

Investigate the Factors Affecting Green Building Projects in Iraq Towards Building Sustainability

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Abstract-- The process of construction can be defined as an extensive system that builds the accommodations for people to settle in, as well as the construction of facilities that keep up the development process. Some of the main steps that the process would cover are the extracting and benefiting raw materials, manufacture of building materials and elements, the construction of the project run from viability to inspection, and the regulation and running process of the sites. The most profound challenges that many cities in Iraq share illustrate the consequences of urban growth. Thus, this study seeks to examine the aspects of sustainability that influence the decisions for the process of building up green building projects. A total number of forty respondents have been requested to evaluate nine elements of building sustainability: life cycle evaluations, energy conservation and renewable energies, water conservation, environmentally friendly construction supplies and standards, depletion of waste materials, alleviation of toxic materials, adequate indoor ventilation, smart innovation, and sustainability in the development of the building process and ecologically friendly construction projects. The findings show that the respondents preferred the use of elements that could give better sustainability in the process of construction building to ensure a healthier and better quality of life. This preference is established from the concept of green building technology. The most chosen aspect for this concept is the efficiency of energy and the use of renewable energy, followed by the alleviation of toxic materials, adequate indoor ventilation, and water conservation.

Keywords: Building Sustainability; factors affecting green Building; green building; life cycle; projects in Iraq.

1. Introduction

In this current modern world, the ecosystem is now on the verge of collapse and is in a critical state. This is highly contributed by the human activities that generally have given adverse effects to the environment ecosystem since past decades but now is considered more worrying as everyone in every part of the world is competing to build the extensive construction for the development of their countries. Research shows that the building construction works contributed the highest percentage of the ecosystem's resources and gave out a high level of pollution to the environment. In the Organisation for Economic Co-operation and Development (OECD) countries, the process of constructing buildings have majorly impacted the environment, in which the percentage of energy consumption is about 25-40%, followed by the utilization of raw materials around 30%, the emission of greenhouse gas in between 30-40%, and about 30-40% of the production of waste materials. Thus, it is important to maintain and ensure a healthy and good indoor quality environment and the aspects would impact the wellbeing of the inhabitants of the building, and at the same time would cut off the additional costs for people through reducing the building-related sickness that would for sure increase an individual's medical costs (Chwieduk, 2002).

The construction process can be realized as an extensive system that builds the accommodations for people to settle in and the construction of facilities that keep up the development process. This involves the exploitation and

gain of raw materials, the manufacture of building components and materials, the construction of the project run from viability to inspection, and the sites' regulation and running process (UNEP agenda 21, 1992). On the other hand, the green construction process and buildings indicate the building components' structure and the implementation of the process that is safe to the environmental setting, and the total utilization of resources without the practice of producing excessive waste materials. These features are expected to contribute to a satisfactory building's life cycle: from the project's site to the planning, construction, running, maintenance, redevelopment, demolition of the buildings. Though many current operations are implementing the newest and modern technologies and tools for the construction work in order to maximize the construction of better environmentally friendly buildings, the most crucial aspect to pay attention to is the green buildings are built not just for the sake of the natural ecosystem. However, they are also built to sustain human's general health condition.

The United States Environmental Protection Agency (US EPA) has considered a number of features for sustainable construction projects. Some of the critical features for the construction works are that each project should have at least 20% energy saving, have a considerable amount of water conservation, or that they could shift to the utilization of green stormwater into their projects as a new advanced approach to have a better water regulation. In order to achieve this, all team members need to give up full cooperation during the whole building process: from the procedures of designing, constructing, supervising to the involvement of the clients. The practice of green building operations would expand and supplement the current conventional building operations, majorly in the aspects of economic sustainability, efficiency, sturdiness, and convenience.

Regarding the governmental system, which is in the European Directive 2002/91/EC, the production of energy by construction works is crucial, which the system made clear in energy certificates, specifically the emission of CO₂. Environmental effects are a crucial catalyst for conserving energy, which is related to climate change, a limited number of natural resources, waste of nuclear, the production of toxic products, and many more. Excellent and wise evaluation processes during the building operations are needed for the reduction of environmental effects. Jönsson (2000) mentioned few crucial aspects that could be implemented in order to achieve this target: (a) The authorities need to make it legal and clear by stating in the policies and construction programs that it is needed to incorporate environmental production extent to the clients throughout the whole operation's process, (b) These requirements are to be given to the designing teams, architects and consultants, (c) Giving out information and instructions in order for both designs and the actual target operations to be reached accordingly, (d) Strategies and techniques for determining the best cost-efficient resources conservation and minimized environmental effect metrics over the development process (Jönsson, Å. 2000).

The complicated issues experienced by many Iraq cities are contributed by the effects of urbanization:

- growing density in the roads and travel hours.
- pollution emissions.
- excessive use of electricity.
- lack of green spaces and biodiversity.
- inappropriate economic distribution.
- lack of sense of culture.

These simultaneous causes, stresses, and the problems confronting the construction sectors, in particular, have contributed to increasing recognition of the need for improvement. As a consequence of these tensions, sustainable ventures are becoming a potential option for Iraq's building industry to satisfy buyers and contractor

requirements, and at the same time achieving economic performance in an intensely restricted and challenging business climate (Vatalis et al., 2011).

In order to achieve this vision to implement better strategies in building construction projects in Iraq, a set of questionnaire survey is designed and distributed to respondents to examine and analyze the clients, agents, architects, engineers, and construction firms preferences with regards to the interest in the implementation of green building projects in Iraq.

To examine the expectations of buyers, agents, architects, engineers, and construction firms about the proper interest in green building projects, a questionnaire survey was conducted on green building projects in Iraq. This study mainly aims to evaluate the overall degree of interest in green building projects in Iraq, including how execution differs with sustainable project characteristics and the value of weighted green elements that influence decision-making in environmental terms by participants. This study primarily aims to evaluate the overall degree of interest in green building projects in Iraq and how application differs with sustainable project attributes, along with the value of assessed green components that influence the decision-making process in environmental terms by people involved.

2. Components for the Sustainable Construction

Though it is widely seen that many of the current building construction works are generally improving in the way of their practices while incorporating better resources to sustain the environment and construct green buildings, the primary intention is to provide a better sustainable process for a better environment and overall human's wellbeing by the series of objectives of sustainable buildings: (a) Life Cycle Assessment (LCA), (b) energy conservation and renewable energies, (c) water conservation, (d) environmentally friendly construction supplies and standards, (e) depletion of waste materials, (f) alleviation of toxic materials, (g) adequate indoor ventilation, (h) smart

innovation and sustainable development, and (i) sustainability in the development of the building process and ecologically friendly construction projects.

2.1 Life Cycle Assessment (LCA)

LCA is a type of systems that would evaluate the environmental impacts that are linked to all of the levels of a product's life cycle from the beginning to the end process (i.e., starting from the process of extraction of the raw materials, followed by the developing process, manufacturing, distributing, utilizing, repairing and maintenance, and disposing and recycling). LCA would assist by giving a broader view on the whole process concerning the environmental details by giving focus on: (a) Compilation of inventories and environmental impacts of the respective energy and resource components; (b) Evaluate the possible implications of the resources and emissions identified; (c) Analyzing the findings in order for the choice to be further conscious. LCA is a comprehensive method involving the evaluation of the manufacturing, assembly, delivery, utilization, and disposal of raw material, along with any required or commodity life-affecting distribution phases. Under ISO 14040 / 14044, the life cycle evaluation phase is established.

There would be a rise in expenditure required for utilization and maintenance throughout the construction process, particularly between all the levels during a building's lifespan. For illustration, if fewer investments are made in the building process (e.g., incorporating weaker insulating materials). The dilemma that would arise is: will it easier to spend instead of just using and preserving in the building industry? (Bribian etc. 2009).

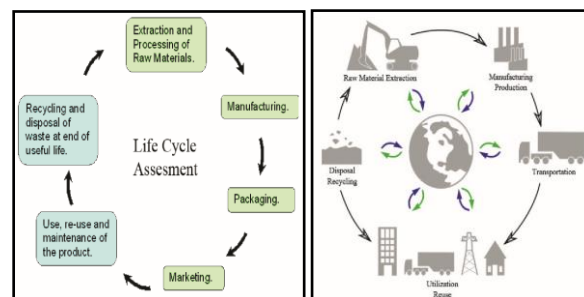


Figure (1): Scheme of LCA by a) Tececo and b) Westwind hardwood inc. 2012

2.2 Energy conservation and renewable energies

The buildings possess a significant effect on energy consumption and the environment. Past research in the United States indicated that many commercial buildings and residential houses incorporate the primary energy consumption up to 40%, and roughly about 70% of the total electricity in the country (EIA, 2005). Up until now, the level of energy consumption is drastically increasing, most possibly due to the fact that many new buildings are being constructed quicker compared to before. This can be analyzed through the statistics that show the consumption of electricity has doubled in many commercial buildings between the year 1980 to 2000, and that it is expected that the number would again increase by 50% before the year 2025 (EIA, 2005).

The efficiency of energy is generally can be simplified as the ratio of energy output to the energy input. This implies making the most out of each energy unit we get. It is typically a by-product of many other social objectives: efficiency, ease, potential savings, or competitiveness in oil. Methodological challenges are tough to calculate energy performance, especially on a macro level and across places or industries across years (Schipper and Haas, 1997). Renewable energy sources generate profitable electricity by turning natural events into usable energy sources, as Hartley (1990) pointed out. Solar and its implications on the planet (photons, waves, waterfall, warmth effects, and crop production), gravity influences, and energy from the Earth's center (geothermal), as the origins from which power emerges from these developments. These innovations use

sunlight energies as a supply for electricity. Electricity buildings consume less energy, lower cost, and convenience, saving consumers and businesses some cash.

2.3 Water Conservation

Water conservation and preservation of green building would become an essential element in the next coming years. According to the United Nations Environmental Program (UNEP), buildings use 20% of the world's water resources and supplies annually. Water conservation implies better technology and methods to offer equivalent or better operation in building with a lesser amount of water consumption. Water management steps may be introduced, and the quality of service for consumers can either be constant or improved, although the cost for overhead is reduced. Improved water quality decreases the operational costs and minimizing the need to build new sources and extend the water supply (for example, irrigation and water treatment). It would also limit extraction from existing water sources to enable further reuse and improve the safety of environmental water and marine ecosystems (www.epa.gov).

The first phase in improving water quality in a household is by decreasing the consumption of drinking water. Two forms could be implemented through this method: collecting the rainwater and indoor laundry water reuse. Cisterns could be installed in order to catch and store drainage from the top of the buildings, and other impermeable surfaces may be mounted above or below ground and from washing machines, dishwashers, bathrooms, and drains (these are categorized as greywater, which does not include sewage or human's waste).

2.4 Environmentally Friendly Construction Supplies and Standards

During the process of construction and demolition of the buildings, most of the construction's components and materials are getting discarded along with the other debris, which accounts for a total of 28% of sites' waste products

in the US. The evaluation of ecologically preferable construction materials starts with the requirements for the evaluation of construction supplies. For each project, component requirements may vary. The requirements rely on whether a new building, a reconstruction, or a current building is a project. There are seventeen environmental content requirements mentioned in Table 1, according to Froeschle (1999). Such standards will contribute to building sustainability in three main areas: (a) Environmental systems, b) Environmentally friendly building components; and (c) Environmental utilization.

2.5 Depletion of Waste Materials

The management of construction and destruction of waste building materials has been one of the greatest environmental issues in the world. Two types of waste og bulding constructions: (a) The bulding structure waste, and (b) The finishing waste (Skoyles and Skoyles, 1987). The structural waste during building is formed, such as the cement pieces, reinforcement bars, discarded timber panel, and fragments. Through the process of the building's completion, much waste would have been generated. Pieces such as mosaic fragments, bricks, ceramics, and colors are discarded due to reckless application. Plasterboard materials are damaged. Based on a review, Bossink & Brouwers (1996) calculated housing development sites to have a total waste of around 1-10% by volume of the building materials obtained. Ehshassi (1996) observed that materials are lost directly and indirectly, which is substantially higher compared to the usually permitted volume, which is around 3.6-11% from the sample of 86 housing developments in Gaza (2 - 4.5 percent).

2.6 Alleviation of Toxic Materials

Most of the building materials can cause air pollution. The consideration into the alleviation of the toxins released from the building materials is focused on the effort on three different types of indoor air pollutions, which are: (1)

Carcinogens, (2) Irritants, and (3) Odors. Humans' carcinogens are fewer in numbers and may cause significant disease, which should generally be avoided to the greatest extent. The irritants of airways and eyes are high in percentage and represent so many types of substance chemicals that contribute to the high chance for a substitution. On the other hand, odors should be avoided. These materials are commonly being used today as sealants, glues and adhesives paints, lacquers, and walls/floors coating (Anderson et al., 1982).

2.7 Adequate Indoor Ventilation

The indoor air quality issues are not necessarily restricted to homes alone. A major cause of air emissions occurs in a significant amount of office building. Any of these building styles may be badly ventilated. The ventilation system could not be equipped to supply external air. There is no relation to green buildings for effective indoor airflow. People also have little influence of their office's indoor air quality as compared to their houses. As a consequence, the amount of health issues is rising. The popular issue of VOC chemicals, namely formaldehyde, acetaldehyde and toluene, isocyanates, xylene and benzene, is emitted from buildings' components. Air quality may be seen at an acceptable level in the sense of improved indoor quality. The value of IAQ interventions also requires climate regulation for heating and ventilation. It was regarded by many experts as an essential IAQ control mechanism. According to Levin (1991), the fundamental ventilation consideration for the IAQ control are: (1) Air cleaning filtration (2) Air absorption place, (3) Microbial control, 4) Dilution by outdoor air ventilation, (5) Space air distribution, (6) Heat air restoration, (7) building exhaust location.

2.8 Smart Innovation and Sustainable Development

There are many definitions that can defined the term sustainable development, but the most profound explanation and has been cited repeatedly is the definition made by Our

Common Future, or commonly known as the “Brundtland Report (WCED 1987)”: Sustainable development comprises of two main notions: (a) The concepts of the needs, which means by the common needs of the poor, in which in this case it would give prioritization and set aside other aspects, (b) The limitation concepts that are being introduced by the state of technology and other social organizations on the capability of the environment to rally with the needs of the current and upcoming events in next years.

The fundamental ideas of the smart innovation framework in the sense of urbanization and mobalization is that this concept is mainly focusing on the innovation in a dense city to avoid any slump. The members of societies use extensive ways to expand, protect and conserve the significant areas, conserve the usage of water and quality of air, caliming back historical sites, as well as reusing the current lands that have been developed before.

The neighborhoods give their inhabitants and tourists an alternative for biking, riding, public transit, or commuting when they are doing business by planning neighborhoods with stores and workplaces, educational institutions, gardens, and other amenities close residences. Many various styles of residences encourage elderly folk to remain while they settle in their home, younger people who can get their first homes, and families to have a secure and desirable household they can provide for a good living. These neighborhoods build diverse environments where they shop, learn and play, thanks to the advanced innovation policies that improve neighborhoods and engage people in planning decisions. These neighborhoods are socially efficient, provide a good standard of living, generate entrepreneurial opportunities and increase local taxes (EPA, 2010).

2.9 Environmentally Contemporary Projects and Practicess

An innovative environment in the construction project is the development that could give a significant contribution to the sustainability of the environment. This covers a variety

of proposals, ranging from eco-safe technical advancement to create socially acceptable sustainable routes. Mass economic and social developments generate needs for modern buildings in the constructed settings. The central aspect of a strategic plan in the construction industry can be building developments. Investment opportunities in building projects, technologies, and utilities are essential, but massive preliminary fees can be complicated. The cumulative indication of countries/economies/projects regarding climate and development performance is a method to quantify the building industry's yearly creative variance. This metric is known as the world measure of creativity.

3. Methodology and Results

This study incorporates a set of a questionnaire survey, which is distributed to 40 respondents. In the survey, they were asked to give their reviews or opinions on nine sustainability components that could have impacts on the implementation of projects of green building (Table 2). The list of the components that are being asked are: (a) “Life Cycle Assessment (LCA)”, (b) Energy conservation and renewable energies, (c) Water conservation, (d) Environmentally friendly construction supplies and standards, (e) Depletion of waste materials, (f) Alleviation of toxic materials, (g) Adequate indoor ventilation, (h) Sustainable development and smart innovation, and (i) Environmentally contemporary projects and practices. The selections of the respondents are based on the following criteria: (a) Respondents have a comprehensive working history under the sustainable environmental construction industry, (b) They are curious and want to build sustainable building projects, and (c) The groups or investment bankers are interested in advocating for green building projects in the country. Table 1 shows the environmental component variables for green buildings.

Table (1): Environmental component variables for green buildings (Froeschle, 1999)

	Variables	Explanation
1	Lower toxicity	Components comprising of lower toxins level or nontoxic
2	Minimum emissions	Components have lower chemical emission or no emissions at all (VOCs, CFCs)
3	Lower VOCs percentage	Lowering the level of indoor contaminants
4	Recycled components	Components that are incorporated from recycled materials
5	Efficiency in resources	Components that are being manufactured in a setting that generates a lower amount of waste materials
6	Recyclable components	Components could be recycled at the final stage
7	Reusable components	Components could be reused at the final stage
8	Sustainable resources	Renewable components that are being generated from sustainable materials
9	Durability of components	Components are made of materials that are compatible with staying strong for a more extended period of time
10	Resistant to moisture	Components are made of solid materials that can not easily catch moisture (to inhibit the growth of impurities)
11	Energy efficient	Components that are able to reduce the energy consumption
12	Water conservation	Components that could help in reducing water consumption
13	Improved IAS	Tools that encourage better IAQ
14	Good maintenance	Components that need easy and nontoxic cleaning
15	Locally made products	Save the energy and costs for transportation
16	Affordable components	Building costs are comparable to the materials used.

Table (2): Sustainability Requirements Criteria

Variables	Rating Criteria										Consideration Weight	Net Score	
	1	2	3	4	5	6	7	8	9	10			

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X	1	Life Cycle Assessment										0.15	0.579
X	2	Energy conservation and renewable energies										0.10	1.161
X	3	Water conservation										0.11	0.735
X	4	Environmentally friendly construction supplies and standards										0.10	0.600
X	5	Depletion of waste materials										0.10	0.630
X	6	Alleviation of toxic materials										0.15	1.500
X	7	Adequate indoor ventilation										0.15	0.750
X	8	Smart innovation and sustainable development										0.15	0.520
X	9	Environmentally contemporary projects and										0.10	0.720

ventilation (X_7) impacts all levels of income. The fourth aspect of importance remains water conservation (X_3). Today's tension came from the regional sectors of the economy induced by the shortage of clean drinking water provides us with the ability and incentives to launch strategies to enhance water protection of building project operations. For example, in the case of retreated water, most water specifications may be met if it is appropriately handled for large-scale water efficiency. The participants' choice for sharing environmentally contemporary projects and practices is a fifth factor of the prioritization (X_9). In the sense of emissions control, urban technology seeks to react in construction projects. Next, the sixth concern is the depletion of waste materials in buildings (X_5). In recent years, Iraq's accelerated urbanization and its unreasonable waste disposal are related to environmental distress, such as reducing living standards and citizens' wellbeing, with environmentally friendly construction supplies and standards (X_4). The products on which a building is designed are considered to play a significant role in its overall environmental effect. Material recycling and enhanced strategies minimize buildings' environmental effects and enable more resource-efficient design, refurbishment, service, and repair models. The life cycle assessment (X_1) is thus the eighth-most critical variable in sustainable building. Under such conditions, the life cycle assessments (X_1) is known to be the eighth largest component in sustainable development. Finally, smart innovation and sustainable development (X_8) was the least significant consideration in the theory of intellectual growth and sustainable development.

This time in Iraq, we can see the clear need for sustainable development with its many advantages to businesses and partners, cooperating organizations, and customers, as being figured out through the findings.

4. Conclusions

In the view of sustainable green buildings, the main element that has to be taken into account is the building's life cycle that would impact the conditions of the environment, in the sense of energy conservation and the living quality. This study came to a list of some main conclusions, which are in order for people to sustain the environment while at the same time having a good quality of life, some aspects need to be accounted while constructing buildings: (a) use of renewable energy, (b) reduce in the production of waste materials, (c) improve the condition of indoor air quality, (d) conservation of water, (e) designing environmentally safe projects, (f) minimize the production of waste products, and (g) reusing all safe building components, so that the amount of waste materials production would decrease and hence sustaining the environment. These would ensure a better quality of life for all people, ensuring green buildings' implementation, especially knowing that most of us would spend our time inside buildings, whether at work or home. Though with all of the extensive research and studies that have been conducted on this topic, the incorporation of green buildings is still not being a prevalent aspect in the building industry in Iraq. We hope to enable developers, workers, and government officials to gain expertise, economic profit, and skills to foster an engaging approach among the numerous building organizations in the region.

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