BARRIERS TO IMPLEMENTATION OF SUSTAINABLE CONSTRUCTION PRACTICE IN JORDAN

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Abstract - In spite of the importance, the actual situation of sustainable construction has not received much interest in developing countries, such as Jordan.
This study aims to point out the barriers to sustainable construction practice and specify the most important barriers to sustainable construction practice in Jordan from the point of view of the main stakeholders.
A questionnaire survey was used for data collection. A total of 130 questionnaires were distributed to major construction industry stakeholders based in Amman and other major cities in this country. Replies from 68 establishments were received. Ranking of the significant barriers was carried out based on the Relative Importance Index.
The study revealed that the three most significant barriers affecting the sustainable construction in Jordan are planning for the required projects is not comprehensive followed by shortage of experienced and professional knowledge, and shortage of financing for these projects. The outcomes of the study comply with many international studies carried out in developing and developed countries.

Keywords - Barriers, Construction projects, Jordan, Sustainability.

I. INTRODUCTION

The construction industry plays a powerful role in sustaining economic growth, in addition to producing structures that add to productivity and quality of life. This industry is large, complex, and diverse. It covers a wide range of business interests and activities, united by their common usage and development of land [1]. The construction sector composed of contractors, consultants, suppliers and product producers. The relationship between construction activities, and the built environment on one hand, and sustainable development on the other, is both significant and complicated. Construction uses more raw materials than any other sector, and the creation and operation of the built environment accounts form an important consumption of natural resources.
Sustainable construction can be defined as a construction process which incorporates the basic themes of sustainable development [2], [3]. Such construction processes would, thus, bring environmental responsibility, social awareness, and economic profitability; and facilities for the wider community [4] – [6].
Sustainable construction is a growing notion that aims to combine the general ideas of sustainability present practice of the building and construction industry. Sustainability means that lifecycle (economic, social, and the environment) is the fundamental criterion guiding the operation of creation and management of the built environment. This includes recent environmentally related construction designs, new environmentally friendly utilization and maintenance practices. It is self-evident that the construction industry has important effect on the environment. For example, buildings produce waste that effectively causing pollution to the natural environment through their implementation and operation [7].

II. THE AIM OF THE RESEARCH

This study aims to point out the barriers to sustainable construction practice and specify the most important barriers to sustainable construction practice in Jordan from the point of view of the main stakeholders. An understanding of the barriers to sustainable construction practice would assist the growth of strategies to ease its adoption not just in Jordan but also in other developing countries as well. The results of the study present insights on measures to improve sustainable construction practice in other developing countries in general.

III. RESEARCH AND SUSTAINABILITY IMPORTANCE

To maintain and to increase the contribution of this industry in the economy through:
1) Reducing cost by saving energy, resources and time.
2) Saving environment by reducing waste and pollution.
3) Focusing on increasing profitability through:
    a) Efficient use of resources.
    b) Adopting modern methods and technology for implementation.

The importance of adopting sustainable construction are the following:
1) Maintaining and increasing the contribution of construction industry in the economy by reducing cost, saving energy, saving resources and time.

2) Focusing on increasing profitability through an efficient use of resources and energy, adopting modern methods and high technology for implementation, reducing the on-going cost of maintenance, and increasing productivity; through creation of new projects, new jobs.
3) Saving environment by reducing waste, pollution and enhancing the policy of re-using materials and recycling.
4) Raising the awareness of safety and precaution measurements.
5) Improving the quality of life.

IV. LITERATURE REVIEW

The building and construction projects are major cause of greenhouse gas emissions to the environment. Several authors like [8], [9] have shown that the implementation of sustainable practice would minimize the opposite effect of the construction sector on the environment. Also the other research works have concluded that the use of elements, such as precast concrete elements [10] and green roof systems [11], results in considerable reduction of greenhouse gas emissions from construction projects. In addition, the studies suggest that the demand for eco-friendly elements have been on an increase [12], [13]. According to the above mentioned studies, it is evident that the implementation of sustainable construction procedures would be of great value for building and construction industry in terms of business output and client satisfaction. However, the implementation of sustainable construction procedures will remain as a threat, especially in developing countries like Jordan.
To the present, the barriers to the implementation of construction procedures have drove to many academic studies in developed and developing countries. In China [8] found that excess cost, time overrun occurred, shortage of information and green suppliers and additional consideration for maintenance are the most important barriers to sustainable building. In Singapore, a study by [9] on barriers to management of green building project accomplished that excess cost, communication problems and desire among participants of project team , low demand/lack of interests by clients, limited research works showing the advantages of sustainable construction practices are the five most important barriers.

V. RESEARCH METHODOLOGY

The research design uses quantitative cross-sectional survey to identify and understand the barriers to sustainable construction practice in Jordanian construction industry. This approach has been widely reported in literature. In this study the quantitative survey was used to rate the significant barriers to sustainable construction practice that are peculiar to the Jordanian construction industry.

The questionnaire was formatted through the following steps:

a) Primary design was prepared in light of knowledge published in literature
b) External experts and specialists judgment.
c) Pilot study.
d) Modifications according to pilot study.

Likert scale was used for the degree of acceptance starting from strongly agree, agree, neutral, disagree and ending by strongly disagree. A covering letter which indicates the objectives of the research and clarifies the meaning of sustainable construction, ending by a commitment from the researcher to participants that their personal information will be top confidential.
The questionnaire comprises two sections. Section A identified demographic data of respondents while section B considers the stakeholders' view on the barriers to sustainable construction practice. In section B, respondents were asked to rate the barriers to sustainable construction practice in Jordan on a scale of 1 to 5 (with 1 being the weakest and 5 being the strongest). A pilot study was used to modify the initial questionnaire. This modification was based on the recommendations and suggestions from experts from two contractors and two consultants. This was done to identify and minimize any form of ambiguity with the survey instrument.
A total of 130 questionnaires were disseminated to major stakeholders in the construction firms based in Amman (the capital) and other main cities (Aqaba, Irbid, and Zarqa). Some the questionnaire was sent via email (supported by a phone call) and physically given to the respondents in their offices. Out of the 130 questionnaires administered, 68 questionnaires were received. In this study RII was used to rank the most significant barriers to the sustainable construction practice in Jordan in relation to other variables as perceived by the research participants.
Reliability was tested by using Cronbach Alpha factor; one of the most popular reliability statistics in use today [14]. Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument to gauge its reliability. The value of Cronbach Alpha factor for the whole questionnaire-20 questions - was 0.70, that means all items are reliable according to the range of Cronbach's coefficient alpha; value between 0.0 and + 1.0 is reliable. Therefore, it can be said that the researchers proved that the questionnaire was reliable.

The factors were ranked according to their relative importance index (RII). The RII is determined using equation 1 below:

$$RII = \frac{\sum WX_i}{AN} \quad (1)$$

Where W is the selected weighting to each factor – according to participant's answer. This is ranges from 1 to 5 where 1 is "strongly disagree" and 5 is "strongly agree".
X is the frequency of each answer.
A is the highest possible weight for that response is 5 in this particular case.
N is the number of respondents.

VI. RESULTS

A. The Sample Characteristics

The sample characteristics can be described through the following:

1) The participants are, generally, highly educated (about two thirds hold BSc) and the rest are post graduates which indicate that still there is a need to enhance education ambition.
2) Most of the participants who contributed to the survey have experience of more than 15 years.
3) More than 50% of the participants have more than one specialization which indicates that they are working hard to be qualified in different fields of work to expand their opportunities and guarantee their market share.
4) About half of the respondents came from the capital Amman, while the rest are distributed from the main cities (Aqaba, Irbid, and Zarqa).
5) The majority of the respondents representing large scale companies and establishments. This is represented by the number of employees and the size of projects at which they are involved.

B. Barriers

The RII and the rank of the barriers to sustainable construction practice in Jordan are presented in Table 1 below.

Factor	RII	Rank
Planning for the required projects is not comprehensive.	0.924	1
Shortage of experienced and professional knowledge	0.916	2
Shortage of financing for these projects	0.897	3
Shortage of strategic planning by government's departments	0.872	4
Shortage of incentives and support provided by the government	0.844	5
Recognized increase in time and cost	0.818	6
Shortage of legislations, enforcement and monitoring	0.801	7
Shortage of public realization of the benefits of sustainability	0.782	8
Thorough pre-contract planning	0.774	9
Shortage of design and construction skilled staff for sustainable construction	0.749	10
Shortage of tools required for the measurement of benefits.	0.745	11
Delays in consultant approvals.	0.736	12
Lack of training opportunities	0.724	13
Risk associated with investment	0.709	14
Cash flow mismanagement	0.679	15
Higher investment cost	0.668	16
Unpredicted conditions	0.654	17
Lack of cooperation	0.627	18
Currency fluctuation	0.613	19
Increased documentation	0.574	20

Table 1 Barriers to sustainable construction practice

The results of the survey revealed the following:

1) The three most significant barriers affecting the sustainable construction in Jordan are Planning for the required projects is not comprehensive with RII of 0.924 followed by Shortage of experienced and professional knowledge with RII of 0.916 while the Shortage of financing for these projects comes third with RI of 0.897.
2) If we consider that the significant barriers are those with RII above the average of all the 20 factors (0.755), then the first nine barriers listed in table 1 are considered significant.
3) The results of this survey comply with many previous studies like [15] in Australia; [16] in United Kingdom; [17] in Finland; [9] in Hong Kong; [18] in Malaysia; [8] in China; [19] in USA; [20] in Kuwait; and [21] in Ghana.

VII. CONCLUSION

The study aims to point out the barriers to sustainable construction practice and specify the most important barriers to sustainable construction practice in Jordan from the point of view of the main stakeholders. The research design uses quantitative cross-sectional survey to identify and understand the barriers to sustainable construction practice in Jordanian construction industry. Out of the 130 questionnaires administered, 68 questionnaires were received. In this study RII was used to rank the most significant barriers to the sustainable construction practice in Jordan in relation to other variables as perceived by the research participants. The respondents participated in the study represents the construction industry in the country with respect to the education, years of experience, fields of works, etc.

The study revealed that three most significant barriers affecting the sustainable construction in Jordan are planning for the required projects is not comprehensive followed by shortage of experienced and professional knowledge, and shortage of financing for these projects. The outcomes of the study comply with many international studies carried out in developing and developed countries.

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