

Assessment of sustainable construction in Lebanon

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Purpose One of the most critical contemporary issues is achieving and maintaining sustainable development, adapting the use of natural resources to provide for the needs of our rising populations without threatening the survival and quality of life for future generations. Sustainable construction, in particular, is a concept that is gaining importance all over the world and is gradually improving life for populations that recognize its importance. The current environmental degradation in Lebanon due to limited natural resources, population increases, and inefficient urban management, threatens the economic growth and the wellbeing of the people and thus dictates the urgent need for planning and taking action on a comprehensive environmental sustainability strategy. The main purpose of this research is to explore the Lebanese construction industry in order to evaluate sustainability achievements on both design and construction levels. This research also studies sustainability standards and practices implemented in some developed countries and in the surrounding region in order to better assess the current status of sustainability development and corresponding public awareness in the Lebanese construction market with respect to foreign industries. Based on the aforementioned, this research addresses challenges to sustainable construction in Lebanon and provides recommendations to enhance the use of energy-saving materials and the application of environmentally-friendly construction methods. **Method** This assessment is done through two complementary approaches: (i) a comprehensive literature review of all pertaining governmental regulations, public policy, and guidelines that have been enacted to promote building sustainability in Lebanon, as well as a survey about existing green buildings and ongoing green projects along with the implementation challenges; and (ii) conducting interviews with Lebanese parties that are key players in achieving sustainable development such as local experts, public agencies, municipalities, architectural and contracting firms, private agencies dealing with environment protection, and real-estate companies. **Results & Discussion** The concept of sustainable production and construction is still very primitive in Lebanon and the role of the government in promoting sustainability is not yet well established. Some public entities including, but not limited to, the Ministry of Industry, the Ministry of Environment, the Ministry of Energy and Water, the Council for Development and Reconstruction (CDR) have put some effort through internationally funded projects and campaigns by UNDP and the European Commission aimed at promoting sustainable production and consumption in Lebanon. However, these efforts were not enough to have a significant impact on these industries and resulted merely in voluntary guidelines rather than serious measures to reduce energy usage and pollution. Another finding of this research is that major efforts need to be made towards enhancing public awareness of sustainability issues. Hence, this research analyses the observed deficiencies in the Lebanese construction market and provides some recommendations that, if turned into action plans, constitute a promising transition from a short-sighted construction focusing on short-term goals of profit making and fast growth and lacking concern for the environment to a global long-term sustainable development that ensures the welfare of the current and future generations.

Keywords: *Management and social issues, sustainability, public policy, construction practices.*

INTRODUCTION

Lebanon has been undergoing a reconstruction and rehabilitation phase since 1990 which marked the end of a hostile 15-years civil war. This war has not only damaged the country's infrastructure but moreover it has weakened its economy, depleted its natural resources and greatly polluted its environment. Additionally, Lebanon has been suffering from power shortage for the past twenty years and as a result private power generators became the main alternative for providing electricity to the population and consequently controlling the society's quality of life. According to the United Nations Framework Convention on Climate Change, Lebanon's energy use resulted in the emission of 12 million tons of CO₂ in 1994 of which 8% generated from energy used in

buildings for heating and cooling purposes. According to the same report, the increase in CO₂ emissions reached 35% between 1994 and 1999¹. These facts highlight the urgent need for a major transition from a shortsighted construction focusing on short-term goals of profit making and fast growth and lacking concern for the environment and for scarcity of natural resources to a global long-term sustainable development that ensures the welfare of our current and future generations.

The concept of sustainable production and construction is still very primitive in Lebanon and the role of the government in promoting sustainability is not yet well established. Some public entities including but not limited to the Ministry of Industry, the Ministry of Environment, the Ministry of Energy and Water, the

Lebanese Institute for Normalization (LIBNOR), and the Council for Development and Reconstruction (CDR) have put some effort through internationally funded projects and campaigns by UNDP and the European Commission that aimed at promoting sustainable production and consumption in Lebanon. However, these efforts were not enough to have a significant impact on the concerned industries and resulted merely in voluntary guidelines rather than serious measures to reduce energy usage and subsequent pollution. In particular, sustainable construction is starting to gain the interest of some developers in the Lebanese market but yet there is still a lot to be achieved in this field namely improving building codes to include more incentives for green construction and enhancing the legislative body to enforce these regulations.

This paper assesses the current status of sustainable development in Lebanon, particularly in the construction sector, and provides an extensive overview over pertaining laws and regulations. It also presents a wide perspective about international sustainability practices in some neighboring Arab countries and other Western countries in order to better understand where Lebanon stands on the international sustainable development scheme. The paper ends by identifying the different challenges the Lebanese industry faces and provides recommendations to enhance sustainable development and to promote green buildings in Lebanon.

THE LEBANESE CONSTRUCTION INDUSTRY

In the past couple decades, Lebanon's environment has been deteriorating exponentially due to destructive exploitation of natural resources and to the pre-occupation of the government with political, financial and economic matters. Forested areas which used to cover 13 % of Lebanon have decreased tremendously to only 5 % as a result of forest fires, cutting of trees and urbanization. Marine resources have suffered from extensive pollution all along the Lebanese coast and have revealed the presence of mercury and copper due to discharge of untreated wastewater and industrial waste. A national water quality survey conducted in 1990 indicated that approximately 70 % of all water sources were exposed to bacteriological contamination². Air pollution resulting from the combustion of petroleum products for power generation and transportation purposes has reached high-levels almost approaching the WHO health norms. Furthermore, most sand and gravel used in construction are obtained through removal of sand from the coastal strip and through quarrying in the mountains; which poses serious threats of intensive coastal erosion and morphology, and mountainous terrain erosion and landslides.

To address these environmental threats, Lebanon has undertaken several initiatives that are mandatory

in paving the way towards a clean and sustainable environment. The Ministry of Environment (MoE) was established in 1993 (decree 216) to protect the environment and was amended in 2005 to address sustainability issues. For instance, giving protected status to some green areas consisting about 2 % of the total surface area, and improving solid waste collection and treatment in several parts of the country are some of the improvements made in this respect³.

Furthermore, the MoE has enacted several laws to govern the protection of the environment in Lebanon. One of these laws is the Environmental Protection Law (decree 444) which addresses the importance of preserving the nature and the environment through setting a strategic national plan, revised every two years. The law dictates that a national environmental council representing the concerned ministries as well as expertise and NGOs working in the private environmental sector will be developing, implementing and supervising the environment protection plan. The law also stresses the importance of increasing public awareness through introducing the concept of nature conservation into academic curriculums and organizing awareness campaigns, lectures and symposiums. Furthermore, the law suggests incentives to encourage the population protect their environment through allowing up to 50% discounts on importation taxes corresponding to equipment or technologies that reduce or prevent environment pollution or that serve solid waste treatment. It also designates fines for each violation of the environment wellbeing. Another important initiative is decree 14865, enacted by MoE in 2005, where the ministry promises to make financial contributions to non-profit organizations to carry out environmental activities that enhance sustainable development including promotion of research in this field.

However, and despite all the environmental regulations that have been adopted by the Lebanese government, indicating the environmental maturity and awareness of the public authorities, the problem still remains in enforcing these legislations. A project led by UNDP in conjunction with the Ministry of Justice was approved in 2007 and aimed at improving the judiciary system of the Lebanese Ministry of Justice and building its capacity in enforcing environmental legislation. However, this project faced many challenges such as the lack of proper archiving and electronic filing of cases, and the lack of environmental law courses offered at the Lebanese universities⁴. Thus, the project focused on introducing an environmental course at the Institute of Judicial training at the Ministry of Justice to help judges better understand the flaws of the current system and the ways it can be improved.

From the construction perspective, this paper conducted a comprehensive survey over the Lebanese building code and found out that it merely provides guidelines or minimal incentives towards achieving sustainable construction. For instance, the code specifies certain design guidelines for windows placement that enhances natural lighting and saves on power, and it allows for subtraction of wall areas from allowable area exploitation only if proper isolation is used like double glazing. Besides, the Ministry of Environment developed several laws that help protect the environment against the hazards resulting from construction activities. One such example is decree 8006 which regulates sanitary waste disposal methods. Another such important decree is the environmental law 444, developed in 2002, that stresses the importance of conducting an Environmental Impact Assessment (EIA) study for public and private buildings exceeding a certain built area. This EIA serves to analyze and reduce any negative impact a building might have on the environment, and to protect the safety of its inhabitants and visitors. But unfortunately, and similar to all other environmental regulations, EIA is not mandatory because it has not been enacted yet by the Council of Ministers. The decree stated that it would be enforced through specialized governmental controlling bodies which have not been formed yet and thus making the law ineffective.

One of the key players towards achieving sustainability in the Lebanese construction market is the Lebanese Green Building Council (LGBC) which is a non-governmental organization founded in 2008 to promote sustainability and the use of energy-saving materials for buildings. To serve its purpose, LGBC organizes sustainability awareness campaigns and evaluates the energy efficiency of buildings through its own developed rating system (ARZ) for green buildings. The ARZ rating system contains four levels of certifications with five-year validity that assess the efficiency of several components: orientation and structure design, energy, materials, water, building isolation, materials, indoor environmental quality, operation & maintenance optimization, and waste and toxics reduction. Although LGBC has been very active in promoting sustainable construction and despite the emergence of some NGOs that have the necessary expertise in tools and techniques required for green buildings (e.g., Lebanese Association for Energy Saving and for Environment, Green Hand, Green Line Association, Lebanese Solar Energy Society, etc.), the movement towards sustainable construction is still very primitive and the percentage of green buildings remains very minimal. Examples of current green projects under construction are Beit Misk which is a rural residential project targeting sustainability, and the Sama Beirut tower aiming for LEED certification. Another example is La

Brocéliande, a residential project in the Beirut suburbs of Yarzé by Greenstone Real Estate Developers, which is the first to take into consideration the sustainability standards of the UK's BREEAM rating system by using building components and construction practices that are energy efficient. However, these projects result merely from personal initiatives by developers or owners that are aware enough of the long term benefits of sustainable construction and are not enough to declare a sustainable construction pattern in the Lebanese industry.

Based on the aforementioned, it is observed that the main obstacle towards green construction is the fact that the current construction law does not take into consideration the environmental impact of design and construction aspects in buildings and hence does not firmly enforce an environmental impact assessment for each project to study and control its effect on the nature. The other main concern, and beside the lack of proper legislation system with adequate monitoring agencies, is the lack of public awareness about the importance of sustainable development and preservation of the nature's resources. A survey conducted by UNDP showed that only six out of fifty universities in Lebanon include courses about environmental laws and policies in their undergraduate curriculums⁴. Thus, a critical and promising step towards achieving sustainability is raising awareness of the public about the benefits of sustainable construction through organizing more campaigns and updating our educational curriculums to teach the new generation about the environment and the relevant regulations. Once real-estate buyers or end users become knowledgeable about green buildings and their benefits, it consequently influences developers and contractors.

SUSTAINABILITY IN FOREIGN COUNTRIES

Arab Countries in the Middle East Region

Sustainable development is recently becoming one of the top concerns in the Middle East region. According to a study conducted by Merrill Lynch, one of the world's leading financial management and advisory companies, around 20% of the wealthy investors in the Middle East region, have already invested in green related technologies. In fact, green building councils have been established in most of the Arab states, and while some rely on previously established rating systems such as LEED, others create their own rating systems such as the ARZ system in Lebanon, Estidama in the United Arab Emirates and the QSAS in Qatar⁵.

On the other hand, the UNDP has been active as well through a comprehensive plan on the regional scale to help the Arab countries save their environment threatened by water scarcity, desertification and other concerns. The UNDP has been working

closely with governments through its Country Office to tackle certain problems on the national level: combating desertification, improving water management, mobilizing funding from the Global Environment Facility, and taking an integrated approach to climate change.

Zooming further into the wealthier countries of the region, the United Arab Emirates exhibits a fast growing economy exposed to extreme heat conditions and desertification risks. This makes the conservation of energy vital and a strategic planning to reduce the environmental harm essential. On the bright side, the UAE benefits from a high GDP and a strong commitment to environmental duties making it one of the leading countries in strategic planning within the Arab countries. Unlike Lebanon, an increased wealth resulting from the extraction of natural oil allowed the UAE to invest in developing and implementing environmental regulations to varying degrees according to each emirate. Also, the UAE ratified several international conventions such as the Kyoto Protocol and the United Nations Convention to Combat Desertification, which shows its commitment to preserve the environment. Besides, the Emirates Green Building Council (EGBC) plays a key role in protecting the environment and in raising public awareness⁶.

Among the United Arab Emirates, Dubai is taking a leading edge towards sustainable construction. In fact, the Government of Dubai, Dubai Electricity & Water Authority, and the Municipality of Dubai coordinated the creation and implementation of the "Green Building Regulations & Specifications". This code, inspired by the LEED system, is applicable to all the buildings in Dubai and targets areas such as ecology and planning, building vitality, and resource effectiveness in terms of energy, water, material and waste. Accordingly, more than 300 buildings are certified to be green today in Dubai alone.

As for the emirate of Abu Dhabi, its Urban Planning Council (UPC) has introduced a framework for sustainable design, construction and operation under the name of Estidama Pearl Rating System. All new buildings, villas, and government-owned and operated buildings are required to achieve a minimum sustainability score under the Pearl system. The Masdar development project, a sustainable city designed to house 50,000 people in a green environment with an investment of almost 25 billion USD, is the highlight of Abu Dhabi's commitment to sustainable development.

On the other hand, Qatar who is living a period of economic prosperity and construction boom has been also one of the leading countries in the Arab region in the sustainability field. Qatar has combined regional and international certification systems into one comprehensive system, the Qatar Sustainability

Assessment System; tailored to the country's conditions and vision. Furthermore, and according to the Ministry of Environment, the QSAS and the Qatar Building Standards of 2010 (QBS) should be applied to all public buildings in Qatar as well as residential and commercial complexes. Another huge leap towards leadership in sustainability is the fact that the country has started its project to host the 2022 World Cup in 12 stadiums presenting zero carbon impact and relying on solar power for all functions⁷. This would definitely become an inspiring incentive for the region.

Saudi Arabia is another country in the Arab region exhibiting a high GDP and gaining further interest in sustainable development. Several initiatives were taken by the kingdom, most importantly, the adoption of the Green Building- EcoSENS program that aims to raise awareness and provides training for local engineers for the LEED certification program. Also, new buildings for Princess Noura University and the Ministry of Higher Education are applying LEED standards⁵. The Saudi Green Building Council is also playing an important role in spreading awareness and providing a platform for various construction sectors to facilitate green construction.

Other countries of the Arab world, with a GDP similar to Lebanon, remain at an early stage of reaching sustainability, notably Jordan. Many efforts are put into the matter, and the Jordan Green Building Council has been established in 2009 taking part of the World Green Building Council. This organization is supported by the USAIDS and has been working on creating standards and recommendations while spreading awareness throughout the country. The campaign is fully supported by the royal governing family along with the concerned ministries. Additionally, other bodies such as the Jordan Engineers Association are working closely with other regional bodies such as the Gulf Organization for Research and Development to promote sustainability. A promising initiative towards green construction is the development of Al-Mushatta Industrial City that aims to become the first green industrial city in the region⁵. While these initiatives enlighten the public about the importance of sustainable development, Jordan, and similarly to Lebanon, suffers from the lack of a proper judiciary body that can implement and enforce environmental legislations.

Egypt is another neighboring country to Lebanon that is also at a preliminary stage of launching and implementing a strategic sustainable development plan. The Egyptian Green Building Council was established in 2009 encouraging the implementation of already existing codes aiming to preserve the environment, combat desertification, and reduce energy consumption in buildings. For this purpose, the council developed the Green Pyramid Rating System which is similar to the ARZ system in Lebanon by

LGBC but accustomed to fit the Egyptian environmental needs and building requirements. Several initiatives have been studied and considered by EGBC that highlight the interest of developers in sustainable projects. Examples are the Eco-villages National Project approved by the Minister of Housing, Utilities and Urban Communities, the Affordable Green Housing project that aims to create sustainable homes for middle income families, and the New Hermopolis, a new resort capable of housing 52 visitors that runs purely on ecological principles. Another important incentive towards sustainability is the construction of the HSBC buildings in Cairo according to the LEED standards. However, and according to developers of these projects, the main challenge to advancing in sustainability remains the absence of enacting and enforcing proper environmental regulations.

Based on the aforementioned, the Arab countries are clearly divided into high and low income governments. And it is well observed that this particular status reflects on the development and implementation of strategic plans towards sustainability. This may be due to the elevated immediate cost of investing in sustainability, or even the fact that awareness comes hand in hand with the buying power of the government and its capacity to reflect on environmental considerations.

Western Countries

In contrast with most developing countries that are still taking the initial steps towards achieving sustainable development, many of the developed countries are past this stage to a more mature phase where sustainability standards and regulations have been enacted and implemented, and are in constant change for the better.

For instance, there are many bodies in the United States of America that contribute to the implementation of sustainable development, most importantly the Environmental Protection Agency (EPA) which issues laws and regulations, compliances and enforcements. The EPA addresses the construction sector by monitoring air pollution, waste, and other hazardous pollutants resulting from construction. Many building codes are issued according to the specific conditions of each region or state. The most recent one is the "2012 International Green Construction Code" issued by the International Code Council and sponsored by the American Institute of Architects and by US green building council. This code constitutes a regulatory framework for new and existing buildings that establish sustainability requirements from the design phase to the construction phase and operation of the building⁸. Another regulating body aiming for the same goal is the US Department of Homeland Security which issued the "2011 Strategic Sustainability Performance Plan".

This plan works on studying lifecycle costs for new buildings while assessing environmental, economical and social aspects. Besides, there are several non-governmental organizations that provide major efforts to raise public awareness and encourage the green industry, the most important of which is the USGBC which provides consulting, monitoring and environmental impact assessment services for buildings through the LEED certification program. This certificate has become very popular over the years to expand over 120 countries, including Lebanon.

As for the United Kingdom, the government is directly involved in assisting and planning sustainable development. The Code for Sustainable Homes and the Energy Performance Certificate (EPC) for Construction set the minimum requirements for buildings in order to attain sustainability (energy and water efficiency). The code for sustainable homes is an environmental assessment rating method for new homes that evaluates the environmental performance of a building during design and post construction phases. The environmental impact of a building is measured according to nine categories including energy and carbon emissions, surface water runoff, water use, materials, waste, pollution, etc. This code is mandatory for all new dwellings and the assessment results are recorded on a certificate assigned to the dwelling⁹. Also, the EPC for construction targets both homes and commercial buildings. The evaluation targets energy reduction within appliances including heating, air conditioning and ventilation. Obtaining the certificate is required according to the building code. Besides, the "Sustainable and Secure Buildings Act 2004" is another legislation among many others that put the UK's on the right track towards achieving sustainability.

On the other hand, the European Union Member States have also formulated their long-term strategy to achieve economic, social and environmental sustainable development and have set certain targets to reach by 2020. Along its sustainability plan, the European Commission has issued many policies and legislations impacting the construction industry some targeting the energy efficiency of buildings, control over hazardous construction materials and others addressing workers' conditions. Among these regulations are the Waste Framework Directive which aims at providing a better management of wastes resulting from the construction industry, and the Energy Efficiency Package aiming at reducing energy consumption¹⁰. These frameworks emphasize the importance of monitoring construction products by classifying and regulating dangerous substances used in the construction industry such as chemicals, waste issues, indoor emissions, soil and groundwater releases, etc.

Moreover, the European Commission has put into action several incentives that encourage its states

and their local governments to improve their environment and commit to sustainable development. One of these initiatives is the European Green Capital award which is granted to the city that has the highest environmental standards and which can be a role model that inspires other European cities to compete for sustainability. For instance, both Nantes (France) and Vitoria-Gasteiz (Spain) were the winners of this prize for 2012. Another such incentive is the One Billion Euros research investment entitled "Energy-Efficient Buildings" and financed jointly by EC and the industry. This programme was launched in July 2009 and aims at promoting the integration of green technologies and energy efficient materials in new buildings in order to reduce CO₂ emissions and save on energy usage.

To summarize, it is clear that Western countries are taking a huge leap towards achieving sustainability due to the complementary efforts of their governments and non-governmental agencies. They mostly exhibit a dynamic platform for green construction supported by public awareness and a legislative body that ensures the orientation of the industry in the proper direction.

CHALLENGES TO SUSTAINABLE CONSTRUCTION IN LEBANON AND RECOMMENDATIONS

In comparison with sustainability development in the surrounding Arab countries, U.S, U.K. and the European Union member states, Lebanon seems to have taken some primitive steps towards the sustainability plan but a lot remains to be achieved yet so it can take a place among the leading countries in this field.

Besides the scarcity of its natural resources, Lebanon has suffered from a long civil war that lasted about 15 years and thus brought the country under a heavy financial debt and hindered its economic growth. In fact, only 2.4 % of total public financial resources are allocated to environmental protection¹¹. And of course green construction requires higher immediate investments than ordinary one which makes convincing developers and users of opting for sustainable construction a challenge. Here comes the importance of public awareness and recognizing the benefits of lower life cycle costs of green buildings. Thus it is mandatory to teach our generations about our environmental concerns, the importance of preserving our natural resources, and the urgent need to develop and enforce environmental regulations in order to protect our environment. Hence, green construction technologies and their effect on the environment as well as building codes and regulations should be introduced into our Civil Engineering curricular programs. Also, the media (visual or written) should help promote sustainability by dedicating enough time or space to talk about environmental issues, show their impact on our daily

lives, and discuss the ways they can be addressed. In addition, the private and public sectors should both coordinate and create incentives to orient developers and users towards sustainable development such as discounts on environment-friendly materials and green construction technologies, rebates on solar panels, reduced interest on loans for green houses, etc.

Another major barrier threatening the sustainable development in Lebanon is the lack of a proper legislative system responsible for enforcing and monitoring green construction practice. While the Ministry of Environment along with the Ministry of Energy and Water are trying to spread awareness through campaigns and other initiatives, the absence of a solid building code or regulations along with the absence of a credible monitoring agency represent the most challenging threat yet to overcome. The government plays a key role in this regard and should at least enforce the minimum requirement of submitting an environmental impact assessment for new buildings to the corresponding authorities for approval. It should also ensure that at least public projects use components and construction practices that are energy efficient and environmentally sustainable so they provide a role model for the private sector. Another incentive that the government can initiate is to organize a Green City Award, similarly to the European Commission, in order to motivate Lebanese cities to compete for sustainability.

Last but not least, cooperation and coordination of efforts between the governmental parties such as the Ministries of Environment, Industry and Public Works, the Council for Development and Reconstruction, the different NGOs such as LGBC and others, the developers, the educational and training institutions and the public is a crucial factor to face the current challenges and to put the country on the right and fast track towards sustainability.

CONCLUSION

This paper presented a detailed assessment of the sustainability aspects of the construction sector in Lebanon discussing the pertaining environmental regulations, in particular the construction law, the contribution of concerned NGOs and the few applications of green construction in the market. Then, it provided an extensive review of the international sustainability practices and their implementation in surrounding Arab countries and in some other developed countries in order to have a better perspective of the Lebanese sustainability efforts. This paper concluded by identifying the challenges towards promoting green construction in Lebanon and provided recommendations that help turn the sustainability development plan into reality.

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