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Conceptual Framework for Implementing Sustainability in Abu Dhabi Residential Building Projects

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Abstract: ***This paper presents a conceptual framework aimed at implementing sustainabilityin Abu Dhabi Residential Building projects. The proposed framework based on the sustainability pillars in Abu Dhabi Urban Planning Council(AUPC) and ESTIDAMA practice including the Green Building Procedures and follow the ESTIDAMA practice aspects, environmental, economic, social and culture. The framework will enhance the implementation of Green Building Procedure and developed to solve the reasons that cause the delay of implementing sustainability in Residential Building Projects and Individual Private Villas in Abu Dhabi. The framework used the Delphi Technique to gather the data from the Professional expertise within their domain of specialization. The technique is designed as a group communication process which aims to achieve a convergence of opinions on a specific real-world issue. Three iterations will be used to collect the required information and to reach a consensus in this case. The Framework provided the basis for a long-term process of integrating sustainability as a practice for the future projects in Abu Dhabi and created a list of measures such as increase public awareness, reduce Sustainability Materials price, change the public culture to accept Sustainability practice and simplify the Government process for Sustainability projects. The important strategic objectives that addressed in the framework are increased public awareness, reduce the Price of Sustainability Materials, change Public Attitude to accept Sustainability Practice, enhance the Technical Knowledge toward Green Building Procedures, simplify the Government process for Sustainability Projects.***

Keywords: Abu Dhabi, Green Building, ESTIDAMA, Framework, Sustainability Implementation, Residential Project, Construction, Private Villas.

1. Introduction

The Middle East region has been witnessing rapid improvements in the green buildings industry, primarily driven by concerns related to environmental degradation, fossil fuel depletion, and energy inefficiency. Buildings in the Middle East use extra energy than those in different parts of the world mainly on account of extremely warm weather and rampant use of glass exteriors. Countries in the region are more promoting energy efficiency as a means to secure power security which has become a boon for the green homes industry. The number of LEED-registered buildings has increased rapidly across the region, especially in Gulf Countries (GCC), in the previous several times. Some of the notable cases of green buildings in the Middle East are MASDAR City in Abu Dhabi, KAUST in Saudi Arabia and MSHEIREB Downtown Doha in Qatar(Nadine Katkhuda, 2015).

The Middle East area meets a unique set of difficulties in phases of sustainable buildings and cities. For example, water shortage is mitigated by expensive desalination, and we are met with high water consumption which leads to a larger carbon footprint and ultimately affects climate change. Middle Eastern nations are at the top of the table of largest per capita ecological footprints. Qatar has the largest per capita level of carbon dioxide emissions, at 44 metric tons per person yearly. Kuwait is second with 30.3 tons, followed by the UAE with 22.6. Therefore, integrating energy efficiency is a critical requirement (Asif, 2015).

The UAE was among the leading countries to have implemented the concept of Green Building; indeed, it was among the earliest countries to join the World Green Building Council in 2007. After the success of implementing Green Building procedures in the USA, the Green Building idea was transferred to the UAE to mitigate its climatic challenges, such as high summer temperatures and lack of rain in addition to the high consumption of water and electricity (Eichholtz & Quigley, 2013). In 2006, The Emirates Green Building Council (EGBC) was established and in 2008 ESTIDAMA - which is the Arabic word for sustainability - was launched in Abu Dhabi with the aim of developing Abu Dhabi's cultural character by generating an ever-improving quality of life for its residents based on the four elements of sustainability: ecological, financial, community, and social (Abu Dhabi Urban Planning Council, 2010).

In 2010, The Pearl Rating System (PRS) was refined to be a frame for green building in all the design, construction and operation stages of buildings and villas. PRS has been designed to support sustainable development from design to construction to operational accountability and provides all guidance and requirements to rate a project's potential performance about the four pillars of ESTIDAMA practice(Abu Dhabi Urban Planning Council, 2010).

2. Literature Review

Sustainability is a systemic idea, relating to the continuity of economic, social, institutional and environmental aspects of human society, as well as the non-human environment. It is meant to be a means of configuring civilization and human activity so that society, its members, and its economies can meet their requirements and express their highest potential in the present while protecting biodiversity and natural ecosystems, and planning and acting for the ability to have

these models for a very long time. Sustainability affects each level of organization, from the local neighborhood to the entire planet. The idea of sustainability relates to thinking holistically about how everything you do changes everything about you. It is an attempt to reduce each person's impact on the world. Today, green building is one of the fastest growing building and design concepts.

Green building also identified as green construction or sustainable building and refers to a structure and using a method that is environmentally responsible and resources effectively throughout a building lifestyle from siting to plan, construction, operation, maintenance, renovation, and demolition. The new technology is constantly being developed to complement current practices in creating greener structures, and that green building is designed to reduce the overall impact of the environment on social health and the general environment by reducing waste, pollution and environment degradation. Green Building transforms the style buildings are designed, built and operated to create extra comfortable, healthier and sustainable built environments, while decreasing energy consumption, greenhouse gas emissions, water consumption and solid waste generation. Moreover, reducing costs and liabilities while growing value and doing more predictable outcomes in built environments is thought to be possible. The cumulative result of the design, construction, and operation of built environments has profound implications for human health, the environment, and the economy.

3. Goals of Green Building

There are many motives to building green, including environmental, economic, social and cultural benefits. While the practices and technologies that employed in green building evolving and may differ from region to region, there are fundamental principles that persist from which the method is derived:

1) Design efficiency, energy efficiency, water efficiency, materials efficiency, indoor environmental quality enhancement, operations and maintenance optimization, and waste reduction (Abu Dhabi Urban Planning Council, 2010).
2) To reach a sustainable future in the building industry, there are some features such as energy saving, improved use of materials, materials waste minimization, pollution and emission control. There are many ways in which the current nature of building activities can be managed and improved to make it less environmentally damaging and without reducing the useful output of building activities (Abu Dhabi Urban Planning Council, 2011)

Sustainability issues

The building sector is arguably one the most resource intensive industries and comparing with different industries, the building industry rapidly developing world energy use and the use of finite fossil fuel resources has already concerns over supply difficulties for heavy environment impacts, carbon dioxide, global warming and climate change. Building materials productions consume energy and the construction phase consumes energy and operation phase of heating lighting, power, and ventilation (Abu Dhabi e-Government Gateway. 2013).

4. The principal issues associated with the key sustainable building have been mapped out:

1) Maintenance and **economic** growth to improved project delivery and productivity, consistent the profit growth, supplier satisfaction, client satisfaction, and minimizing the defects. Increased profitability and productivity to delivering services that provide the best value to clients and focus on developing client business. The good project is a vital overarching aspect in delivering sustainable projects, both in the short and long term. Projects should clearly identify and seek to satisfy the real needs, requirements, and aspiration of communities and stakeholders while involving them in a key decision (Abu Dhabi Department of Planning and Economy,2007).
2) To adequate protection of the **environment** to minimizing pollution emission and preventing nuisance from a noise and dusty by good site and depot management. Avoiding pollution by waste minimization and preventing pollution incidents of environment requirements. Designs should enhance living, leisure, and work environments and not endanger the health for the builders, users or others by exposure to pollutants or toxic materials (Abu Dhabi Urban Planning Council, 2012).
3) **Social** progress which recognizes the needs of everyone that including the respect for staff and providing health, safety and the conductive working environment. Building effective channels of communication through local employment and procurement for long term relationship with clients and local supplies to provide best values and focus on developing clients business. Improve the quality of life, provision for social self-determination and cultural diversity to protect and promote human health through a healthful and safe working environment (Abu Dhabi Urban Planning Council, 2011)
4) **Cultural** sustainability includes human capital, such as awareness and skills, and cultural capital, such as local social relations and customs. It is distinguished from Social Sustainability as cultural heritage and customs form the foundations of society. As Globalization and urbanization raise, it is important that culture is not eroded as this could decrease the ability of a nation to contribute innovations that spring from their unique geographical settings, culture, identity and history. Preserving local culture and diversity continues a crucial task for cities (Abu Dhabi Vision 2030 plan. 2012).

5. Issues and challenges that are facing the implementation of green building in Abu Dhabi

While the advantages of building 'green' can be debated, the dangers associated with its construction are frequently apparent and rapidly evolving. In a recent Marsh survey, construction industry executives named five primary risk categories associated with green building projects that both construction firms and project owners:

1) The additional costs of green buildings may affect completing projects on time and budget, but necessity is weighed against the cost of not going green.
2) Project owners/develops are starting to need additional Contract provisions and warranties about the energy performance of green buildings, causing increased exposure to potential liability for breach of contract or warranty.
3) Lack of experience by these parties in green construction can lead to problems obtaining LEED certification, delays and improper material specifications.
4) Changing from conventional construction project to green or sustainable project is another challenge for implementing green building in the UAE. Many of projects managers and engineers having difficulties to adapt and refuse to accept change to sustainable practices from conventional practices.
5) Guidelines for green building projects from design, supervision and maintenance and code of practice on energy efficiency and renewable energy to achieve low carbon building in the market. The existing guidelines and rating tool also do not integrate the design process, project management procedures, maintenance procedures with government policies or local guidelines and requirements.
6) Public perception and awareness about green building and its contribution to the environment is still at the minimum stage. Awareness of implementation of green building by the communities will create industry drive and demand for green building projects. Public is not conscious of the importance of the implementation of green building and society should be exposed and educate about the importance of green building and its contribution to the environment to create bigger demand on the implementation of green building and the level of general awareness about sustainability building benefits among the construction professional is little and also the awareness of sustainability is limited.
7) High cost for sustainable project implementation compare to the common projects and many stakeholders; agencies prefer implementing current project to green building project. Stakeholder and public should be educated about the return on investment (ROI) that green building provides in the future. Saving in electrical consumption and water usage is very important part in of the (ROI) of the green building provided for the user and stakeholders. Government and semi-government should be financing or budget for implementation of green building projects to distribute and promote it to all government agencies in addition to enhance demand on the implementation of the green building project to help in lessening the high-cost impact in the implementation of the green building project.
8) The Higher final cost of the sustainable building project and the market value until now not know from the public for long time investment.

6. Framework Objectives

The principal aims of this research framework are to:
1) **Identify** the factors that delay the implementation of the green building practice in Residential Building and Private Residential Villas in UAE.
2) **Evaluate** the factors that delay the implementation of the green building practice in Residential Building and Private Residential Villas in UAE.
3) **Develo**p a framework to improve the implementation of the green building practice in Residential Building and Private Residential Villas in UAE.
4) **Validate** the developed framework that improves the implementation of the green building practice in Residential Building and Private Residential Villas in UAE.

In general to identify the reasons that cause the delay of implementing sustainability in residential building projects in the UAE and to determine all the elements that make delay through the project stages. Also to understand the factors that maybe cause the delay in final finishing through the project process.

Framework strategic objectives

The framework strategies are addressed to eliminating the reasons that cause the delay of implementing the Green Building Procedures for Residential Building and Individual Private Villas in Abu Dhabi. By takes the proposed solutions as a necessary comment to solve the research problem by building a framework that including all the strategies than validating the framework by the Delphi participants.
The important strategic objectives that addressed in the framework are:
1) Increase public awareness.
2) Reduce the Price of Sustainability Materials.
3) Change Public Attitude to accept Sustainability Practice.
4) Enhance the Technical Knowledge toward Green Building Procedures.
5) Simplify the Government process for Sustainability Projects.

Framework Initiatives
The framework addressed a lot of initiatives to support the strategies and to solve the delay of implementing the Green Building Procedures for Residential Building and Individual Private Villas in Abu Dhabi such as:
1) Provide training sessions to increase the public awareness of Sustainability Practice in Abu Dhabi, embrace social media and utilize these tools to increase the public awareness and include GBP as a subject at the university level.
2) More studies are required to find new alternative materials for Green Building, direct support for materials cost from Government and use the Sustainable recycled materials.
3) Improving the quality of life for its residents based on four elements of sustainability: ecological, financial, community, and social, designing should reflect the culture of the residents and educate the public to change their resistance about GBP.
4) Sharing the academic expertise in GBP to design specific programs for training, sharing the global practices such as Leed practice for workshops and conduct Workshops for the technical people of ESTIDAMA.
5) Government projects requirements need extra review; special private organization needs to coordinate between

the Government and stockholders projects and Green Building Procedure should be a legal term in the UAE.

The sustainable information framework is in its initial stages of development. It is expected that its modularity and expandability will allow for flexibility of this framework, to accommodate changes in rating system requirements and the subsequent mapping of objectives in the Green Building Procedures in Abu Dhabi. Implementation framework of Green Building Procedures for Residential Building and Individual Private Villas in Abu Dhabi is significant in the resent time to ensure the success of ESTIDAMA practice as an implementer of Green Building for Abu Dhabi Projects.

The framework is intended to be applied by all organizations of Abu Dhabi Government and the private sector of construction, consultancy, contractors and developers in the Green Building industry. The development of this framework need support from the Government and ESTIDAMA practice in Abu Dhabi Urban Planning Council (AUPC) to accelerate the Green Building Procedures process on the Residential Building and Individual Private Villas projects in Abu DhabiDeveloped Framework shown in Figure (1).

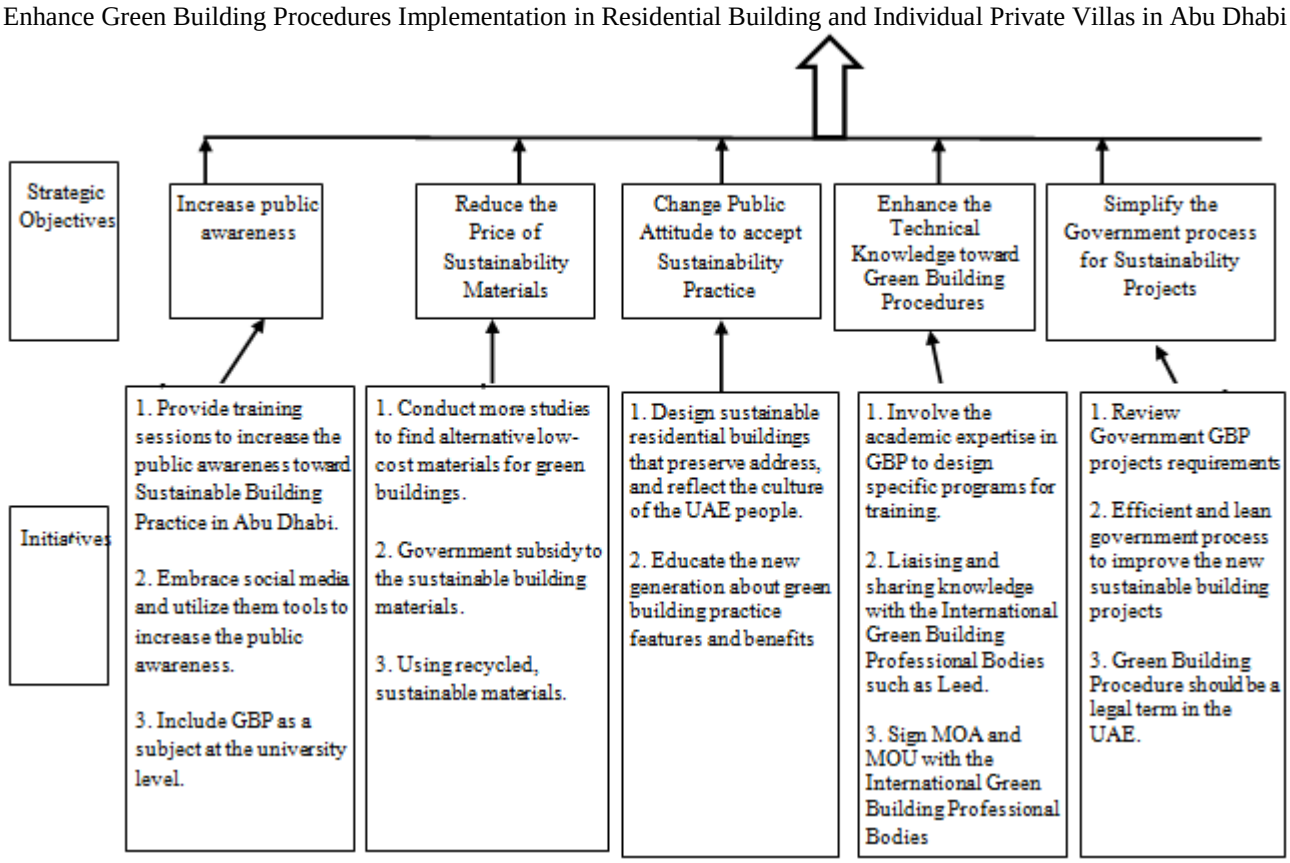

Figure 1: Framework for Green Building Procedures Implementation in Residential Building and individual private villas in Abu Dhabi

Framework Validation

The framework is validated by the members of Delphi group, and the most of the group is agreed with the proposed framework. Some of the members added comments to support the developed framework, and the comments are just to add some solutions that do not involve in the developed framework.

This is the validator's comments about the developed framework, and in general, they are agreed on this final framework to accelerate the implementation of Green Building Procedures in in the Residential Buildings and the Individual Private Villas in Abu Dhabi. Framework Validation Feedback showed in Table (1).

7. Master Plan

The master plan is used to generate and build community interest and participation, to build a new and common vision for the Abu Dhabi, and to develop a clear and solid set of recommendations for implementing the strategy of the UPC and ESTIDAMA program to solve the delay of the implementation of the Green Building Procedures in Abu Dhabi Green Building projects (https://en.wikipedia.org/wiki/Master_plan).

The proposed master plan to enhance the Implementation of the Green Building Procedures in Abu Dhabi is shown in Table (2). Master plan including five phases and each phase provide the possible solutions for the research problem, all the reasons that cause the delay the Green Building Procedures Implementation in Residential Building

including in the master plan and each phase complete the previous one.

Table 1: Delphi Round 5: Framework Validation Feedback

No	*Expert Name*	*Feedback*
1	Saeed Alabbar	I have gone through the framework, and I find the initiatives very promising for addressing the issues. I, therefore, validate the framework from my side.
2	DR. Khaled Mahmoud	The outcomes resulted from this study is accepted and all items mentioned will affect the ability to perform sustainable design and will accelerate the implementation of green concepts, and it will help to turn Abu Dhabi into a model of the green and sustainable oasis.
3	Eng. Lubna Senan	I see awareness as a key factor to promote the Sustainability Practice in the property development market of the UAE, the fact of higher investment is the main concern for developers coming from various segments (individual, property developer, financer, etc.)
4	Maged Louis	I have reviewed the outcome of the study and the proposed framework, and I confirm that this framework has successfully concurred all the key factors affecting the successful and timely implementation of the green building concepts into the residential building.
5	DR. Mohammed Omar	If this framework is adopted by all the stakeholders and if the government authorities commit to the need to simplify the procedures and improve the quality of education provided to the public and the design development professionals, I can see that this will be fruitful towards the achievement of the ultimate goal for UAE and the environment at large.
6	Amr Ibrahim	The outcomes resulted from this study is accepted and all the items mentioned will affect the ability to perform sustainable practice design and will accelerate the implementation of green building concepts, and it will help to turn Abu Dhabi into a model of green and sustainable. More investment in infrastructure supporting sustainability system.
7	Hassan Ibrahim	The framework should be adopted by the Government and the private sector in construction projects to help Abu Dhabi to meet the sustainability vision 2030 plan and improve the ESTIDAMA four pillars, environment, economy, social and culture.

Table 2: Master Plan to implement the proposed Framework

PHASE	*Issue1* *Lack of Awareness*	*Issue1I* *High Cost of Sustainable Materials*	*Issue1II* *Lack of Experiences in Green Building Practices*	*Issue1V* *Culture of the Community Does not support GBP*	*Issue V* *Inadequate of Government Regulations*
Proposed Solutions	1. Increase the level of awareness through ESTIDAMA programs by conducting courses and workshops. 2. Use the media (TV, Radio, and Newspaper) to enhance public awareness. 3. Include GBP as a subject at the university level.	1. Support from the Government to reduce the cost of the Sustainable materials in the market. 2. Alternative low-cost, sustainable materials can be used. 3. Using recycled Sustainable materials.	1. Involve the academic expertise in GBP to design specific programs 2. Liaising and sharing knowledge with the International Green Building Professional Bodies such as Leed. 3. Sign MOA and MOU with theInternational GBP	1. Design sustainable residential buildings that preserve discuss and reflect the culture of the UAE people. 2. Educate the new generation about green building practice features and benefits	1. Simple Government Regulations. 2. Efficient and lean government process to improve the new sustainable building projects 3. Reduce fees for the new sustainable building projects.
Authority Involved	1. ESTIDAMA 2. Ministry of Education 3. Universities. 4. Minister of Culture and Knowledge Development. 5. Ministry of Environment and Water 6. Ministry of Building and Construction	1. Ministry of the economy. 2. Ministry of Environment and Water 3. Ministry of Building and Construction 4. Private sectors. 5. Universities and R&D Centers. 6. ESTIDAMA	1. Ministry of Environment and Water 2. Ministry of Building and Construction 3. Universities. 4. R&D Centers 5. ESTIDAMA.	1. Minister of Culture and Knowledge Development. 2. Ministry of Environment and Water 3. Ministry of Building and Construction 4. ESIDAMA 5. Community Councils. 6. Universities and Schools.	1. Ministry of Environment and Water 2. Ministry of Building and Construction 3. ESTIDAMA
Role of the Authority Involved	1. Developing a policy to include ESTIDAMA practice in the school curriculum. 2. Develop policy to use TV, Radio, and Newspaper to	1. Develop a plan to lower the cost of sustainable materials. 2. Conduct researches to find a low-cost, sustainable	1. Develop a training center for GBP to educate technical staff of ESTIDAMA. 2. Send ESTIDAMA staff overseas to attend GDP course	1. Conduct workshops, conferences, and studies to enhance the design of a sustainable residential building that preserves and reflect UAE people	1. Conducting workshops with the stakeholders to revise the current Governments GBP regulations and process.

	educate the public	materials.	and conferences.	culture.	
Expected Outcome	1. High awareness among the public towards the GBP 2. New generations understand the important of green building future.	1. Affordable, sustainable Materials price.	1. Experienced personnel in the field of GBP.	1. Sustainable Residential Building Design that preserves and reflect UAE people culture.	1. Efficient and lean Governments GBP regulations and process.
Time Frame	**Through five Years Plan(Abu Dhabi Vision 2030 plan reviewed every 5 Years)**				

8. Conclusion

The developed Framework will enhance the Implementing of Green Building Procedures in Abu Dhabi Residential Building and individual private villas Projects. Furthermore, the Framework is important for construction companies, and consultant sector in Abu Dhabi and the UAE as it helps them to implement the Green Building Procedures in the Residential Building Projects and individual private villas projects in Abu Dhabi. The framework explains the proposed solutions that addressed by the researcher and Delphi participants to solve the reasons that cause the delay of Implementation of the Green Building Procedures in Abu Dhabi projects.

The developed framework designed to enhance and support Abu Dhabi 2030 vision plan in the construction field in Abu Dhabi. The framework will allow design teams, ESTIDAMA staff, contractor & construction companies to have an appropriate balance between economic, social, culture and environmental issues, and changing the way construction practitioners think about the information they use when designing building projects, for Green Building thereby facilitating and improving the Green Building industry in the UAE in future.

Delphi Round 5, the Framework Validation Feedback is addressed by the Delphi group to approve the framework and support it by their comments that help to improve the solutions of the problem.

Finally, a master plan was developed. The master plan is a detailed description of the policies, guidelines & strategies that will ensure the elimination of delay factors in implementation the Green Building Procedures in Abu Dhabi Residential building projects and addressed the time frame to do the proposed solutions in the short term depending on Abu Dhabi Vision 2030 plan strategy.

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