cohesiveness were made possible by the very nature of streets. Saraiva et al. also posits that traditional features of older Bahraini houses contributed to their social sustainability [25]. Unfortunately, such figures no longer have the same social significance in modern Bahraini society as they once had because of globalization. This demand shift has changed the urban environment, requiring new structures inside the metropolis [26]. Residents

are fleeing older, more established villages for new metropolitan centers with greater economic possibilities. Abandonment and neglect have damaged these historically important locations and harmed Bahraini communities' social features [27].

Nabih Saleh is an island in the Arabian Gulf that belongs to Bahrain. Its precise location in Tubli Bay is 2.5 km south of Manama, the capital of Bahrain, and to the east of Bahrain Island. This site is significant not just because of its cultural and historical worth, but also because of its one-of-a-kind island setting. Public services (PS), special projects (SP), and recreational areas (REC) are the three distinct zones that the property is divided into according to urban planning and authority.

In Nabih Saleh according to MP Mohammed Yousif Al Mezal, land reclamation, waste, and a lack of attention are ruining Nabih Saleh, which used to be beautiful with gardens and a historic mosque and shrine. Mr. Al Mezal informed the GDN that the mosque and shrine are in a terrible state of disrepair, having undergone renovations just 26 years ago. He said that by reliving the experiences of the individuals who lived and worshipped in the mosque and the events that transpired there, the shrine offered tourists a glimpse into the cultural identity of Bahrain through its past. Continual reclamation operations, rubbish discharge into the sea, and a lack of care have greatly diminished Nabih Saleh island, which was once a verdant "paradise" with gardens and public parks where the typical family could relax and enjoy themselves, according to the MP." There are several merits to this mosque/shrine. The fact that it was constructed over 600 years ago gives it historic significance. Because it has traditional and distinctive Bahraini characteristics, it has religious meaning.

D. SBTool International

The SBTool International Method, established by the non-profit iiSBE (International Initiative for the Sustainable Built Environment), collaborates with teams from over 20 nations. This technique provides a framework for evaluating sustainable performance of buildings and projects, assisting local organizations in creating SBTool-based assessment systems [28].

Regenerative solutions prioritize self-sustaining urban systems, community well-being, and ecological restoration and enhancement. Although SBTool International offers a framework for evaluating sustainability in urban projects, additional urban sustainability assessment tools that share comparable metrics and ideas include LEED, BREEAM, CROSS TOOL SYNERGY, One Planet Living Framework, Green Star, and CASBEE [29].

To provide a broader perspective and validate the choice of SBTool International as the primary methodology, Table I compares it with three widely recognized sustainability assessment tools: LEED (Leadership in Energy and Environmental Design), BREEAM (Building Research Establishment Environmental Assessment Method), and the Living Building Challenge (LBC). The comparison focuses on adaptability, criteria, and alignment with regenerative and sustainability principles.

TABLE I. COMPARISON OF SUSTAINABILITY ASSESSMENT TOOLS

Aspect	SBTool International	LEED	BREEAM	Living Building Challenge
Adaptability	Highly adaptable to local contexts, considering cultural, environmental, and economic factors.	Standardized globally but offers regional adaptations through local credit weightings.	Offers national-level versions tailored to specific countries.	Highly prescriptive but emphasizes performance outcomes, allowing local interpretation.
Focus Areas	Holistic approach encompassing environmental, social, and economic sustainability.	Strong emphasis on energy, water, and indoor environmental quality.	Lifecycle assessment, ecological value, and resource efficiency.	Regenerative approach, focusing on net-positive impacts in energy, water, and materials.
Application Scope	Applicable to buildings, urban areas, and regional planning.	Primarily focused on buildings and neighborhoods.	Broad application for buildings and infrastructure projects.	Focused on individual buildings aiming for self-sufficiency.
Regenerative Principles	Emphasizes regenerative practices by integrating ecological and social benefits.	Supports sustainability but less focused on regenerative outcomes.	Focuses on sustainability and efficiency but does not explicitly target regenerative impacts.	Fully embraces regenerative principles, aiming for net-positive contributions.
Ease of Use	Requires customization for each project, which can be resource-intensive.	Standardized process with accessible documentation and tools.	Structured framework with predefined pathways.	Rigorous certification with stringent criteria and detailed documentation.
Key Metrics	Adaptable metrics based on local priorities, including energy, water, and socio-economic factors.	Fixed metrics focused on quantifiable outcomes, e.g., energy and water savings.	Broad metrics with a focus on lifecycle impacts and performance benchmarks.	Qualitative and quantitative metrics requiring extensive documentation of performance.

III. METHODOLOGY

This research aims to identify the regenerative sustainability strategies and evaluate these strategies by using SBT Tool for enhancing the sustainability of urban spaces that are shared spaces of public use. Qualitative questionnaire and observations were performed to achieve the primary data. The data was achieved based on three main objectives:

- To analyze how people perceive the sustainability of urban spaces
- To investigate the importance of regenerative sustainable strategy
- To evaluate the regenerative strategy against SBT

Focusing on the decaying neighborhood of Nabih Saleh, this case study examines the significance of regenerative urban sustainability in Bahrain. Here are the main parts of the methodology:

Choosing a Case Study

Nabih Saleh was selected as a case study for investigating the efficacy of regeneration techniques because of its extreme deterioration and loss of identity.

The regenerative strategies tested in Nabih Saleh provide a foundation for transformative urban regeneration efforts in Bahrain and beyond. By scaling these strategies and integrating them into broader policy and planning frameworks, Bahrain can create sustainable, resilient, and culturally vibrant urban environments. These efforts have the potential to serve as a model for similar communities globally, particularly those in arid regions with comparable challenges.

Data collection

Interviews: People in the community were asked to share

their thoughts and feelings about the city as it is now in order to collect qualitative data. To delve further into the inhabitants' experiences and ideas for development, semi-structured interviews were carried out.

Sample Selection Technique

Using a snowball sampling approach, the study's sample was chosen. The first person to get the Google Form questionnaire was a resident of Nabih Saleh, a tiny Bahraini hamlet with a population of around 3,200. The first responder was then asked to distribute the questionnaire to other community members. In order to be eligible, individuals had to be at least eighteen years old.

Through social networks inside the tight-knit community of Nabih Saleh, this approach made it possible for the study to contact participants. The poll had 15 responders in total, which is a very tiny percentage of the village's population. Because it works well for reaching people in hard-to-reach or smaller groups where direct access to a bigger sample frame would not be possible, the snowball sampling technique was used.

This sampling technique is non-probabilistic and so it avoid bias since it was forwarded randomly using WhatsApp from one person to another and initial respondent had no relationship with ones shared later. It offered a useful means of data collection for this investigation.

Observation

Documents analysis: information was gathered from the chosen subset that stands in for the whole. Data collection included gathering site urban map from urban authority, performing site analysis with various aspects listed in table below. Along with maps, the results were placed into wider sustainability frameworks via the assessment of pertinent planning documents, prior research, and urban development rules.

Advancement of the Schematic Design

Regenerative solutions were integrated into a schematic design that aims to revitalize Nabih Saleh, based on input from the community. Sustainable resource management, green infrastructure, and public areas are the focal points of this plan.

Assessment in Light of SBT Requirements

The SBT framework was used to evaluate the proposed design's sustainability potential and conformity with recognized criteria for urban development.

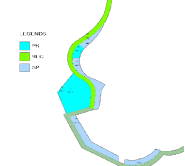
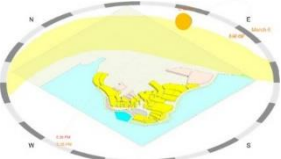
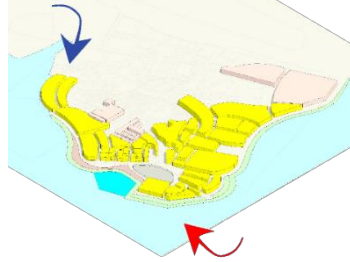
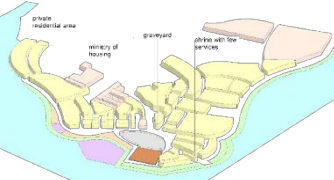
Qualitative analysis:

Analysis

Key concerns and ambitions of people were identified via thematic analysis of qualitative data collected from observations and interviews. In order to show that the suggested regeneration procedures were feasible and had an effect, the assessment findings were combined.

The maps and urban plans for qualitative analysis is organized in Table II.

TABLE II. MAPS AND URBAN PLANS

Material	Visuals	Legends
Urban map		- Private residential area - Ministry of housing - Graveyard - Shrine - Future development - Public services area - Recreational area - Special projects
Target area		- Private residential area - Ministry of housing - Graveyard - Shrine
Solar analysis		Sun
Wind analysis		Wind
Surrounding analysis		- Private residential area - Ministry of housing - Graveyard - Shrine
Connectivity analysis		- Highways - Secondary road - Tertiary road

Observation Analysis

The qualitative analysis of the site for observations was

performed by bodily experience to better understand the quality of urban space as a user. The researcher created a table with main aspects of bodily experience and rated the place according to feel.

Bodily Experience of the Site

Visual

Visually, the site was plain. There was lack of appealing views, neither manmade nor natural. Even the natural view that was sea was contaminated by the industrial waste making it totally a waste area. Fig. 2 shows this.



Fig. 2. Visual bodily experience

Sound

The sea breeze was beautifully heard, but there's no sign of birds due to lack of habitat. There are no plantation sounds. Fig. 3 is where this was observed.



Fig. 3. Sound bodily experience

Touch

Sand and water was the only material making limited stimulation of touch although it's rough and bumpy currently. This is depicted in Fig. 4.



Fig. 4. Tactile bodily experience

Temperature

At the time of visit, the temperature was pleasant, but no temperature controlling devise is implemented. Figures 5 to 7 show the area where this was observed.



Fig. 5. Temperature bodily experience



Fig. 6. Temperature bodily experience



Fig. 7. Temperature bodily experience

Proposed Schematic Design

The goal of the suggested schematic design in Table III is to provide an inclusive, sustainable, and regenerative framework for Nabih Saleh's growth. Three dimensions are anticipated to be affected in the long run:

- a. Social Impacts
 - Enhanced Community Well-being
 - Cultural Preservation
 - Improved Quality of Life
 - Social Inclusion
- b. Economic Impact
 - Cost Savings Through Efficiency
 - Job Creation
 - Increased Property Values
 - Sustainable Tourism Potential
- c. Environmental Impacts
 - Biodiversity Enhancement
 - Reduction in Carbon Footprint
 - Improved Water Management
 - Climate Resilience

Criteria for Success

The success of the proposed regenerative strategies will be assessed based on measurable outcomes in three key dimensions: environmental, social, and economic. Each criterion reflects the intended impacts of the strategies and ensures alignment with sustainability and regeneration goals.

a. Environmental Criteria:

- Reduction in Urban Heat Island Effect: Measured through localized temperature monitoring in areas with increased vegetation and reflective materials.

- **Improved Air Quality:** Reduction in particulate matter (PM2.5 and PM10) and other pollutants due to increased green cover.

- **Water Conservation:** Reduction in potable water use through rainwater harvesting, smart irrigation, and the use of treated water for landscaping.

- **Biodiversity Enhancement:** Increase in native plant and animal species within the project area.

b. Social Criteria:

- **Community Engagement and Satisfaction:** Measured through periodic surveys assessing residents' satisfaction with green spaces, accessibility, and overall quality of life.

- **Usage of Green Spaces:** Increased foot traffic and participation in community activities within open spaces and gardens.

- **Cultural Integration:** Preservation and enhancement of local cultural identity through design elements and community feedback.

c. Economic Criteria:

- **Cost Savings:** Reduction in energy and water costs due to renewable energy and efficient systems.

- **Property Value Growth:** Measurable increase in property values within the community.

- **Economic Opportunities:** Job creation through the implementation and maintenance of regenerative infrastructure.

Framework for Long-Term Monitoring and Evaluation

To ensure the long-term success of the regenerative strategies, a structured monitoring and evaluation framework will be established:

a. Baseline Data Collection:

Collect initial data on key indicators such as air quality, temperature, water usage, and biodiversity to serve as benchmarks.

b. Monitoring Tools and Methods:

- **Environmental Monitoring:**

- Install sensors to track temperature, humidity, and air quality.

- Conduct periodic biodiversity surveys to document ecological changes.

- **Social Monitoring:**

- Use community surveys and interviews to gauge resident satisfaction and gather qualitative feedback.

- Observe usage patterns of green spaces and public amenities.

- **Economic Monitoring:**

- Analyze energy and water bills to track cost savings.

- Use local government and market data to monitor changes in property values and job creation.

c. Frequency of Monitoring:

- Quarterly reviews during the first year post-implementation.

- Bi-annual evaluations after the first year to identify long-term trends and impacts.

d. Stakeholder Involvement:

- Form a monitoring committee comprising local residents, government representatives, and sustainability experts to oversee the process.

- Ensure transparency by regularly sharing findings with the community.

e. Feedback Loop and Iterative Improvements:

- Use monitoring results to identify gaps and adjust strategies as needed.

- Encourage community participation in proposing solutions for emerging challenges.

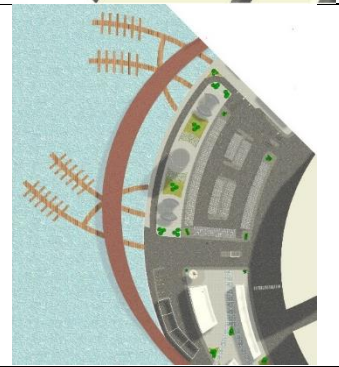
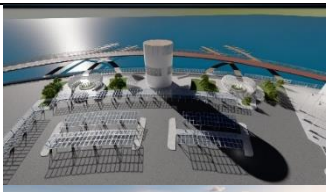
f. Reporting and Documentation:

- Publish annual reports summarizing key findings and impacts.

- Share success stories and lessons learned to inspire similar initiatives in other regions.

TABLE III. PROPOSED SCHEMATIC DESIGN

Proposals	Visuals	Implemented strategies	Strategies and their relationship with regenerative sustainability
Site plan		Imageability: Lynch claims that in a picture-perfect city or location, individuals may readily make sense of the environment by categorizing its features. In their own time, visitors may identify the many features of the locations. Assuming everything is under control, the location should be nice overall. The researcher proposed point of imageability starting from the main entrance of site till the target place. Creating interconnected transit spaces that allow locals and tourists to easily access Nabih Saleh's primary social core.	As mentioned in literature review, the main principle of regenerative urban design is imageability of the place and it's a potential strategy. Therefore, the same strategy has been implemented that secure the project with this point.

Master plan		The researcher proposed functions that are aligned with Bahrain urban planning specification of target area. The proposed functions are placed based on surrounding zoning that will help user navigate the site properly. • Entrance • Planned Seating • Cycling Track • Outdoor Fitness • Event Area • Food Trucks • Seating For Food Truck • Formal Majlis • Amphitheatre • Fisherman Entrance • Boat Services • Fisherman Parking • Sustainable Public Parking • Outdoor Fitness Area • Kids Indoor Play Area • Kids Outdoor Play Area • Elderly Informal Meeting Place • Indoor Informal Meeting Place • Bicycle Stand with Seating • Farming Area • Walking Track • Walk of History • Sustainable Gazebo • Gathering Area • Retail • Storage • Water Taxi • Ice Factory • Workshop • Parents Area • Boat Slips	Ability to regenerate
Zone 1		 	Harmonization
Zone 3		 	Collaborating With Place
Zone 3			

Challenges Encountered During Community Engagement and Mitigation Strategies

Community involvement was essential in establishing the suggested schematic design for Nabih Saleh. Nevertheless, several difficulties arose during the procedure, which were resolved utilizing flexible tactics:

Challenges:

a. Limited Awareness of Sustainability Concepts:

Many locals were unfamiliar with sustainable practices and their advantages, making it difficult to convey the long-term worth of the recommended measures.

b. Reluctance to Participate:

Community members were unwilling to participate owing to skepticism about the results or lack of time and interest.

c. Diverse Priorities:

Different community factions prioritized economic prospects, cultural preservation, or environmental improvements, which often clashed.

d. Access to Participants:

Due to the village's small population and snowball selection approach, it was challenging to represent all demographics, especially marginalized ones.

e. Resource Constraints:

Time was one constraint to having community interaction.

Implementing the Schematic Design

The schematic design for Nabih Saleh is intended to be a practical and adaptable solution to enhance the village's sustainability and livability. The future implementation of REC (Recreational Project is zoned in this area) in the urban planning authority of Bahrain is already zoned.

Monitoring and Evaluation Plan:

Establishing an intense monitoring and evaluation structure will guarantee the schematic design's success. This framework will assess results, monitor progress, and guide incremental enhancements.

Key Performance Indicators (KPIs):

a. Environmental Metrics:

- Reduction in heat island effects (e.g., temperature monitoring)
- Improvement in water conservation (e.g., reduction in potable water use)

b. Social Metrics:

- Increased use of green spaces (e.g., through surveys or observational studies).
- Community satisfaction and engagement levels.

c. Economic Metrics:

- Cost savings from renewable energy and water efficiency.
- Economic activity generated by eco-tourism or local businesses.

Data Collection Methods

- a. Baseline Data: Established prior to implementation for comparison.
- b. Regular Surveys: To gather feedback from residents.
- c. Remote Monitoring: Sensors for energy usage, water consumption, and environmental changes.
- d. Periodic Audits: On-site evaluations to assess physical conditions and infrastructure performance.

Evaluation Frequency

Quarterly evaluations during the first year of the pilot, followed by bi-annual reviews.

Stakeholder Review Panels:

Panels comprising residents, local authorities, and sustainability experts will review progress and recommend adjustments.

Reporting and Transparency

To ensure transparency, the monitoring process's findings will be shared with the community and stakeholders through workshops and reports.

IV. EVALUATING REGENERATIVE STRATEGIES AGAINST SBT TOOL

SBTool International Methodology comprises two steps. The first step, Evaluation of Project Implantation Site, addresses planning and local context problems to support macro issues. The second step, Evaluation of Project and Building Performance, evaluates design, construction, and operation characteristics relating to local rehabilitation, urban design, infrastructure, and built environment challenges. [30].

This study focuses on evaluating based on first step that is evaluating the schematic design as this is the proposal to sustainable urban development. Below, Table III shows the list of sustainable urban development that are aligned with SBT international standards.

TABLE IV. EVALUATING REGENERATIVE STRATEGIES AGAINST SBT INTERNATIONAL

SBT International Criteria No.	Urban elements implemented	REFERENCE [31]
A2.3	Passive solar planning	Larsson, 2012
I.2	Ventilation	Larsson, 2012
I.3	Urban connectivity	Larsson, 2012
I.5	Adaptable use	Larsson, 2012
I.7	Revitalization of culture	Larsson, 2012
I.9	UGS distribution	Larsson, 2012
A3.13	Parking	Larsson, 2012
D1.5	CO2 concentration for indoor air quality	Larsson, 2012
F1.1	Considerations for impaired	Larsson, 2012
E4.5	Energy adaptive	Larsson, 2012
D3.1	Daylight management	Larsson, 2012

V. CONCLUSION

There is a verified new worldwide trend toward using sustainable principles in creating urban management models in response to the demands of modern cities. Still, many project designers are unaware of this; thus, it's worth investing in tools that can help cities become more sustainable. The methods used by different proposals, evaluation, and certification tools are great options when it comes to evaluating. An adaption of the SBTool International technique is recommended. This study has found how impactful regenerative strategies are. Its implementation in the urban revitalization of Nabih Saleh has been evaluated with the SBTool. It was found that the strategy align with the tool. Therefore, in order to achieve sustainable development, the key is to use a regenerative strategy.

ACKNOWLEDGMENT

The authors acknowledge the University of Bahrain, postgraduate master program. Also, they thank Celine Alava for proofreading this submission.

REFERENCES

- [1] C. A. Mensah, "Destruction of Urban Green Spaces: A Problem Beyond Urbanization in Kumasi City (Ghana)," *American Journal of Environmental Protection*, vol. 3, no. 1, pp. 1-9, 2014.
- [2] R. Skeldon, "International migration, internal migration, mobility and urbanization: Towards more integrated approaches," 2018. [Online]. Available: https://publications.iom.int/system/files/pdf/mrs_53.pdf.
- [3] UN-Habitat, *Global Report on Human Settlements 2011: Cities and Climate Change*, Earthscan, 2011.
- [4] C. Turcu, "Local experiences of urban sustainability: Researching Housing Market Renewal interventions in three English neighbourhoods," *Progress in Planning*, vol. 78, no. 3, pp. 101-150, 2012.
- [5] G. Castanheira, L. Bragança and R. Mateus, "Defining best practices in sustainable urban regeneration projects," *Portugal SB13 - Contribution of Sustainable Building to Meet EU 20-20 Targets*, 2013.
- [6] A. Elshater, "Architecture and Urbanism: A Smart Outlook," in *Proceedings of the 3rd International Conference on Architecture and Urban Planning*, Cairo, Egypt, Cairo, 2020.
- [7] C. Du Plessis, "Towards a regenerative paradigm for the built environment," *Building Research and Information*, vol. 40, no. 1, pp. 7-22, 2012.
- [8] J. Hoornbeek and T. Schwarz, "Sustainable Infrastructure in Shrinking Cities," July 2009. [Online]. Available: <https://www-s3-live.kent.edu/s3fs-root/s3fs-public/file/Sustainable%20Infrastructure%20in%20Shrinking%20Cities%20-%202009.pdf?VersionId=3MfLdR7yYGZw0rK1r9wbEPJ9FGtuH5MU>.
- [9] T. Toros, *Restorative Urban Design: Toward A Design Method For Mitigating Human Impacts On The Natural Environment Through Urban Re/Development*, Kansas State University, 2015.
- [10] V. Singh, "What is a Sustainable Development Initiative? How It Helps in Community Growth?," 7 August 2024. [Online]. Available: https://www.developmentinitiatives.org/2024/08/07/what-is-a-sustainable-development-initiative-how-it-helps-in-community-growth/?utm_source=google_grant&utm_medium=search&utm_campaign=FDI_Blogs_2024_DGTL_What_is_a_Sustainable_Development_Initiative&utm_ca.
- [11] R. Ciegis, J. Ramanauskiene and B. Martinkus, "The Concept of Sustainable Development and its Use for Sustainability Scenarios," *Engineering Economics*, vol. 2, no. 62, 2009.
- [12] United Nations, "Take Action for the Sustainable Development Goals," 2018. [Online]. Available: <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>.
- [13] S. Jenkin and M. P. Zari, "Rethinking our built environments: Towards a sustainable future," October 2009. [Online]. Available: https://www.researchgate.net/publication/261476724_Rethinking_our_built_environments_Towards_a_sustainable_future.
- [14] Q. He and A. Reith, "(Re)Defining Restorative and Regenerative Urban Design and Their Relation to UNSDGs—A Systematic Review," *Sustainability*, vol. 14, no. 24, 2022.
- [15] S. Attia, *Regenerative and Positive Impact Architecture: Learning from Case Studies*, Springer, 2018.
- [16] G. Thomson and P. Newman, "Urban fabrics and urban metabolism – from sustainable to regenerative cities," *Resources, Conservation and Recycling*, no. 132, pp. 218-229, 2018.
- [17] E. Naboni, J. Natanian, G. Brizzi, P. Florio, A. Chokhachian, T. Galanos and P. Rastogi, "A digital workflow to quantify regenerative urban design in the context of a changing climate," *Renewable and Sustainable Energy Reviews*, vol. 113, 2019.
- [18] A. Dale and L. L. Newman, "Sustainable development for some: Green urban development and affordability," *Local Environment*, vol. 14, no. 7, pp. 669-681, 2009.
- [19] P. Mang and B. Reed, "Regenerative Development and Design," *Sustainable Built Environments*, p. 478–501, 2015.
- [20] M. D. Anderson, "Higher education revisited: Sustainability science and teaching for sustainable food systems," *American Journal of Alternative Agriculture*, vol. 7, no. 1-2, 1992.
- [21] N. Rosales, "Towards the Modeling of Sustainability into Urban Planning: Using Indicators to Build Sustainable Cities," in *Procedia Engineering*, 2011.
- [22] N. S. Mang, *Toward a regenerative psychology of urban planning*, San Francisco: Saybrook Graduate School and Research Center, 2009.
- [23] P. Mang and B. Reed, "Regenerative Development and Design, 2nd Edition," November 2017. [Online]. Available: https://www.researchgate.net/publication/321156684_Update_Regenerative_Development_and_Design_2nd_edition.
- [24] F. Shubbar and R. Furlan, "Connectivity of the Public Realm: The Case of Bahrain Fort and King Faisal Corniche in Bahrain," *Saudi Journal of Civil Engineering*, 2019.
- [25] S. S. Saraiva, M. Serra and G. Furtado, "Bahrain-continuity and rupture: Traditional and subsidized housing in Bahrain," in *Proceedings of the 11th Space Syntax Symposium*, 2017.
- [26] M. N. Al-Nabi, *The History of Land Use and Development in Bahrain*, Information Affairs Authority, 2012.
- [27] I. H. El-Ghonaimy and M. H. Al-Haddad, "Towards Reviving the Missing Noble Characteristics of Traditional Habitual Social Life: 'Al-Farej 'In Kingdom of Bahrain," *Contemporary Urban Affairs*, vol. 3, no. 2, p. 35–46, 2019.
- [28] L. Bragança and E. Guimarães, "Introducing the Portuguese Sustainability Assessment Tool for Urban Areas: SBTool PT - Urban Planning," in *SBE 16 Malta, Europe and the Mediterranean: Towards a Sustainable Built Environment*, 2016.
- [29] D. Doan, A. Ghaffarianhoseini, T. Zhang and A. U. Rehman, "Green Building Assessment Schemes: A critical comparison among BREEAM, LEED, and Green Star NZ," in *Proceeding of International Conference on Sustainable Built Environment*, Seoul, 2016.
- [30] N. Larsson, "Current Status of Climate Change and Scenarios for Action," in *SBE 16 Malta, Europe and the Mediterranean: Towards a Sustainable Built Environment*, 2016.
- [31] N. Larsson, "SBTool 2012-20," 2012. [Online]. Available: <https://www.iisbe.org/node/140>. [Accessed 2024].