International Journal of Earth, Energy and Environmental Sciences
ISSN: 2517-942X
Vol:5, No:11, 2011

Challenges of Sustainable Construction in Kuwait: Investigating level of Awareness of Kuwait Stakeholders

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***Abstract*—**Buildings and associated construction methods have a significant impact on the environment. As construction activity increases in Kuwait, there is a need to create design and construction strategies which will minimize the environmental impact of new buildings. Green construction is a design philosophy intended to improve the sustainability of construction by the minimization of resource depletion and CO_2 emissions throughout the life cycle of buildings. This paper presents and discusses the results of a survey that was conducted in Kuwait, with the objective of investigating the awareness of developers and other stakeholders regarding their understanding and use of green construction strategies. The results of the survey demonstrate that whilst there seems to be a reasonable level of awareness amongst the stakeholders, this awareness is not currently well reflected in the design and construction practices actually being applied. It is therefore concluded is there is a pressing need for intervention from Government in order that the use of sustainable green design and construction strategies becomes the norm in Kuwait.

***Keywords*—**Sustainability, Sustainable construction, Green Building, Environmental assessment

I. Introduction

BUILDINGS and the construction industry play an important role in the needs of society by not only adding value health and economic benefits but also contributing to improving the way of living. Consequently, this sector is also a major cause of the depletion of natural resources high energy consumption, global greenhouse gas emissions, waste generation, and air pollution [1]. Recently in Kuwait, there is a growing concern form the researchers and specialists in field of construction industry on environmental impacts resulting from construction activities. As the construction of building in Kuwait is on the increase and with the environmental impacts of buildings and its construction practices known, more attention must be paid to the creation of additional strategies for the enhancement of environmental performance in building design. The concept of sustainability is being recognized worldwide as an essential need for the future.

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One definition of green building is *'a current design attitude which requires the consideration of resources reduction and waste emissions for the period of its whole life cycle'* [2]. The concept of green building and sustainable construction facilitates the construction industry to have a positive and practical attitude towards environmental resources[3]. Green building practices include and emphasize on the principles of sustainable site, water efficiency, energy conservation and efficiency, resource-efficient materials, waste minimization, ventilation whereas other practices help to minimize environmental impact and resource consumption [4].

Sustainability issues become a focus point for communities and countries, as the earth's recourses are under severe pressure due to raising populations and economic expansion. Construction works and the maintenance/ refurbishment of buildings impact on the environment and caused an irreversible changes in the climate of the all over world, atmosphere, and ecosystem. Buildings are a significant source of greenhouse gas emissions (and in particular CO_2 , and unless action is taken, these emissions is will increase with Sustainability adaptation of all approaches of life and works towards facing demands with minimizing impacts of consumptions, and with saving the future generation[5].

Kuwait is one of the leading countries in the Middle East in terms of construction activity, and the government of Kuwait spends a substantial amount of budget to support this sector. However, realizing the importance and impact of this industry on environment and national economy, the concept of green and sustainable construction requires additional strategies in order to be able to implement sustainable construction practices in the future projects. envelopments in the concept of green and sustainable construction are perceived to change *both "the nature of the built environment and the delivery systems used to design and construct the facility according to a client's needs"* [4]. This paper forms part of an ongoing research exploring the present knowledge, level of awareness and accepting of the Kuwait's construction industry stakeholders concerning the meaning of sustainable construction and to determine their awareness, approach, and behaviors in adopting the concept of sustainability and green building. A questionnaire was designed and administered in this regard to investigate the opinions of a range of stakeholders about sustainability and green building concepts and whether that they haves understood the concept of sustainable construction into practices at construction industry.

II. BACKGROUND

A. Green Building

Green building has now become a major of sustainable development in this century, [6], different countries worldwide take responsibility to implement this concept in the construction industry and several definition can be found of the term " green building" , this terms " .. *refers to the quality and characteristics of the actual structure created using the principles and methodologies of sustainable construction"* [4]. Kibert, (2007) defined the green building as "healthy facilities designed and built in a resources-efficient manner, using ecologically based principles" [4]. Other definition can found and giving in the In the report of white paper on sustainability stated definition of green building given by the definition given by the Office of the Federal Environmental Executive defines green building as "*the practice of 1) increasing the efficiency with which buildings and their sites use energy, water, and materials, and 2) reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal — the complete building life cycle."* [7]. Glavinich (2008), articulated in the define the terms of green building according to the term green building is defined in the American Society of Testing and Materials (ASTM) Standard E2114-06a *".. as a building that provides the specified building performance requirements while minimizing disturbance to and improving the functioning of local, regional and global ecosystems both during and after its construction and specified service life."* [8].

The key elements of green building can be summarized it as: sustainable site, water efficiency, conserves energy and energy efficiency, materials and resources, indoor environmental quality and resource conservation design. And to implement this issue there is now existing international environmental assessment tools work throughout the life cycle of the building starting from the design, construct, operation and maintenance within the green building concept. Ali and Nsairat (2009) stated that green design not only makes a positive impact on public health and the environment, but that it also increases occupant productivity , enhances building and organizational marketability, reduces operating costs and helps create a sustainable community [6].

B. Sustainable Construction

Green buildings are constructed based on the principles of sustainable construction, which addresses the ecological, economic and social and issues of a building. [9]. Green building is frequently mentioned together with sustainable construction, and sometimes these two terms are used interchangeably [9]. The term `sustainable construction' was originally projected to describe the responsibility of the construction industry in attaining `sustainability' [10]. Hill et.al (1997) define the term as "*…a process which starts well before construction per se (in the planning and design stages) and continues after the construction team have left the site"* [10]. The Sustainable and green constructions are technique practices method focuses on '*the social, ecological, economic concerns of a building* and *ethical and practical response to issues of environmental impact and resource consumption' [4]*. In other words, its construction technique using *" best-practice clean and resource-efficient techniques from the extraction of the raw materials to the demolition and disposal of its components*"[11].Glanvinich(2008),defined green construction as*" planning and managing a construction project in accordance with the contract documents in order to minimize the impact of the construction process on the environment"* [8]. Kibert (2007) mentions seven principles of sustainable construction were given by the Conseil International du Batiment (CIB) 1994, as shown in Table I.

TABLE I
THE PRINCIPLES OF SUSTAINABLE CONSTRUCTION

The principle of sustainable construction
Reduce recourses consumption
Reuse recourses
Use recyclable recourses
Protect nature
Eliminate toxics
Apply life-cycle costing
Focus on quality

He notes that these principles which are inform decision making during each phase of the design and construction process. These factors also apply when evaluating the components and other resources needed for the construction and throughout the life cycle of a building, from planning phase to disposal phase [12]. Additionally, the principles apply to the resources needed to create and operate the built environment during its entire life cycle: land materials, water, energy, and ecosystems [12].

C. Environmental Building Assessment Methods

There are several environmental building assessment methods which are used at many countries all around the world. For example, the Building Research Establishment Environmental Assessment Method (BREEAM) is an environmental assessment method was found in 1990 in U.K. It was the first complete assessment method for building performance[13].The principle of BREEAM system is to make a list of the environment criteria beside what the building performances are evaluated and checked. This assessment could be applied at the design stage of the project. The results of the application could be fed into the design development step for buildings and changes could be done to satisfy pre-designed criteria [14].

BREEAM has made a significant impact worldwide, with Australia, Hong Kong, Canada and other countries use BREEAM to develop the environmental building assessment methods. Many of the tools for the environmental building assessment face the construction level and depend on some shape of life cycle assessment record. Tools divide into groups:

1) Assessment tools: to present quantitative performance indicators for design options.

2) Rating tools: to present performance level to the building in stars. Table II mentioned the old and new methods for the environmental building assessment in different countries.

D. Kuwait Buildings Constrctuion Industry And Sustinability

Kuwait is small Arab country It is relatively rich with per capita income as high as of US$51,700 GPD- per capita (PPP)[15]. Petroleum accounts for 49% of gross domestic product(GDP) ,95% of export revenues, and 80% of government income [16, 17]. The building construction industry plays a major role in the economy of the State of Kuwait its consumed of 2% of economic of Kuwait and share of 4.7% of non-oil sector by end of year 2008 as scored by the Kuwait Central statistical Office which is come the second part of Kuwait investment after oil sector [16]. The construction industry builds by the government and private sector that provides the foundation for Kuwait economic and military elements of national power. There is growing concern and awareness about the environmental issues and sustainability in Kuwait within professional bodies, researchers and construction companies'.

Currently, there is only one official green building certificated construction project. Kuwait achieved the first certificated in a LEED® Gold rating under the core & shell rating system from the U.S. Green Building Council (USGBC). At the moment, there is no legislation at national or local level for the implementation sustainability and green construction. However, some efforts are being made by the professionals and developers in both private and government sector to establish good practice guidance for the Kuwait construction industry. The Kuwait construction industry must respond to this development and have to become more aware of this development and must become more aware for concept of green and sustainable construction and take the responsibility for the resources consumes and its impact on the environment. There is also some indication of action at national governmental level.

III. Survey

A. Introduction

The sustainable future concept adopts on the knowledge and the participation of individuals, as well as on the awareness of the consequences of people actions [3]. The government and private sector in Kuwait started to take action realizing the importance of sustainability and green building.

The rate of progress towards sustainability in construction depends mainly on improving awareness, knowledge and understanding of the impacts of people actions [3]. In order to investigate the range of awareness to the concept of sustainability among the stakeholders in the Kuwait construction industry a survey was conducted. The participants of this survey included stakeholders such as engineers, contractors, consultants, clients and developers working in construction firms in Kuwait. The objective of the survey was to focus on their considerate on the subject, how they have integrated this knowledge in their projects for past and present, and what is their expectation of the outcome and impact of this concept in future.

TABLE II
ENVIROMENATL BUILDING PERFORMANCE ASSESSMENT METHODS*

Assessment method	Origin	Characteristics
ABGR: Australian Building Greenhouse Rating	Department of Commerce, NSW, 2005	• Using star rating, one to five stars. • Based on 12 months of energy consumption. • Present a national approach to determine green house performance.
BEPAC: Building environmental performance assessment criteria.	Canada, 1993	• Like BREEAM method but a more comprehensive and detailed assessment method. • A voluntary tool. • Make use of a point system for rating.
CASBEE: "Comprehensive assessment system for building environmental efficiency".	Japan, 2004	• A co-operative project between government and industry. • Possibility to apply at pre-design stage, new construction, and/or renovation to the building.
CEPAS: Comprehensive environmental performance assessment scheme.	HK, 2001	• For all types of new or existing buildings. • Having an eight performance categories.
GB Tool: Green building challenge	International, 1995	• The most comprehensive framework. • Worldwide collaboration of over 20 countries. • Four levels of weighting.
Green Star	Green Building Council	• The first Australian comprehensive method to evaluate performance to the environmental building. • Just for commercial building only. • Rating system from 0 to 6 stars
HKBEAM: Hong Kong building environmental assessment method	Hong King, 1996	• Like BREEAM • Evaluate new building as 'as built' more that 'as designed'. • Focus on life cycle effects of the environmental issues. • Rating system on a scale from fair to excellent. • Evaluation varieties under the global, local, and indoor scales.
LEED: Leadership in energy and environmental design	USA, 2000	• Found by the US Green Building Council. • Possibility to apply at new and existing institutional, commercial, major renovation and high raise residential. • Includes five area of sustainability.
SBAT: Sustainable building assessment tool	South Africa	• Emphasis on social and economic issues. • Depends on the life cycle for building to make integration to all the buildings parts.

*Seo et al., 2006

B. Survey Objectives

The main objectives of the survey in were:

- To identifying the level of awareness and knowledge of different stakeholders in Kuwait on the concept of green building and sustainability in construction.
- To investigate the current situation of the application of green buildings and sustainability in construction industry in Kuwait.
- To investigate the future expectations and outlook of implementation of concept of green buildings in the constructions industry in Kuwait.

C. Survey: Questionnaire

The first phase of this study comprised of a survey that was conducted with the stakeholders within the Kuwait's construction industry. In order to carry out the survey included: the selection of appropriate sample of stakeholders within the Kuwait's construction industry was the initial and crucial step. Other important aspect was to develop the survey tool and to validate its content and format. The questionnaire was distributed to the selected samples. The samples a questionnaire were sent through email and in some cases the questionnaire were given in person. The questionnaire was questionnaire replies were collected and then the data was compiled and analyses in order to determine the level of awareness for the concept of sustainability and green construction overall.

D. Samples Selections and Distritbution

The population being considered for this survey included both governmental and private sector involved with the construction industry such as contracting companies, consulting offices, ministries in the government sector, local institutes and universities. Survey questionnaire were distributed by email or the stakeholders were asked the questionnaire telephonically or they were asked in person. The survey was developed keeping in view the following objectives,

(1) To understanding and identifying the level of awareness and knowledge for different stakeholders in Kuwait on the concept of green buildings and sustainability.

(2) To investigate the present situation for use the *sustainability* and *green* buildings.

(3) To establish the future outlook of the implementation of sustainability in the constructions industry in Kuwait.

(4) To examine the current situation of green building in daily business of each company and ministries (private and governmental sector).

(5) To examine the expectations of these companies and ministries on the impact of green buildings on corporate practice in the future of Kuwait's' construction projects.

E. Analysis Of Survey Response 9results Abd Discussion)

A total of 205 questionnaires were distributed and in response a reply of 122 questionnaires were received. These stakeholders had working experience ranging from 5 to almost 30 years, in both private and government sector construction industries. The analysis was carried out after receiving all the replies, when all data was collected and verified through the research methodology.

The initial part of the questionnaire included the general information regarding the respondents such as their age, work experience etc. Figure 1 shows the age distribution of the respondents with 23% respondents in the age group above 55 years, followed by 20% in the age group ranging from 45-55 years. 19% of the respondents were in the age group of 35-40 years and 25-30 years respectively. 8% of the participants were in the age group of 30-35 years.

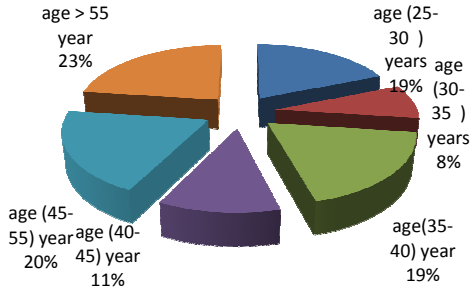

Fig. 1 Ages for the group participant in survey

Figure (2) to shows the distribution of the respondents based on their major business types. 29% of the respondents were in the category of and Consultants contractors, followed by engineering firms 20%, developers firms 14% and client firms 8%, In addition 53% respondents are employed in the private sector and rest 47%in governmental sector.

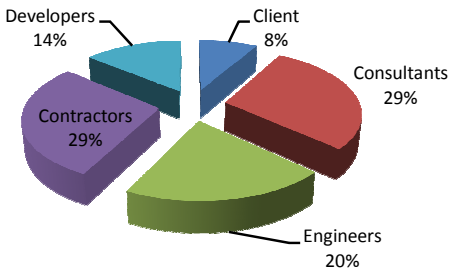

Fig. 2 Type of business

The work experience is an important aspect, as the respondents' reply presumably is based on their actual work experience and knowledge of the construction industry. 73% of the respondents have a work experience of more than 10 years in the construction industry, with 23% of the respondents having experience of 5-10 years. Only 4% of the respondents have a work experience of less than 5 years.

The relevant background experiences was also taken in account to form part the questionnaire as it facilitated in analysis to know the field and level of experience of the respondents and their familiarity with the needs of local market in Kuwait. Results indicated that respondents had a diverse experience and had worked in different types of

projects. Respondents had been involved in various types of building projects such as commercial, residential, and industrial. Most of the respondents had work in two types of building projects. 50% of the respondents had worked in commercial/office types of building projects whereas 26% had worked in residential building projects and 24% in residential buildings respectively.

In order to assess the level of knowledge and awareness of the theory of green building and sustainability construction, the respondents were asked three questions on the subject. One question out of the three focused on their knowledge of the concepts of sustainability, whereas the other two were regarding the self-assessment on the development of knowledge on the concepts and on the actions taken on the basis of awareness of the concept through proper planning, designing and budget allocations. The response to these questions were based on liker type scale ranging from 'Very poor' to 'Excellent' as shown in Figure 5, 6 and 7.

The majority of the stakeholders was aware of and had a particular knowledge about sustainable construction; however its application was an unusual issue. Most of the respondents agreed that the level of application of sustainable principles were either good or at a moderate level.

As shown in Figure (3), 36.89 % of the respondents believe themselves to have a moderate knowledge about sustainable theme, with 31.15% considered to have good knowledge, whereas 22.13% considered having excellent and 7.38% considered low knowledge of sustainable concept. 2.46% of the respondents believed that their knowledge of sustainability was poor.

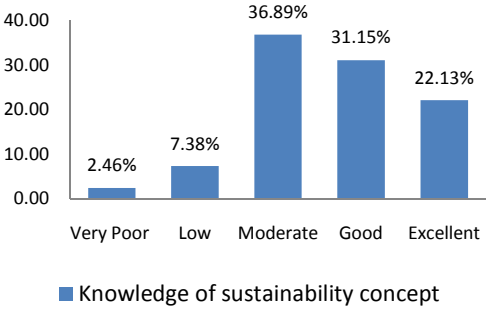

Fig. 3 knowledge of sustainability concept (in percentage)

In figure (4), 53.28 % of respondents considered themselves to have moderate development of knowledge of sustainable theme, 21.13% considered to have good development the knowledge, 13.93% considered to have excellent and 6.56% considered to have low development knowledge of sustainable theme. 4.10% of the respondents believed that their level of development of knowledge of sustainable concepts was poor.

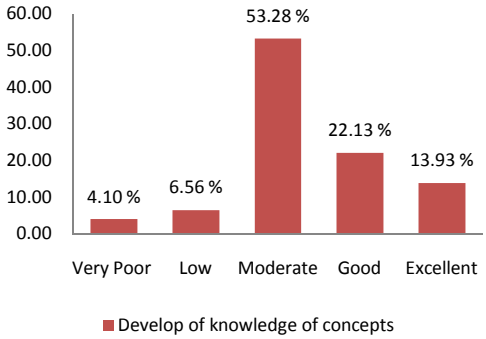

Fig. 4 Develop the knowledge of the sustainability (in percentage)

Figure (5), represented the awareness of stakeholders through the implementation of sustainability in their own projects. The response indicted that 54.10% had moderate awareness to implementation of sustainability, 24.59% had good awareness level, 11.48% reported to have excellent awareness whereas 8.20% had low awareness to implement the sustainability in their own projects. 1.64% of the respondents considered that their achievement of sustainable theme was poor.

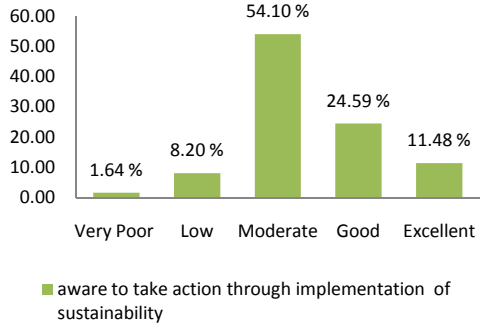

Fig. 5 Aware to take action through implementation of sustainability

To further investigate about the current awareness and to assess whether the stakeholders shall implement the concept of green building by rule and legislation from government or shall do it in their own capacity. Figure (6) indicates that 88.52% respondents agreed that rules and legislation from government are required to enforce the concept thereby binding them to implement. This response assured that in Kuwait the concept is not be applicable unless it is imposed as law and legislation from the government. However, 11.48% of the respondents believed that they did not need local laws to implement and maintain the environment and natural resources. However, majority of the participants were of the view that with the aim of compete and participate in the global market, the awareness and perception of this concept is important as this concept is now being given a global attention.

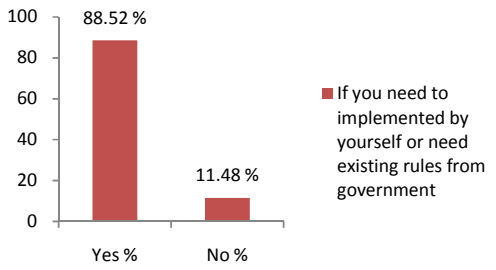

Fig. 6 Whether will implement the suitability concept by Owen self or need rule from government

Even though many stakeholders were responsive and had assured knowledge about sustainable construction, but whether they were implementing this concept in practice was a different matter. One of the explanations for the present level of poor application is due to the shortage in monitoring and enforcement of legislation and law. In order to implement this concept the onus lies with the government to join the implementation with the enforcement of legislation, through create new polices, and/or by giving motivations to developers who want to apply sustainability concept in their projects. However, it is not only the government's responsibility, other players from construction industry such as consultants, contractors, developers, suppliers and even buyers play a major role at implementation the sustainability concepts. Currently, in Kuwait, most of the stakeholders in construction are still ignoring the significance of sustainability issues. The respondents stated that they do not recognize the need to adapt sustainability practice and as such do not see any other local benefit from it. During the interviews, especially some of the local contractors stated that, their interest on this matter shall only get better when sustainability concept become an interested issue for the client. Right now, the sustainability concept is not the main concern of the local contractors because it lacks publicity and the interest of the potential buyers.

The next question focused on the current situation of the companies and ministries about the concept of green buildings. 64.75% of the respondents indicated that they have a situation and targets to implement it in their future projects. However 35.3% of the respondents did not have this concept in their current and future agenda.

A question was also asked regarding the thinking of the employees whether the productivity shall increase or otherwise if the concept of green building is adopted. 50.82% of the respondents indicated the productivity shall increase by adopting the concept of green buildings whereas 29.51% respondents thought there is no such relationship between productivity and the concept of sustainability. Productivity shall not increase while adopting the concept of sustainability.

A question was also asked to determine the view of the stakeholders whether the concept of sustainability is environmental friendly or not? Figure (7) shows that 84.43% of the respondents believed that this concept shall have a good impact on the environment and is overall environmentally friendly whereas the rest 15.57% reported that this concept is not environment friendly or has any impact on the environment. This shows the acceptance of the respondents to the rules and regulations enforced by the government on environmental policies.

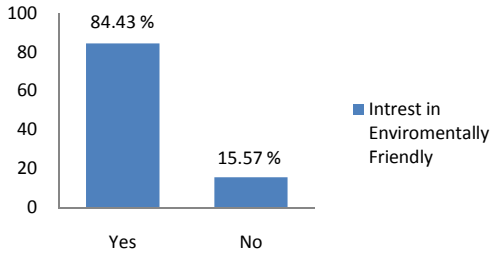

Fig.7 Environmentally friendly

The next question was about the expectations of the respondents on the future of green buildings in Kuwait. Some of responded indicated lack of clarity in the future of sustainability in Kuwait as the current situation for local legislation and rules by the government are not clear. It was suggested by the respondents that more support and encouragement from the government is required to facilitate the application of this concept and to increase the public awareness as well as that of private and government sector. Some respondents indicated that the concept of green building shall be limited in the future of the construction industry in Kuwait unless the awareness is increased so that its implementation will be accepted more in the construction industry. The rest of respondents agreed that the green building concept shall be a standard practice in future of construction industry in Kuwait.

IV. Conclusions

Sustainable construction and development is a complex system engineering problem that merges with technical, political, social and economic aspects [3, 4, 18]. Several conclusions emerge and can be drawn from the analysis of this research. First, the sustainability and the concept of green buildings in Kuwait construction industry market is in the preliminary phase and shall have a significant share in both private and government sector if there is 'moderate to good' acceptance to adapting this concept in practice.

The level of knowledge is in the range from 'moderate to good' level, which indicates that there is good acceptance of the sustainability concept. Some of respondent's primary focus was in improving and increasing their level of knowledge of the concept (both in the government and private sector) by attending training courses, workshops, conferences, and study tours for similar projects worldwide.

Although the level of knowledge is in the 'good' rank in the both sectors, however its application is still considered to be very low due to many factors like shortage of knowledge for application, lack of awareness at social levels, poor enforcement of legislation, and poor support from the government. Some of the respondents noted that in their

opinion the green building concept shall not be adopted unless it is legislated by the government to support the idea. Intensive support from both government and private sector is required to implement the concept and this needs to be further strengthened effective governmental policies and legislations in place in order to ensure its 100% implementation in future projects in Kuwait.

The level of awareness of sustainability and green construction is considered to be in the 'moderate to good' range. However more actions are required to be taken as recommended by the stakeholders through education programs such as training courses, conferences, seminars, study tour, public announcement and workshops in order to increase the level of awareness and knowledge.

Construction-related companies agree that green construction is very important and shall be a standard practice in the future only if they get more support from the government to ensure effective implementation. This requires coordination between the government and private sector to encourage the range of awareness and highlight the importance of sustainability. Furthermore, some developers suggested in order to minimize administrative burdens, government should offer several incentives to promote green construction.

A number of stakeholders reported that the initial cost premium for the green building is very high compared to conventional construction, so they prefer conventional construction unless it is specified by the client. Based on the literature review, it is recommended that in order to reduce the initial cost green construction has to be a common practice, and material manufacturers have to minimize the cost of green building materials, and owners have to be aware of potential savings from a life cycle perspective. Highlighting other benefits for real estate, developers suggest that that the benefit from the LEED certification of the building increases the real estate value and the renting rate.

V. Recommendations

Based on the analysis presented above the following recommendations are made:

1) The results of the survey highlighted that the implementation of the concept of sustainability is low in Kuwait construction industry. Thus it requires more action and strategies to improve and encourage this concept so that it can be applied efficiently in future construction projects. The main responsibility lies with the government to encourage the implementation and adopt the concept of sustainability and green construction in Kuwait construction industry.
2) Constructions stakeholders both in the private and government sector have to make sure that the construction activities have the least impact on the environment. For that reason both sectors have a responsibility towards the sustainability, the government has to issue special legislations, codes or standards relating to sustainable construction practice specific to Kuwait's construction environment and the private sector to ensure their proper and effective implementations.
3) Improving the knowledge and level of awareness of sustainable applications could make a large impact on the applications of sustainable construction concepts at the larger scale especially for the stakeholder dealing with construction industry. This could be achieved by introducing proper guidelines, tools or techniques based on prior research carried out in the industry to make them more practical and effective. Also by holding more discussions, seminars, training, and workshops, directing the small and medium-sized stakeholders and developers to enhance the level of awareness and knowledge.
4) The results of the survey highlight the need of new legislations and rules and guidelines for fulfilling sustainability and environment protection in Kuwait. To encourage sustainable practices, the government can provide some economic incentives for using local resources in adapting standards and guidelines for green practices.
5) Taking away subsidies given for energies from the consumers with polluting industries shall encourage the practice for safe energy and environmental buildings. Developers highlight that more support is needed to increase the price of energy and water to ensure its efficient and economical use.
6) Finally, developers, contractors, architects and consultants roles are influenced by the existing market situation and also on the demand from the client. To summaries, more hard works are required to encourage the range of environmental awareness among the individuals to ensure sustainability future.

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