



# Critical Success Factors of Green Building Retrofitting Ventures in Iraq

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DOI: <https://doi.org/10.30880/ijscet.2021.12.01.002>

Received 22 April 2020; Accepted 23 October 2020; Available online 19 May 2021

**Abstract:** Climate change has become one of the challenges for development. The building sector represents the largest resource of greenhouse gas production. Iraq depends on fossil fuels in producing energy, electricity with a lack of energy standards. This has made Iraq one of the utmost carbon-intense economic in the world. There is a lack of studies about green building retrofitting (GBR) projects in Iraq as well as lack of awareness about the importance of this concept and its welfare regarding the reduction of the climate change crisis. The enhancement of the implementation of GBR projects in Iraq will be a promising solution to overcome the negative impact of the existing buildings. The GBR projects represent a complicated project that needs an effective project management practices. It is crucial to identify the challenges that restrict the success of these ventures. This paper provides critical success factors (CSF) that will stimulate the achievement of GBR ventures in Iraq. A questionnaire survey is conducted to collect reliable data from the experts in retrofitting projects in Basra, Iraq. Findings showed that the top five challenges in implementing GBR are; absence of government legislation, lack of awareness about benefits of GBR, low government and private sectors' investment, incompetent team members, and lack of sustainability knowledge. Additionally, the top five CSFs are; efficient legislation, competent team members, subsidies or tax reduction, sufficient experience and competence of the project manager. This research will contribute to the improvement of project management practices in GBR projects, reduction of environmental pollution and enhancement of Iraq's oil revenues instead of using oil as energy fuel.

**Keywords:** Project management, Iraq, critical success factors, green building retrofitting projects

## 1. Introduction

One of the unwarranted impendence for future development is climate change. The building sector represents the colossal resource of greenhouse gas production. In spite of the promising features, the construction of green buildings alone is unable to overcome the negative impact on the environment which resulted from the existing buildings. Therefore, one rational solution in minimizing the impact is through the green building retrofitting (GBR) approach (Jagarajan et al., 2017). Chiang, Li, Zhou, Wong, and Lam (2015) emphasize that the green building retrofitting projects have a positive effect on the natural environment. The negative influence of buildings in Iraq and other countries on the

environment is obvious; this problem starts to take scientific and human dimensions (Doos, Al-Saadwi, & Ibraheem, 2016). Therefore, the proposed GBR projects in Iraq will become the perfect opportunity to overcome such challenges.

The dependence on fossil fuels in producing energy, electricity, and usage of old technologies to generate electricity with a lack of energy standards, made Iraq be one of the utmost-carbon intense economic in the world in 2010 (Iraq Energy Outlook, 2012). The shortage in the electricity supply led the local people to utilize diesel generators especially in the hot summer in which the temperature reaches 55° C. This increases the environment pollution and CO<sub>2</sub> emissions (Iraq Energy Outlook, 2012). The GBR ventures are instituted as an essential perspective to decouple from fossil fuels and overcome the future energy crisis (Xing, Hewitt, & Griffiths, 2011). The buildings consume about 50% of energy, in that, if the GBR is being utilized, this will reduce the energy consumption in the traditional ways and as a result, so that, these ventures will minimize the CO<sub>2</sub> emissions (Jagarajan et al., 2017).

The Iraqi government routine prefers the investment of constructing a new building instead of emphasizing on the existing building's maintenance and its retrofitting (Doos et al., 2016). Meanwhile, Dakhil, Qasim, and Chinan (2017) mentioned that the prevalent corruption, lack of maintenance comprehension and poor maintenance culture affect negatively on the Iraqi building sector. In addition, the new construction investment supplies more chances to get bribes or participate in other shapes of corruption (Dakhil et al., 2017).

Achieving sustainable buildings in Iraq faces a serious challenge. This is attributable to the lack of popular perception of sustainable concepts (Doos et al., 2016; Zebari & Ibrahim, 2016), absence of green building legislation that supports the technology progress (Mahmoud, 2014; Zebari & Ibrahim, 2016), lack of training and competent skills, lack of education programs regarding such problems of climate change and future environmental crisis also the unavailability of building materials used in green buildings and lack of sustainable subjects at the institutional level (Zebari & Ibrahim, 2016). There is a need to refine more lessons based on the experience of many other countries about GBR projects for which this will enhance the comprehension of the problem faced by existing buildings (Lomas, 2010). This paper postulates the critical success factors (CSFs) that will stimulate the achievement of green building retrofitting projects in Iraq.

## 2. Sustainable Maintenance and Green Retrofitting

Maintenance plays an essential role in enhancing the building performance for occupants and the environment. The crucial purpose of the maintenance is to achieve the sustainability of buildings. The contemporary maintenance approach takes responsibility and promising of a sustainable future (Olanrewaju & Abdul-Aziz, 2014). (Chan, 2014; Chiang, Li, Zhou, Wong, & Lam, 2015) affirms that, the conventional maintenance approaches are not adequate and may not suffice to achieve the occupant's needs, therefore; the modern sustainable maintenance strategy is the right direction. Thus, in order to preserve the easy usage and competency of the building, there is a necessity to be frequently maintained and refurbished.

The building retrofitting not only enhances the building conditions, firmness and value, but also aims to save energy (Ma, Cooper, Daly, & Ledo, 2012). Sustainable building retrofitting emphasizes energy saving, cost and reduction the CO<sub>2</sub> emissions and its effect on climate change. Sustainable maintenance emphasizes the continued functioning of the facility, the energy cost will diminish, and reworks will reduce (Olanrewaju & Abdul-Aziz, 2014). In developed countries, there are various organizations that take the accountability of measuring and enhancing the buildings and the built environment achievement within the concepts of sustainability. Whereas in the developing countries including Iraq, they experience a lack in the building maintenance that meet the sustainability measurements (Doos et al., 2016).

GBR can be defined as promoting the operations and physical systems of the building to be more energy saving (Fulton et al., 2012). It represents a critical strategy to upgrade the sustainability of existing buildings (Love & Arthur Bullen, 2009). Additionally, Ürge-Vorsatz, Danny Harvey, Mirasgedis, and Levine (2007) indicate that retrofitting buildings sector has the greatest share of reducing the negative effect of greenhouse gas (GHG) with low-cost activities among all other sectors.

The enhancement of a green approach to the overall life cycle of the buildings plays an essential role in fulfilling sustainability (Zhang, Shen, & Wu, 2011). Chiang, Zhou, Li, Lam, and Wong (2014) recommend that there is an urgent need for policy support to enhance sustainable building maintenance practices. The Iraqi government buildings need to be maintained according to the new sustainability measurements; environment, economy and social (Doos et al., 2016) and, therefore the created pollution problem in Iraq can be observed across energy consumptions, CO<sub>2</sub> emissions, consuming water and building materials for the development and maintenance of the buildings (Doos et al., 2016).

### 2.1 Challenges of Green Retrofitting Projects

GBR projects are considered as one of the typical complicated projects especially with respect to the involvement of various stakeholders (Sui, Shang, & Wen, 2014). The GBR of existing buildings has many opportunities and barriers, for which the major barrier faced is that there are multi uncertainties, such as service alteration, climate change, human attitude change, and alteration of government policy. All of these will influence the choice of green retrofitting technologies and the degree of success of the GBR project (Australian Carbon Trust report: commercial buildings emissions reduction opportunities, 2010; Tobias & Vavaroutsos, 2012). The GBR optimization issue is to determine,

execute and apply the GBR technology that meets the most cost-effective requirements to fulfil improved energy performance while maintaining an acceptable level of service and adequate indoor thermal comfort, under a particular set of operating barriers (Ma et al., 2012).

The development of sustainable concepts in developing countries, such as Iraqi's Kurdistan region; can be a serious challenge; the performance of sustainable buildings remains in its early phases compared with other developed countries (Zebari & Ibrahim, 2016) such as Australia (Bond, 2010) and England (Davies & Osmani, 2011). According to Zebari and Ibrahim (2016), the barriers of Green Buildings (GB) in the Kurdistan region; are the lack of a common comprehension of sustainable concepts, the inadequate availability of building materials used in GB, untrained workers and staff, shortage of sustainable subjects supplied at the Iraqi institutional levels. Furthermore, housing building in Kurdistan hardly utilizes any shape of thermal envelope insulation to fulfil minimization in energy demand.

This paper therefore summarizes the challenges that influence the success of the GBR project execution and indicated in Table 1 below:

**Table 1 - The challenges of GBR projects**

Challenges	References
High initial cost of GB Projects.	
Lack of funding. Inconstancy of the cost of green building.	
Inexperienced consultants and contractors.	
Deficiencies in the skills and training for GBR projects	
Lack of sustainability knowledge.	
Lack of awareness of building owners, investors about benefits of GBR	Updated from: (Jagarajan et al., 2017)
Low investment and involvement from the government and private sectors	
Lack of established benchmarks and criteria for assessing sustainability.	
Absence performance data about retrofitting existing buildings.	
Poor communication among the stakeholders such as owners, tenants and, consultants. Incompetent project manager.	
Lack of leadership from top management.	
Unreliable or unproven technology.	
Limited historical data about return on investment (ROI) for GBR projects.	
Corruption	(Dakhil et al., 2017)
Resistance to change of both building's owners and tenants to engage in new technology and process.	Ernest, Ankomah, Tengan, and Asamoh (2016)
Absence of government legislation of green retrofitting in Iraq.	(Mahmoud, 2014; Zebari & Ibrahim, 2016)

## 2.2 Incentives of GBR Projects

Incentive is "something that encourages a person to do something" (Cambridge). Emmanuel and Baker (2012) highlight many drivers that stimulate the achievement of GBR projects such as legislative, cultural, financial and environmental incentives. Furthermore, they anticipated that the power of behavioral alteration as an incentive will be

extremely promoted by financial, technical and legislation motivators. Meanwhile, on the other hand, Davies and Osmani (2011) founded that the development of a specific standard is a key motivator for the implementation of GBR ventures in the UK.

In Iraq, the shortage in the national electricity supply leads the utilization of the diesel generators to recover this shortage; this bear local people a lot of money which can be an incentive for them to implement the high energy efficiency buildings' standards for lower electricity bills, and less investment in power generation (Iraq Energy Outlook, 2012). Meanwhile, Sui et al. (2014) identify multi incentives for GBR ventures such as governmental legislation policies, rising electricity prices, return on investment (ROI), marketing/branding motive, corporate social responsibility (CSR) and improving the wellbeing of occupants. Furthermore, Davies and Osmani (2011) also, highlighted that, the clear specific standards and criteria for GBR projects as an important incentive.

### 2.3 Critical Success Factors of GBR Projects

“Critical Success Factors are those variables or circumstances necessary to enable a positive outcome for a business program or strategy”(REH, 2019). Jagarajan et al. (2017) highlight the necessity to determine the key success factors to increase the opportunity of success in the GBR projects due to the lack of such studies. The successful green building retrofitting program relies on multi uncertainties. Ma et al. (2012) reveal the key factors that have critical influences on green building retrofitting, involving regulations and policies, client purse and anticipation, green retrofitting technologies, building particular data, human behavior factors. Liang, Yu, and Guo (2017) notice the importance of the stakeholder management in GBR projects that it considered a complicated venture and highlight the critical success factors for the GBR projects namely; cost, subsidies / tax reduction, existing building condition and information, project management, experience sharing and education, cultural traditions, complexity of technology, maintainability and also clear government program and policies. Sui et al. (2014) have identified the success factors of GBR ventures to be related to the top management support, effective project planning and control, the involvement of the building owners, cost management, responsiveness of the building owners, legislation, clear project scope and clear priorities of the stakeholders, competent project manager, space management and reduce the discomfort to the occupants, contract conditions and competence team members.

## 3. Research Methodology

This research adopts a quantitative approach regarding the research undertaken by (Dakhil et al., 2017; Supply Chain Analysis into the Construction Industry - A Report for the Construction Industrial Strategy, 2013). The supply chain analysis research clarifies that “this research provides greater clarity with respect to the coordinating role of the PM particularly on projects with diverse supply chain. The PM role could be a single. The author develops a hypothesis to understand and clarify these complicated projects” (*Supply Chain Analysis into the Construction Industry-A Report for the Construction Industrial Strategy* 2013).

The justification is the similarity between this report and our paper with respect to complexity, because the retrofitting projects are one of the typical complicated construction projects with respect to involvement of various stakeholders (Sui, Shang, & Wen, 2014) At first, a comprehensive literature review had been conducted to get a whole understanding of the GBR constructed industry. Depending on the research objectives, questions and the literature review, a list of the challenges, incentives and success factors of the GBR projects was identified to develop the conceptual framework as shown in figure 1. The questionnaire survey is distributed to the building stakeholders from the construction industry include; architects, civil engineers, project managers, facility or maintenance managers, contractors, mechanical engineers, electrical engineers, academics and others; were selected to provide a more general approach due to their involvement with general or green retrofitting buildings. The justification: the selected respondents have the good experience in green/general retrofitting projects. The constructed questionnaire survey method is ranked to address the research questions and objectives, which are; to identify the incentives, to explore the challenges of GBR projects and to evaluate the GBR critical success factors. In this paper, the pilot test was executed to ensure the accuracy of data, prior to the actual survey. Moreover, a null hypothesis (Loftus, 2009) is developed at this paper that; there is no difference in the answers for the level of importance of the three items; challenges, incentives and, CSF for the GBR projects among respondents with different type of organization; government and private sectors. Then this hypothesis has been tested using the ANOVA and the Related-Samples Kendall's Coefficient of Concordance Tests by the SPSS program; refer to Table 7. The Basra city is selected due to its significance as the economic capital of Iraq; due to its massive reserves of oil (Commissions, 2017); and it can be a substantial point for the process of the sustainable environmental structure in the future, it had a conventional eco-energy residential units that called “Shanashil” which represent the GB in its simple concept (Almusaed & Almssad, 2015).

### 3.1 Development of Conceptual Framework

Relying on the paper objectives, questions and the literature review, a listing of the challenges, incentives, and CSF of the GBR ventures was specified to improve the conceptual framework in figure 1 below.



**Fig. 1 - The conceptual framework**

The questionnaire survey was constructed to collect data from green or general building retrofitting stakeholders to get a comprehensive view of the GBR projects, Basra city. The questionnaire has three sections consisting of: (A) respondent's profile; (B) main challenges to GBR projects, (C) incentives to encourage the implementing of GBR projects and (D) the success factors of GBR projects. A seven-point Likert scale is used in the survey to provide a wider range of possible opinions to facilitate the statistical analyses. Moreover, the questionnaire form has been designed with Google

Drive service. The questionnaire survey response rates are shown in Table 2 below. The No. of respondents are 218 valid respondents. Occasionally, the political instability, in Iraq; in general; prevent the author from getting more than 218 responses.

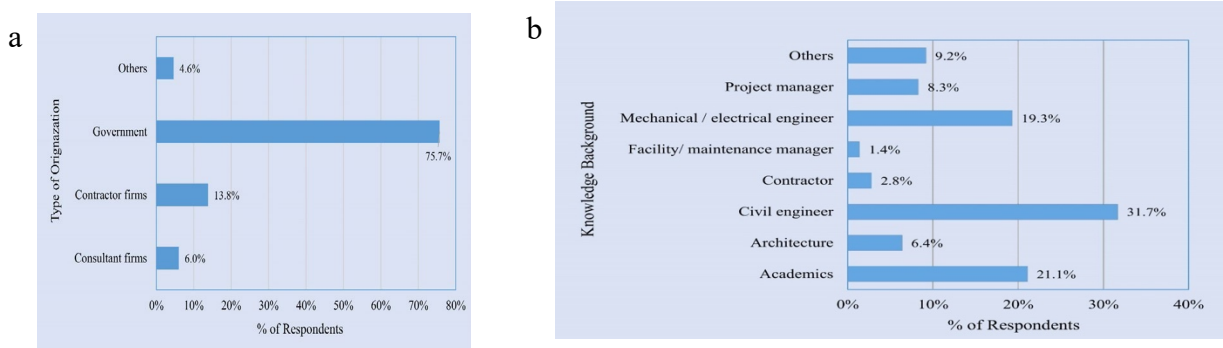
**Table 2 - Questionnaire survey response rate**

Disseminating Approach			Give Out	Received	Valid	Response Rate (Valid)
1.	Social Network	Snowball technique, Basra engineers syndicate group	unknown	153	142	Unknown
2.	Hand-selected	The Engineering colleagues	70	45	40	57.1%
3.	Emails	Official website of the Basra university presidency / Engineering college	100	39	36	36 %
Total			unknown	237	218	n/a

#### 4. Analysis and Discussion

##### 4.1 Background information

The respondent’s knowledge background is cleared in fig.3-b, while the type of organization that the respondents worked in is shown in fig. 3-a below.



**Fig. 3- (a) The type of respondents’ organization; (b) The knowledge background of the respondents**

The scale of internal consistency measured by Cronbach’s alpha coefficients is 0.929 for the questionnaire’s 43 items. This value is considered very high when is compared with the value of 0.7 as a benchmark. Therefore, the data, which used in this questionnaire are consistent and have superior reliability and validity of assessments made. Furthermore, the results reveal the type of organization that the respondents worked in, most respondents worked in the government sector, they constitute more than 75%. Binayan (2011) confirms that the private sector in Iraq affords from several issues that require more work to increase its economic activity. The mean scores analysis by SPSS of the three items; challenges, incentives and, critical success factors; of the GBR project.

##### 4.2 Ranking the challenges of GBR projects in Iraq:

The finding from the questionnaire highlights several challenges that restrict the successful implementation of GBR projects in Iraq. As shown in Table 3, the top five challenges that the respondents indicate are (i) absence of government legislation of GBR in Iraq, (ii) lack of awareness of building owners and investors about benefits of GBR projects, (iii) low investment and involvement from the government and private sectors, (iv) deficiencies in the skills and training for GBR projects and finally (v) the lack of sustainability knowledge respectively. This paper utilizes the SPSS program for analyzing the collected data (i) Mean scores, (ii) the One-way ANOVA test (iii) Kendall’s Correlation test.

#### 4.2.1 Absence of Government Legislation of GBR Projects in Iraq

Modern legislation is absent such as the GB legislation that supports the technical progress and GBR projects in Iraq (Mahmoud, 2014; Zebari & Ibrahim, 2016). Therefore, the successful projects need the collaboration of the work frame of the Iraqi government through undertaking the political steadiness and engaging investment by providing the appropriate climate and suitable environment depending on rules and laws to stimulate the new investment (Binayan, 2011). In Ghana, for example, a developing nation, Ernest, Ankomah, Tengan, and Asamoh (2016) indicated that insufficient government enactment is an important challenge of GBR projects.

#### 4.2.2 Lack of Awareness of Building Owners and Investors about the Benefits of GBR Projects

There is a lack of awareness regarding the concept of sustainability in Iraq (Zebari & Ibrahim, 2016). The awareness about the GB should be sophisticated to essential aspects in the construction industry in addition to the whole community to achieve more benefits of the GB (Esa, Marhani, Yaman, Noor, & Rashid, 2011). Furthermore, investors and building owners with insufficient data Will not be convinced that GB is the best approach, unaware of the benefits of GB and also knowledge gap about financial institutions have major discouraged stakeholders from execution GBR (Jagarajan et al., 2017; Richerzhagen, 2008).

#### 4.2.3 Low Investment and Involvement from the Government and Private Sectors

In general, there is not much investment and participation by the Iraqi government and private sectors in the new ventures in Iraq. This articulates the urgency for the government to ensure the political stabilization and effective legislation to support ventures specifically in the private sector. The private sector represents the co-partnership with the government sector to assure Iraq's economic evolution. Furthermore, it should ensure the critical role of the private sector in the evolution operation. The private sector in Iraq affords from several issues that require more work to increase its economic activity (Binayan, 2011).

#### 4.2.4 The Deficiencies in the Skills and Training for GBR Projects

One of the most important risks of the GB projects; which can be a challenge to execute such projects; is the lack of experience of the project's team and staff (Ashuri & Durmus-Pedini, 2010). In developing countries, there are multi challenges that restrict the execution of GBR projects such as limited training and experience of the staff (Lomas, 2010). Furthermore, achieving GB in Iraq faces a serious challenge. One of these challenges is the lack of training and incompetent skills, lack of education programs regarding such problems of climate change and future environmental crises (Doos et al., 2016; Zebari & Ibrahim, 2016).

#### 4.2.5 The Lack of Sustainability Knowledge

Lack of sustainability knowledge about GBR projects is a key factor influencing their success (Jagarajan et al., 2017). The Colliver's study showed that the incorrect understanding of the expenses of the GBR ventures; because of the lack of sustainability knowledge & experience; discourage the decision-makers to execute these projects (Ashuri & Durmus-Pedini, 2010). There are some factors that lead to the lack of sustainability knowledge in Iraq such as the lack of educational programs about climate change and future environmental crisis also the lack of sustainable subjects at the higher learning institute level (Doos et al., 2016; Zebari & Ibrahim, 2016).

**Table 3 - Challenges of GBR projects**

No.	Challenges	Mean	SD	Rank	ANOVA test	
					F	Sig.
1.	The absence of government legislation of green retrofitting in Iraq	5.91	1.375	1	0.238	0.870
2.	Lack of awareness of building owners, investors about benefits of GBR	5.77	1.498	2	0.347	0.792
3.	Low investment and involvement from the government and private sectors	5.74	1.312	3	0.204	0.893
4.	Deficiencies in the skills and training or GBR projects	5.72	1.365	4	0.457	0.713
5.	Lack of sustainability knowledge	5.68	1.387	5	1.124	0.340
6.	Lack of established benchmarks and criteria for assessing sustainability	5.66	1.352	6	0.544	0.652
7.	Corruption	5.61	1.568	7	1.182	0.318
8.	Absence performance data about retrofitting existing buildings	5.57	1.339	8	0.778	0.507

9.	Limited historical data about return on investment (ROI) for GBR projects	5.5	1.352	9	1.723	0.163
10.	Poor communication among the stakeholders such as owners, tenants and consultant	5.46	1.421	10	0.672	0.570
11.	Inexperienced consultants and contractors	5.41	1.448	11	0.609	0.610
12.	Resistance to change of both building's owners and tenants to engage in new technology and process	5.29	1.597	12	1.539	0.205
13.	Lack of funding	4.91	1.723	13	2.003	0.115
14.	Lack of leadership from top management	4.74	1.589	14	0.361	0.781
15.	High initial cost of GBR projects	4.53	1.434	15	1.201	0.310
16.	Inadequate availability of building materials and technologies used in green buildings	4.42	1.795	16	0.702	0.552
17.	Incompetent project manager	4.08	1.666	17	2.326	0.076
18.	Unreliable or unproven technology	3.79	2.016	18	0.374	0.772

### 4.3 Ranking the Incentives of GBR Projects in Iraq

The outputs from the questionnaire highlight several incentives that will stimulate the implementation of GBR projects in Iraq. As shown in Table 4 below, the most significant incentives that the respondents indicate are; (i) improving the well-being of occupants, (ii) clear specific standards and criteria for GBR, (iii) governmental legislation policies, (iv) corporate social responsibility (CSR) and (v) marketing / branding motive respectively.

**Table 4 - Incentives of GBR projects**

No.	Incentives	Mean	SD	Rank	ANOVA test	
					F	Sig.
1.	Improving the wellbeing of occupants	5.78	1.307	1	0.782	0.505
2.	Clear specific standards and criteria for GBR	5.77	1.253	2	0.740	0.529
3.	Governmental legislation policies	5.59	1.642	3	0.719	0.542
4.	Corporate social responsibility (CSR)	5.55	1.354	4	0.270	0.847
5.	Marketing/ branding motive	5.26	1.313	5	0.116	0.950
6.	Shortage of national electricity supply and rising its prices	5.24	1.50	6	3.788	0.011*
7.	Return on Investment (ROI)	4.67	1.472	7	2.128	0.098

\* (P<0.05)

#### 4.3.1 Improving the Wellbeing of Occupants

The target of GB is to evolve the life's quality by special factors that impact the occupant's well-being and his/her productivity; developing the building's functionality, the design of the building, building's ventilation and the quality of air (Zebari & Ibrahim, 2016). Aletaiby, Kulatunga, and Pathirage (2017) confirm that the employees' relief and amended work environment are the critical success factors of Total Quality Management (TQM) and company achievement in Iraq.

#### 4.3.2 Clear Specific Standards and Criteria for GBR Ventures

The initial traditional Iraqi code that determined the legislation for buildings' safety in the history was Hammurabi code: despite that; Iraq at the present time, has no native code, so that the designers and engineers depend on the ACI / British codes criteria and standards (Al-Taie, Al-Ansari, & Knutsson, 2014). With respect to the green requirement, Iraq depends on the United States Green Building Council (USGBC) and its criteria and the Energy and Environmental Design (LEED) or Building Research Establishment Environmental Assessment Methodology (BREEAM) in the UK (Q. M. Doos, 2016). Actually, the Government in Iraq should institute its specific standards and criteria to supply the least safety requirements for the buildings that fit the economic, social, and environmental issues in Iraq (Al-Taie et al., 2014).

#### 4.3.3 Governmental Legislation Policies

The Iraqi government can play an essential role to stimulate and achieve green domestic buildings. The state should put rigorous guidelines to build healthier domestic buildings (Zebari & Ibrahim, 2016).



#### 4.3.4 Corporate Social Responsibility (CSR)

The CSR aims to ensure the legal responsibility of the corporate towards the community. The corporate in achieving their CSR is expected to work with the correspondence of the legislation (Yusoff, Isa, Aziz, & Chin, 2012). The annual meeting in Iraq of the UNGC (United Nations Global Compact) Network in December of 2012, in Baghdad, will motivate the practising on the CSR in Iraq included the Basra city (Network, 2012). In Singapore, Sui et al. (2014) indicate the CSR as a significant incentive for GBR ventures' success.

#### 4.3.5 Marketing/ Branding Motive

Sui et al. (2014) agreed that the adaptation of GBR projects by companies will enhance the value of reputation to them; for safety, health and comfort reasons. The viability success of any firm is impacted by the market's desires and priorities, therefore, the successful companies should strive to meet the market needs (Dess, 2014).

#### 4.4 Ranking the Critical Success Factors (CSF) of GBR Projects in Iraq:

The results of the evaluation for GBR projects' success factors according to respondents are shown in Table 5 below. The top five CSF are (i) efficient legislation, (ii) competent team members through training and skills developments, (iii) subsidies/tax reduction, (iv) experience and sharing education and (v) competence of project manager. The fifth factor of the CSF is the competence of the project manager, which articulates the importance of the qualified project managers in success such as complicated and significant projects such as GBR projects.

**Table 5 - CSF of GBR projects**

No.	Critical Success Factors	Mean Score	SD	Rank	ANOVA test	
					F	Sig.
1.	Efficient legislation	6.25	1.031	1	0.632	0.595
2.	Competent team members through training and skills developments	6.11	1.160	2	0.961	0.412
3.	Subsidies / tax reduction	6.11	1.260	3	3.456	0.017*
4.	Experience and sharing education	5.97	1.164	4	0.887	0.449
5.	Competence of project manager	5.85	1.259	5	0.685	0.562
6.	Existing building conditions and information	5.79	1.141	6	0.885	0.450
7.	Effective project planning and control	5.75	1.286	7	0.308	0.819
8.	Top management support	5.70	1.086	8	2.538	0.058
9.	Cost management	5.67	1.211	9	0.297	0.827
10.	Maintainability of the green technology (cost/complexity)	5.61	1.340	10	2.393	0.069
11.	Contract conditions	5.54	1.299	11	1.625	0.185
12.	Clear projects scope and priorities of stakeholders	5.51	1.215	12	0.696	0.556
13.	Building owner involvement	5.51	1.208	13	2.282	0.080
14.	Minimize disturbance to existing occupants	5.48	1.271	14	1.468	0.224
15.	Space management	5.42	1.290	15	2.208	0.088
16.	Responsiveness of building owner	5.37	1.242	16	3.798	0.011*
17.	Culture tradition	5.13	1.555	17	2.421	0.067
18.	Complexity of technology	4.81	1.566	18	2.437	0.066

\* (P<0.05)

#### **4.4.1 Efficient Legislation**

Davies and Osmani (2011); Sui et al. (2014) found that the “significance of effective legislation policies” has a prominent role in the success of the implementation of GBR projects. Furthermore, the Iraqi government can put rigorous guidelines to build GB to stimulate and achieve these projects successfully (Zebari & Ibrahim, 2016).

#### **4.4.2 Competent Team Members through Training and Skills Development**

The sufficient training and evolution of workers is a significant factor in human resource management (HRM) in Iraq (Aletaiby et al., 2017). The lack of trained labour workers; on the GB ventures in Iraq; by the contractors represents a critical factor that influences their success (Zebari & Ibrahim, 2016).

#### **4.4.3 Subsidies/ Tax Reduction**

Davies and Osmani (2011); Liang et al. (2017) concluded that the tax discount for GBR ventures and eliminate the value-added tax (VAT) difference between new buildings and retrofits will be prominent items to enhance the success of GBR ventures. “Property tax (TX): the present value of the total amount of property taxes that the owner must pay during the building's service life (building with improved energy efficiency or use of renewable energy may be eligible for tax credits to offset some of the costs)” (Jafari & Valentin, 2018). Furthermore, the Iraqi government can put effective guidelines to stimulate the GB project execution (Zebari & Ibrahim, 2016).

#### **4.4.4 Experience and Sharing Education**

The experience, skills, abilities and, knowledge represent the most significant assets for the viability success of a company, knowledge management nowadays considered the main competitive instrument for numerous businesses (Fong & Wong, 2009). Moreover, (Davies & Osmani, 2011; Kasivisvanathan, Ng, Tay, & Ng, 2012; Liang et al., 2017) asserts that the experience and sharing education about the GBR projects is necessary to ensure the venture's success. Furthermore, one of the effective ways to get such knowledge and experience is learning on the career, sharing education with others is a crucial alternate (Fong & Wong, 2009).

#### **4.4.5 The Competence of Project Manager**

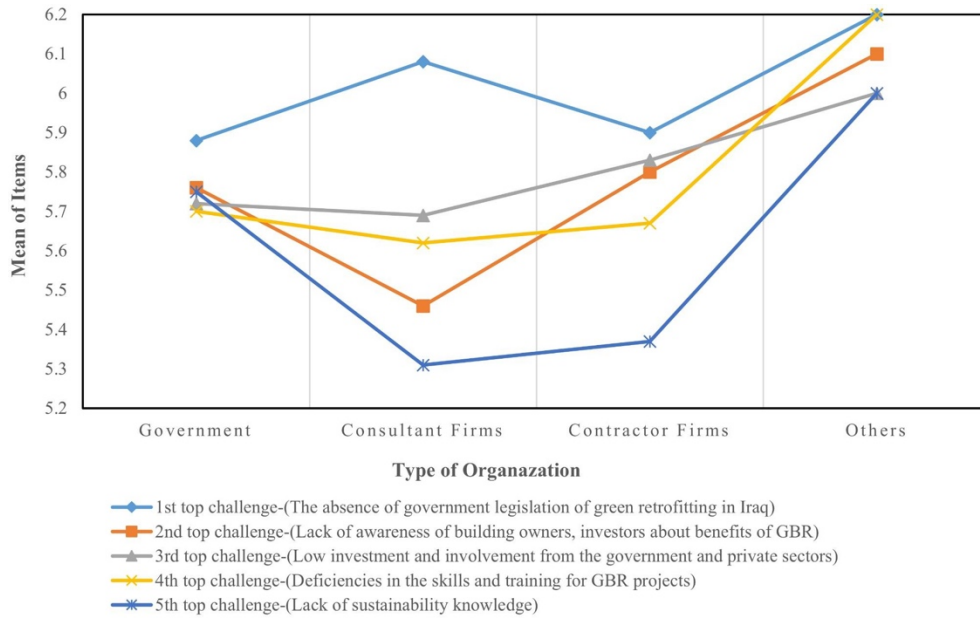
The project manager should have outstanding personal skills, “soft skills”, and technical experience to fulfil success (Gillard, 2009; Sui et al., 2014). With respect to the complicated and total vision of sustainability, it is a necessity for a project manager to perceive the combination between the sustainability and the competency correlated to project management; the project manager needs to be qualified in comprehending the sustainability's aspects of the venture (Moon, Abd-Karim, & Danuri, 2018; Silvius & Schipper, 2012). “The project manager that doesn't understand sustainability, also cannot act upon it!” (Silvius & Schipper, 2012). Moon et al. (2018) confirm that the “competency of project manager” considered one of the utmost significant factors impacting venture success.

### **4.5 Results' Discussion of the ANOVA Test and Kendall's test by SPSS**

#### **4.5.1 ANOVA Test by SPSS**

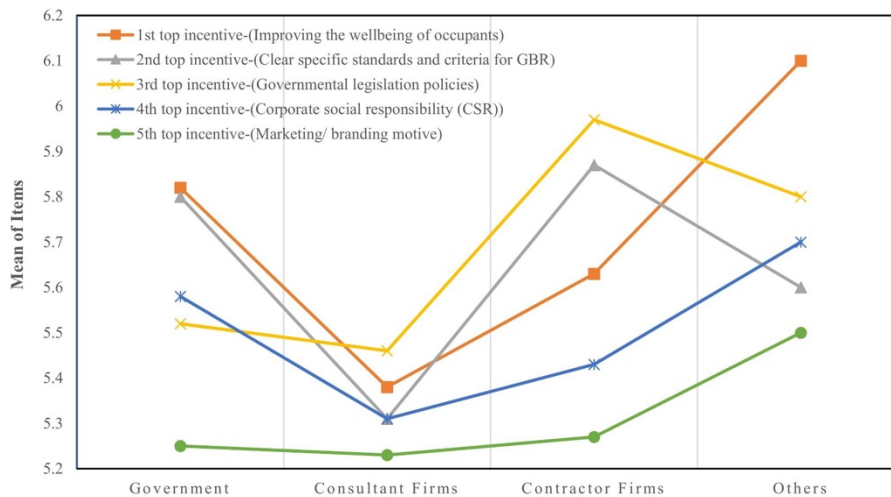
As noticed before, more than 75% of respondents belong to the government sector while the three groups of the private sector form approximately 25% of the respondents. that made this paper conducts the one-way ANOVA test by SPSS among the government sector and the other three sectors; private sectors; consultant firms, contractor firms and, others. This analysis is about finding if there is a significant difference between government and private projects. Therefore, the analysis is conducted to all 43 items of the questionnaire (challenges, incentives and, CSF) of the GBR projects in Iraq.

As the ANOVA test findings (refer to table 3), there is no significant difference between the groups (government, consultant firms, contractor firms and, others) for the challenges of the GBR ventures. Its noticed that the significant level for all challenges' items is more than 0.05 ( $p > 0.05$ ). That means there is no significant difference in the challenges items between the government sector and the private groups' sector. The relationship between the mean of the top five challenges items and type of organization are articulated in fig. 4 below.

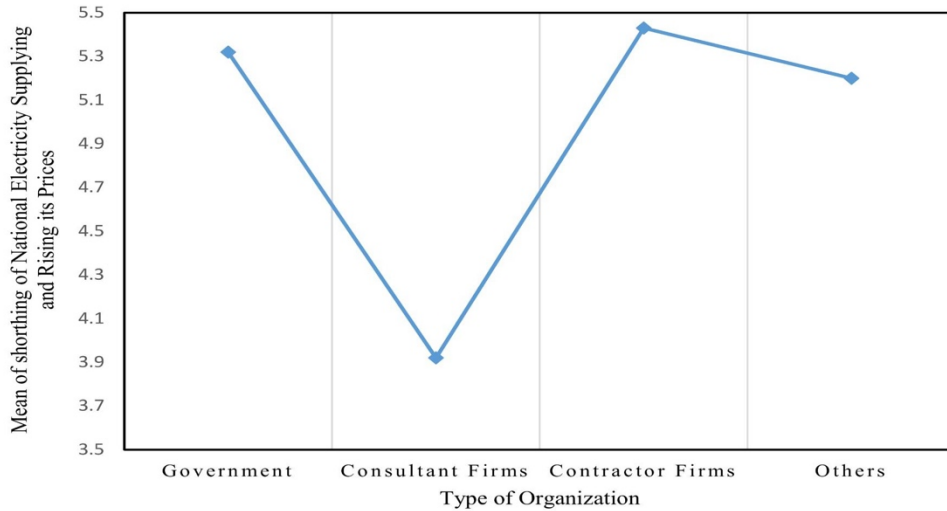


**Fig. 4 - Relationship between the mean of top five challenges items and “type of organization”**

Moreover, it is noticed from the Table 4, that there is no significant difference in the incentives items except for one incentives’ item; shortage of national electricity supply and rising its prices; the value of ( $P < 0.05$ ,  $F=3.788$ ) is significant. Thus, the null hypothesis is rejected and the ANOVA test shows that there is a significant difference in the answers for the importance in the incentive items GBR projects among respondents with different types of organization. The relationship between the mean of the top five incentive items and type of organization is determined as shown in fig.5 below. The mean plots clearly show (refer to fig.6) that the mean score of those groups is differed from the mean scores of the other groups for; the shortage of national electricity supply and rising its prices; item.

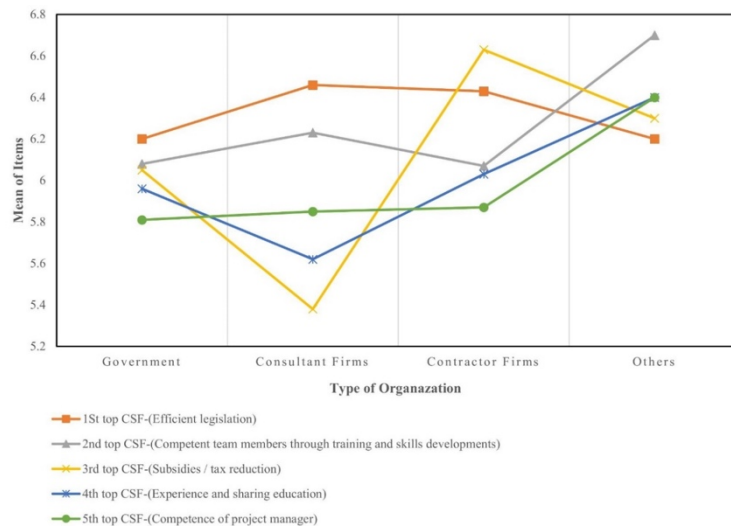


**Fig. 5 - Relationship between the mean of top five incentives items and “type of organization”**

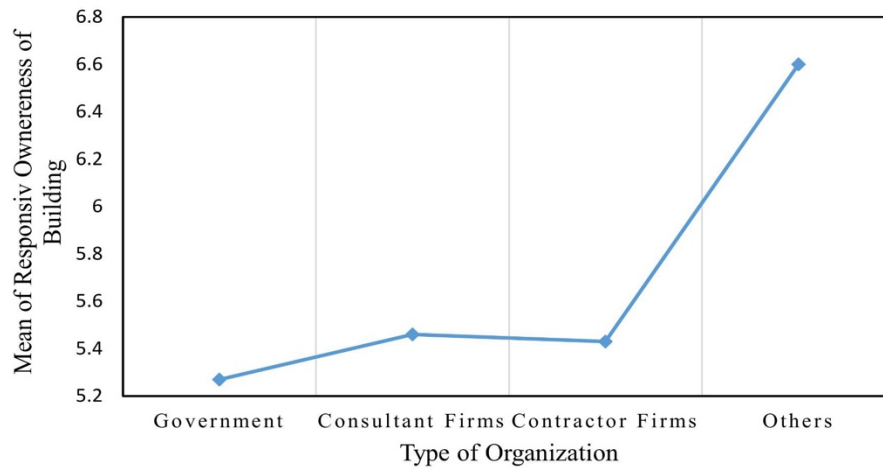


**Fig. 6 - Relationship between the mean of “national electricity supply shortage and rising of its prices” item and “type of organization”**

This paper submits the CSF items to the One-Way ANOVA test and observed from table 5, that there is a significant level of difference for two CSF items ( $P < 0.05$ ). These items are the (i) responsiveness of building owners and (ii) subsidies / tax reduction. For the former, the value of F equalizes 3.798, ( $P < 0.05$ ) is significant also for the later, the value of F equals 3.456 ( $P < 0.05$ ) is significant too as shown. Moreover, one of these different CSF items; subsidies/tax reduction as the third most important CSF; is articulated in fig.7; the relationship between the mean scores of the top five CSF items and the type of organization; while the other different items; responsiveness of building owner is shown in fig. 8 below.



**Fig. 7 - Relationship between the mean of top five CSF items and “type of organization”**



**Fig. 8 - Relationship between the mean of the responsiveness of building owner and “type of organization”**

Therefore, the null hypothesis is rejected when there is a difference in the answers for the level of importance in the three items; challenges, incentives and, CSF for the GBR projects in Iraq among respondents with different types of organization. In this paper, the meaning of rejecting the null hypothesis in favour of the alternative hypothesis is that the “type of organization” has *little effect* on the challenges, incentives and, CSF of the GBR ventures in Iraq; refer to table 7 below. As the ANOVA test results, in general, there is a similarity between the (government, consultant firms, contractor firms and, others); government and private sector; in 40 items from 43 items although there is a significant difference in just three items mentioned above.

#### 4.5.2 Kendall’s Correlation Analysis by SPSS

This paper conducts the Kendall’s correlation test between the “type of organization” and the three items that show a significant difference; as the ANOVA test’ results; to discover which of them has a significant correlation with the type of organization. Kendall’s correlation test shows that there is no significant correlation ( $P > 0.05$ ) between the “type of organization” and “shortage of national electricity supply and rising its prices” and “subsidies or tax reduction” items, while there is a significant correlation ( $P < 0.05$ ) between the “type of organization” and “responsiveness of building owner” item as shown in table 6 below.

**Table 6 - Kendall’s correlation test between the “Type of organization” and the three different items**

No.	Different Items by ANOVA analysis	Sig.
1	Shortage of national electricity supply and rising its prices	0.497
2	Subsidies/tax reduction	0.099
3	Responsiveness of building owner	0.013*

\* ( $P < 0.05$ )

**Table 7 - Hypothesis Test summary**

Null Hypothesis	Test	Sig.	Decision
The distribution of type of organization and all the 43 items; challenges, incentives and, CSF items.	Related-Samples Kendall’s Coefficient of Concordance Test	0.000*	Reject the null hypothesis

\* ( $P < 0.05$ )

In general, the reasons behind that there is an effect of the “type of organization” on the respondents’ answers might be because that the respondents of government sectors have a different point of view compared to the private sector respondents.

This is because there are some differences between the government sector and the private sector. The decision-making process in the public sector is more complicated with various accountabilities than the private sector; the private decision-makers can deal with market rates as offered, but the government sector has a commitment to ensure that these prices precisely be inverted to the social interests such as the reducing of climate pollution, health care (Gramlich, 1990). Therefore, the government's work environment differs from the private sector's in some aspects that cause some differences in the point of view of the respondents in some factors.

Although there are some variances between the government sector and the private sector as explained above, the general similarity in finding responses, of this research, can be attributed to the similarity between the private sector and government sector in other aspects. There is a similarity between the government sector and private sector employees in the common values; fulfilment, well-being, obedience, power, self-leadership, safety, encouragement, convention, universalism and, the job values; challenge, motivating job, intellectually exciting job and creativity (Lyons, Duxbury, & Higgins, 2006).

## 5. Conclusion


One of the dangerous impedence for future development is climate change. The sector of the building represents the hugest resource of greenhouse gas production. There is one rational solution to minimize the environmental negative impact of the existing buildings is the GBR approach (Jagarajan et al., 2017). There is a need to get more lessons, experience many other countries about the GBR projects and this will enhance the comprehension of the problem size faced by existing buildings (Lomas, 2010). The negative influence of buildings in Iraq on the environment is obvious (Doos et al., 2016). Therefore, this paper identifies the challenges, incentives and critical success factors of GBR projects in Iraq, Basra city to increase the implementation of these ventures in this region of the world.

Overall, from the literature review, the researcher can develop the conceptual framework that utilized as a basis for the questionnaire survey to benefit from the professional stakeholder's opinion for data collection. Then, the analysis of these data will provide the basis to explore the challenges of GBR projects, identify the incentives or drivers and evaluate the CSF that will stimulate the execution of the GBR projects in Iraq. As a conclusion, the ANOVA analysis reveals that in general there is little difference between the government sector and private sector in three items from 43 questionnaire items and according to Kendall's correlation test, there is only one item that has a significant correlation with the "type of organization", therefore the future studies should focus on separate research sample once to the government sector and another to the private sector to address the challenges, incentives and, CSF more specifically.

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