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MOTIVATORS OF GREEN DESIGN ADOPTION IN BUILDING PROJECTS OF LIBYA

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ABSTRACT

Aim of this study is to identify the important motivators of green design adoption in building projects of Libya. Green buildings are unpopular in Libya and are still in their early stages. This might be because of various reasons. Hence, this study focused on identifying major motivators of green design adoption. A total of 24 motivators identified from the literature review were investigated through questionnaire survey. Statistical analysis was carried for analysing 74 collected questionnaires sets with SPSS software Package. It is found that the 24 motivators considered in this study play an important role in pushing the adoption of green design in Libyan building projects. The results provide evidence that top five ranked motivators for green building adoption as ranked by the experts, include; control of climate change, providing improved comfort, health, and well-being of occupants, providing lower annual energy cost, increasing indoor air quality; and increasing indoor air quality; respectively. This study adopted a quantitative approach for collecting data. The targeted respondents were only within the capital Tripoli. As to the climatic change, global warming and lack of resources, the 'green' design issue has trended into a measurement in the construction industry. In Libya, rapid growth of developments has contributed significantly in greenhouse gases omission to environment. This has motivated the practitioners to adopt green design concept in building projects. This study has highlighted the key motivators of green design adoption in building industry of Libya which will enable the practitioner for moving forward to take advantage of those motivators for encourage the implement of green buildings. Finally, this study has suggested that international building standards and assessment tools should be adapted as guide to produce the laws and guidebook for green buildings practices in Libya.

***Keywords**: Motivators. Green Design. Building projects. Libya.*

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1 INTRODUCTION

As in any system, stakeholders need something that drive them to act in certain ways; this is what called *"motivators"*. The term *"motivators"* in the field of green architecture is considered as any factor that encourages the decision-makers in the construction industry, including project owners, designers (architects and engineers), and governmental authorities, to adopt and apply green building concepts in projects. These motivators may be caused by the characteristics and advantages of the green buildings, or may be through decisions or actions taken by others that may lead and motivate people to apply this system [1].

The "*green building motivators"* indicate to the potential benefits of the green building system and to the actions taken by others that lead people to apply and adopt the green building concept. These motivators have an obvious effect on decision-makers to adopt and implement the green building concept practically [2].

In order to increase the decision-maker's choices towards green building projects, they need to be motivated. Several studies have indicated that the motivation of stakeholders may increase the successful implementation of green building projects [3]. An overview of these motivators is fundamental in order to understand how green buildings can be more popular and successful [1].

There are numerous factors that can affect the decision to follow green design in building projects. In this section, a systematic review of the literature will be provided to identify; what the important motivators for the adoption of green buildings among construction stakeholders are; how literature categorized these motivators; and what the efficiency of these green building motivators are, in order to provide worthy information to decision makers in the building industry, i.e. governments, designers, and owners of projects regarding what motivate people to help further promote green buildings.

1.1 Identification of Green Building Motivators

The term *"motivators"* is considered as any factor that encourages the decision-makers in the construction industry, including project owners, designers, architects, engineers and governmental authorities, to adopt and apply green building concepts in projects. These motivators may be caused by the characteristics and advantages of the green buildings, or may be through decisions or actions taken by others that may lead and motivate people to apply this system [1].

To find ways to implement green buildings, first it is important to identify potential motivation factors [4]. Identifying motivators for the adoption of green buildings was the first objective of this study. To achieve this objective, an online search were conducted in famous search engines and databases to find out the previous studies on topics relevant to the motivators for green buildings by using the keywords; *green building motivators, green building incentives, green building drivers* [5].

After reviewing the content of 70 published research studies related to the mentioned keywords, only the studies which actually clearly defined what the green building motivators

were selected. It was seen that, based on this criterion only 40 studies remained, which were journal articles, conference papers, theses, and reports, conducted from different countries of the world, including developed and developing countries. From a detailed review of the literature, 24 motivators were identified for the adoption of green buildings. Table 1 lists these motivators derived from reviewing the selected studies. As to Table 1 it can be stated that; 'Providing lower annual energy cost', 'Protection of the environment and ecosystem', 'Providing lower operation, maintenance, and repair cost', 'Providing lower water and wastewater cost', and 'Providing improved comfort, health, and well-being of occupants' are the top five motivators for green building adoption, regarding its frequency in the selected studies.

Table 1. The potential motivators derived from reviewing the selected studies

Label	Green Building Motivators	References
M1	Protection of the environment and ecosystem	[32], [29], [4], [15], [31], [24], [8], [16], [27], [1], [33], [34]
M2	Control of climate change.	[29], [13], [15], [31], [16], [30]
M3	Compatibility with environmental regulations	[14], [24], [18], [35], [1]
M4	Increasing indoor air quality	[15], [28], [1], [34]
M5	Recycling and waste reduction	[32], [13], [15], [27], [1], [20]
M6	Improve reusable and recycle building elements	[32]
M7	Increasing building quality and value	[23], [13], [14], [17], [18], [1], [37]
M8	Providing lower operation, maintenance, and repair cost	[6], [23], [13], [14], [7], [24], [26], [27], [18], [25], [1]
M9	Providing lower building life-cycle cost	[6], [32], [26], [25], [1], [34]
M10	Providing a good opportunity for investment returns	[6], [23], [36], [13], [37], [24], [1], [38], [34]
M11	Increasing occupant productivity	[6], [23], [24], [1], [34]
M12	Increasing occupancy rate	[6], [1]
M13	Increasing rental and sale value	[6], [23], [37], [24], [17]
M14	Providing lower annual energy cost	[6], [32], [13], [4], [15], [24], [39], [16], [27], [30], [35], [25], [10], [1], [33]
M15	Providing lower water and wastewater cost	[29], [13], [4], [15], [16], [27], [35], [25], [1], [34]
M16	Giving a good reputation for marketers	[23], [14], [37], [24], [34]
M17	Availability of more financing channels	[37], [8]
M18	Increase in demand of clients/tenants	[14], [17], [18], [5], [10], [1]
M19	Product and material innovation and/or certification	[26], [1]
M20	Providing improved comfort, health, and well-being of occupants	[6], [24], [27], [17], [18], [5], [1], [34]
M21	Satisfaction from doing the right thing	[14], [8], [26], [18]
M22	Government regulations and policies	[35], [4] [31], [8], [39], [35], [10], [1]

M23	Moral imperative or social conscience	[29], [7], [24], [1], [40], [34]
M24	Creating of better future opportunities	[24], [10]

1.2 Categorisation of green building motivators

In order to comprehensively understand the green building motivators and their level of effectiveness in the implementation of green building development, it is essential to classify these motivators and to differentiate them [1]. Half of the 40 selected studies just identified these motivators without any classification, while the remainder of these studies classified the green building motivators in different ways.

The motivators were classified by turner construction [6], on a *financial* and *non-financial* basis, while, Diyana and Abidin [7], and Abidin and Powmya [8] classified them on a *financial* , *knowledge*, *business*, and *ethical* basis. On the other hand, Olubunmi et al. [5], Olanipekun [9], and Giz and Odi, [10] classified the motivators as *external*, and *internal* motivators.

However, the studies of; Su Ang and Sara Wilkinson [11]; Häkkinen and Belloni [12]; H Gundogan [13]; McGraw-Hill construction [14]; Waidyasekara and Fernando [15]; Naim h. Rustom [16]; Usman and Gidado [17]; Dodge Data & Analytics [18]; Mohamed Ghazali et al. [19]; and Durdyev et al. [20] which make up the largest proportion of the 40 selected studies (22.5%), classified green building motivators as *environmental*, *economic*, and *social* motivators, followed by (10%) which classified them as *external*, and *internal* motivators.

Based on this fact, in this study, it was decided to classify the green building motivators under three main categories; which are: environmental, economic, and social motivators. Table 2 illustrates these classifications from the point of view of the authors of the 40 selected studies.

1.2.1 Environmental motivators

Environmental motivators include; environmental protection, climate change, recycling and waste minimization. Tarja hakkinen and kaisa belloni [12] stated that according to the draft of ISO 21929 (2010a), climate change, deterioration of the ecosystem, and depletion of resources are considered as the main environmental reasons to motivate building stakeholders for the adoption of green building concept in their projects [12].

McGraw-Hill Construction, in its report ‘World Green Building Trends: Business Benefits Driving New and Retrofit Market Opportunities in Over 60 Countries’ [14], showed that the ‘Lower greenhouse gas emission’ is considered the second significant environmental motivation for European and Australian respondents, while, the ‘Natural resource conservation’ is considered as the second significant environmental motivation in South Africa and Singapore [14].

Dodge Data & Analytics [18], reported that ‘Reduce the consumption of energy’ still the top environmental cause of green building by 66% of all respondents, followed by ‘Protecting

natural resources' which was ranked second globally, with 37%, and 'Reducing water consumption' was third, with 31%.

Table 2. Categorization approach of the 40 selected studies on green building motivators

Categorization Approach	Studies References	Number	%
• **Financial** • **Non-financial**	[6]	1	2.5
• **External** • **Internal**	[5], [9], [10], [3]	4	10.0
• **Environmental** • **Economic** • **Social/Cultural**	[11], 12], [13], [14], [15], [16], [17], [18], [19]	9	22.5
• **Stakeholder** • **Responsibility** • **Techniques** • **Feedback**	[32]	1	2.5
• **Financial** • **Knowledge** • **Business** • **Ethical**	[7], [8]	2	5.0
• **Enhanced value** • **Costs/Savings** • **Sustainability** • **Legislation**	[24]	1	2.5
• **Pressure** • **Benefits**	[35]	1	2.5
• **External** • **Property-level** • **Corporate-level** • **Project-level** • **Individual-level**	[1]	1	2.5
Without categorization	[23], [36], [29], [4] [37], [31], [41], [26], [39], [41], [22], [27], [30], [28], [25], [42], [40], [38], [34], [43]	20	50.0
	Total	**40**	**100**

1.2.2 Economic motivators

Based on the study conducted in Sri Lanka in 2013 by Waidyasekara and Fernando, most respondents think that 'Lower cost of energy', is the most effective economic motivator in adopting green buildings in Sri Lanka. It was identified that 'Lower cost of annual electricity', 'Reducing the annual cost of water and sanitation', 'Reducing the annual cost of fuel', and 'Reducing the cost of waste disposal' are the next top four economic motivators according to the respondents. It is obvious that most of the economic motivators are based on long term benefits, where they are achievable within two years of ~~constructing~~ the building [15].

Naim H. Rustom [16], points out that 'Consider costs of life cycle', 'Internalizing external costs', 'Consider alternatives to funding mechanisms', 'Develop the suitable economic tools to encourage sustainable consumption', and 'Considering the economic impact on local structures' were the top five economic motivators for adoption of green design in building construction.

Usman and Gidado [17], observed in their study 'An Assessment of the Factors Affecting Green Building Technology (GBT) Adoption', that the economic and financial benefits of green buildings include: 'Higher rents', 'Higher sales prices', 'Lower cost of occupancy', 'Greater tenant demand', 'Human capital savings', and 'Building value insurance'.

Mohamed Ghazali et al. [19], stated that, economic motivators, including; 'long-term cost of money compensation', 'High market demand', 'Cost saving in energy use', 'Financial incentives and tax exemption', 'Full life cycle design', 'Reducing cost of water consumption cost', 'Low cost of waste disposal', 'High return on investment', and 'Minimum maintenance and repair cost' are the main motivation for developers to push the development of green buildings not only in Malaysia but also in other countries around the world. By determining the economic motivators, the developer can obtain benefits of green buildings not only for them but also for humanity and the environment [19].

1.2.3 Social motivators

The motivators; 'Improved quality of life', 'Well-being of occupants', and 'Better occupant health', are considered as the most important social factors for the adoption of green buildings, as stated by Gündoğan [13], McGraw-Hill [14], Waidyasekara and Fernando [15], and Dodge Data and Analytics [18]. On the other hand, Hakkinen and Belloni [12], and Usman and Gidado [17] identified 'Health', 'Satisfaction', 'Equity', and 'Cultural value' as the majority of social motivators for the implementation of green buildings.

Moreover, Rustom [16], observed that 'Involving stakeholders in order to enhance the participatory approach', 'Promote participation of the public', 'Advance the improvement of suitable institutional frameworks', 'Thinking about the effect on the current social framework', and 'Evaluating the effect on well-being and the life quality' are the main important social motivators to implement the concept of green buildings.

Based on the above-mentioned literature review, and as to the approach of classifying the green building motivators into three categories as environmental, economic, and social, adopted by this study, the 24 potential motivators, which were identified from reviewing the 40 selected studies, were classified under these three categories as shown in Table 3.

1.3 Efficiency of green building motivators

The efficiency of green building motivators varies from country (or region) to another, depending on the environmental, economic, and social conditions. Through a global survey conducted by Dodge Data and Analytics in 2015, it was found that; 'Client demands' ranked first in the list of top five motivators to increase levels of green buildings in UK and US, while it ranked the last in India and Colombia. On the other hand, it was found that 'Environmental regulations' has topped the list in UK, Singapore, and Australia, while tailed the list in Poland, Germany, and Saudi Arabia [18].

As a result of a survey conducted in Malaysia, among a number of stakeholders, the majority of respondents stated that legislations and policies have a higher influence than other motivators [21]. Unlike the result obtained from other countries, the reason 'Satisfaction from doing the right thing' is a key social motivator driving the implementation of green buildings in South Africa [14]. As to the situation in Turkey, based on Gundogan's study conducted in 2012, 'Lower annual water cost', 'Lower annual energy cost', and 'Increased profitability of company with improved productivity' were the top three important motivators for green building development, while, the 'Government support' listed at the end of the list of potential motivators [13].

Table 3. The Potential Motivators for the Adoption of Green Buildings

Label	Categorized	Motivators
M1	Environmental	Protection of the environment and ecosystem
M2		Control of climate change.
M3		Compatibility with environmental regulations
M4		Increasing indoor air quality
M5		Recycling and waste reduction
M6		Improve reusable and recycle building elements
M7	Economic	Increasing building quality and value
M8		Providing lower operation, maintenance, and repair cost
M9		Providing lower building life-cycle cost
M10		Providing a good opportunity for investment returns
M11		Increasing occupant productivity
M12		Increasing occupancy rate
M13		Increasing rental and sale value
M14		Providing lower annual energy cost
M15		Providing lower water and wastewater cost
M16		Giving a good reputation for marketers
M17		Availability of more financing channels
M18		Increase in demand of clients
M19		Having a good market for green buildings in Libya
M20	Social	Providing improved comfort, health, and well-being of occupants
M21		Satisfaction from doing the right thing
M22		Government regulations and policies
M23		Moral imperative or social conscience
M24		Creating of better future opportunities

Abidin, and Powmya [8] discusses the drivers to motivate development specialists to take an interest in executing a green concept into their building projects and investigate the impression of these experts on the future standpoint of the green approach in Oman. Through surveys, the study found that 'A good method to save the environment', 'Company cares for the society and the environment', and 'A safe method to avoid encroachment of laws and regulations', were identified as the top effective motivators of green building adoption in Oman [8].

It is noticeable from the above mentioned that the green building motivators differ in terms of efficiency from country to another. The motivators related to the economic aspects such as; reducing costs, saving money, and increasing profits, plays a major role in motivating the stakeholders to adopt the green building in some countries such as US, Turkey, China, and Saudi Arabia [22, 13, 14, 1, 18, 23, 24, 25, 7, 26, 27]. On the other hand it found that the environmental and social aspects, such as; protection of the environment and ecosystem, control of climate change, waste reduction, and improving the quality of life, have played a key role in other countries such as Malaysia, Singapore, Oman, and South Africa [16, 28, 29, 30, 31, 15, 17, 8].

2 MATERIALS AND METHODS

The study is part of PhD research, a triangulation technique was implemented, which combined quantitative and qualitative date collection approaches. This research was carried out using a quantitative approach with the questionnaire survey. The survey was conducted in the capital, Tripoli. The aim of this survey was to understand the major motivators of adopting green design in building projects of Libya. The respondents of this study are comprised of professional architects, structural engineers, mechanical engineers and electrical engineers who are working in the construction industry, including consultancy firms in both governmental and private sectors.. A total of 150 questionnaire sets were completely distributed by the same percentage to eight governmental institutions, which played an important role in the development plans and programs of the state and involved in the design works of major projects and agreed to provide their assistance in distributing the survey. These institutions were: engineering consulting office for utilities (ECOU); national consulting bureau; organization for development of administrative centers (ODAC); housing and infrastructure board; cities development organization; center for solar energy research and studies (CSERS); industrial research center/building materials department (IRC); academics in higher education institutions.In addition, for private sector participation, a sample of architects and engineers was chosen from some of engineering and consulting offices in Tripoli city, which included: private architecture firms; and private consulting companies.After receiving the responses and reviewing them carefully, the responses were classified as follows; the total number of distributed questionnaire forms were 150 copies (100%), the total returned were 96 respondents (64%), the total rejected were 22 respondents (14.66%), and 74 replies were found to be worthy for analysis the required data, and giving a good final rate of response of about 49.33%. The details are shown in the table 4.

Table 4. Distribution of respondents to the target population

Institutions/Organizations		Distributed	Returned	Rejected	Accepted	
					Quantity	%
Governmental institutions	Engineering Consulting Office for Utilities	15	10	3	7	46.66
	National Consulting Bureau.	15	6	3	3	20.00
	Organization for Development of Administrative Center	15	14	2	12	80.00
	Housing and Infrastructure Board.	15	8	3	5	33.33
	Cities Development Organization.	15	7	1	6	40.00
	Centre for Solar Energy Research and Studies	15	10	2	8	66.66
	Industrial Research Centre / building materials department	15	3	2	1	6.66
	Academics in Higher Education Institutions	15	11	0	11	73.33
Non-Government Organizations	Private Architecture Firms	15	13	4	9	60.00
	Private Consultant Companies	15	14	2	12	80.00
	Total	**150**	**96**	**22**	**74**	**49.33**

3 RESULTS AND DISCUSSION

3.1 Demographic Profile of Respondents

The results of the survey have shown that 36.5% of the respondents were architects, 32.4% were civil engineers, 10% were mechanical engineers, and 7% were electrical engineers, while the urban and regional planners accounted only 4% of the total sample. This suggests that architects and civil engineers are more engaged in the design process than other project participants are. Table 5 shows the distribution of sample subjects according to their job title.

The survey indicates that 41.9% of respondents have more than fifteen years of experience, followed by 14.9% of them with at least ten years of experience. This indicates that more than half of the respondents (56.8%) have significant experience and therefore are familiar with the design process that helps to provide this study with reliable data. Table 6 shows the distribution of sample subjects according to their years of experience.

Table 5. Distribution of sample according to job titles

Job Titles	Frequency	Percent
Architect	27	36.5
Civil Engineer	24	32.4
Mechanical Engineers	10	13.5
Electrical Engineers	7	9.5
Urban & Regional Planner	4	5.4
Contractor	1	1.4
Investor	1	1.4
Total	**74**	**100**

Table 6. Distribution of sample according to the years of experience

Years of Experience	Frequency	Percent
Less than 5 years	17	23.0
From 5 to 10 years	15	20.3.4
From 11 to 15 years	11	14.9
More than 15 years	31	41.9
Total	**74**	**100**

The survey also indicates that 41.9% of respondents had an involvement of more than fifteen buildings, and 16.2% of them had an involvement at least ten buildings. This also indicates that more than half of the respondents (58.1%) have extensive experience in building projects and therefore the data collected from this survey are reliable and accurate because they were obtained from respondents with long experience in building sector in Libya who participated in many building projects. Table 7 shows the distribution of sample subjects according to the number of building projects they have been involved in.

Table 7. Distribution of sample according to the number of building projects

Number of Building Projects	Frequency	Percent
Less than 5 buildings	25	33.8
From 5 to 10 buildings	6	8.1
From 11 to 15 buildings	12	16.2
More than 15 buildings	31	41.9
Total	**74**	**100**

3.2 Perception of Green Building Tendency

In order to determine the extent of the participants' tendency towards the subject of "green buildings", their opinion regarding the “need for green buildings" in Libyan building projects were asked and then measured, using four-point scale ranging from (1) strongly disagree to (4) strongly agree. From the survey, as shown in Table 8, almost all respondents (94.6%) whether strongly agreed or agreed that the Libyan building projects needed to become ‘green’.

Table 8. Participants opinion regarding the need for Libyan building projects becoming ‘green’

Participants’ opinion	Frequency	Percent
Strongly disagree	0	0.0
Disagree	4	5.4
Agree	39	52.7
Strongly agree	31	41.9
Total	**74**	**100**

This gives an indication of the need of adopting the green design concept in Libyan building projects, as well as to the importance of this study as an attempt for developing the Libyan construction policies.

In the same context, and to expand the knowledge of the extent of awareness and culture of the participants, with regard to the green building adoption of the concept of green buildings, the respondents were asked to express their opinion on the mandatory or voluntary application of the concept of green design in Libyan building projects, both in public or private buildings.

Figure 1 shows that, more than half (64.86%) of the respondents confirmed that the application of the green design concept should be mandatory for public buildings. On the other hand, about two third (74.32%) of the respondents confirmed that the application should be voluntary for private buildings.

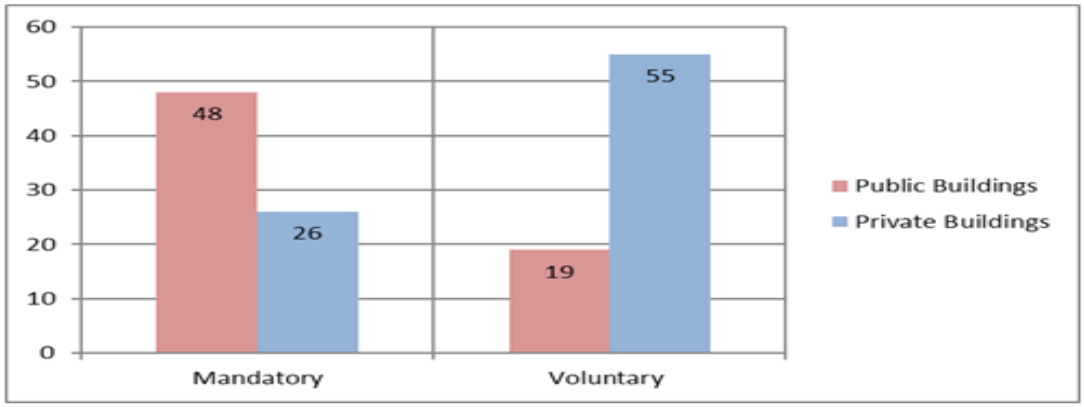

Figure 1- Policy choice of the application of the green design concept in public and private buildings

EVALUATION 0F MOTIVATORS FOR ADOPTING GREEN BUILDINGS

One-sample t test is used to evaluate the motivators that affect the implementation of green design in Libyan building projects. This test is used here to measure the level of effect compared to the average mean value of scores reported for each sub group of motivators namely; environmental, economic, and social motivators. A one-sample t test was conducted on environmental motivators, economic motivators, and social motivators that affect the implementation of green design in Libyan building projects scores to evaluate whether their mean was significantly different from (3.109), the average mean value of scores reported for the three types of motivators.

Table 9 shows one sample t test of the three types of motivators that affect the implementation of green design in Libyan building projects. Environmental motivators varied from the test value significantly (3.109), p> .05. 'environmental motivators' is the most effective factor which had the highest positive mean difference (0.264). The least effective motivation factor is 'economic motivators' which had the highest negative mean difference (-0.095). These results support the conclusion regarding, environmental motivators being the most effective factor in the implementation of green design in Libyan building projects.

Table 9. Ranking of Environmental, Economic, and Social Motivators

Type of Motivators	Mean	Test value = 3.109			Rank
		Mean Difference	t	Significance	
Environmental Motivators	3.373	0.264	5.509	0.000	1
Economic Motivators	3.013	- 0.095	- 1.841	0.070	3
Social Motivators	3.037	- 0.071	- 1.185	0.240	2

3.2.1 Environmental Motivators

The participants were asked to rank the major environmental motivators as how they affect the implementation of green design in building projects according to their experience. A one-sample t test was conducted to evaluate whether their mean was significantly different from the average mean value of scores reported for environmental motivators, namely (3.373).

Table 10. Ranking of Environmental Motivators

Environmental Motivators	Mean	Test value = 3.373			Rank
		Mean Difference	t	Significance	
Protection of the environment and ecosystem	3.513	0.139	1.924	0.058	1
Control of climate change	3.432	0.058	0.915	0.363	2
Compatibility with environmental regulations	3.297	- 0.076	- 1.214	0.229	5
Increasing indoor air quality	3.378	0.004	0.076	0.939	3
Recycling and waste reduction	3.364	- 0.008	- 0.131	0.896	4
Improve reusable and recycle building elements	3.256	- 0.117	- 1.752	0.084	6

The overall result in table 10 shows that none of the environmental motivators varied from the test value significantly (3.373), p> .05. The most effective environmental motivator was ‘protection of the environment and ecosystem’ which had the highest positive mean difference (0.139). The least effective environmental motivator was ‘improve reusable and recycle building elements’ which had the highest negative mean difference (-0.117). The results support the conclusion that there are no significant differences between environmental motivators that affect the implementation of green design in Libyan building projects.

3.2.2 Economic Motivators

The participants were also asked to rank the main economic motivators as how they affect the implementation of green design in building projects based on their experience. A one-sample t test was conducted to evaluate whether their mean was significantly different from the average mean value of scores reported for economic motivators, namely (3.014).

Table 11 shows mean and one sample t test of economic motivators that affect the implementation of green design in Libyan building projects. Six economic motivators varied from the test value significantly (3.014), p <.05. The most effective economic motivator is ‘Providing lower annual energy cost’ which had the highest positive mean difference (0.391). The least effective economic motivator is ‘Having a good market for green buildings in Libya’ which had the highest negative mean difference (-0.662). The results support the

conclusion that there are significant differences between economic motivators which affect the implementation of green design in Libyan building projects.

Table 11. Ranking of Economic Motivators

Economic Motivators	Mean	Test value = 3.014			Rank
		Mean Difference	t	Significance	
Increasing building quality and value	3.270	0.256	4.377	0.000	**2**
Providing lower operation, maintenance, and repair cost	3.202	0.189	2.319	0.023	**5**
Providing lower building life-cycle cost	3.243	0.229	3.003	0.004	**4**
Providing a good opportunity for investment returns	3.121	0.108	1.407	0.164	**6**
Increasing occupant productivity	3.040	0.027	0.416	0.679	**7**
Increasing occupancy rate	3.013	0.000	0.000	1.000	**8**
Increasing rental and sale value	2.905	- 0.108	- 1.356	0.179	**10**
Providing lower annual energy cost	3.405	0.391	6.164	0.000	**1**
Providing lower water and wastewater cost	3.270	0.256	3.529	0.001	**3**
Giving a good reputation for marketers	2.986	- 0.027	- 0.336	0.738	**9**
Availability of more financing channels	2.891	- 0.121	- 1.361	0.178	**11**
Increase in demand of clients	2.473	- 0.540	- 5.110	0.000	**12**
Having a good market for green buildings in Libya	2.351	- 0.662	- 5.701	0.000	**13**

3.2.3 Social Motivators

The participants were also asked to rank the main social motivators as how they affect the implementation of green design in building projects according to their experience. A one-sample t test was conducted on social motivators that affect the implementation of green design in Libyan building projects scores to evaluate whether their mean was significantly different from (3.037), the average mean value of scores reported for Social Motivators.

The overall result in Table 12 shows that all social motivators varied from the test value significantly (3.037), p> .05. The most effective social motivator is ‘Providing improved comfort, health, and well-being of occupants’ which had the highest positive mean difference (0.381). The least effective Social Motivator is ‘Libyan government policies and regulations support the green design concept’ which had the highest negative mean difference (-0.605). The results support the conclusion that there are significant differences between social motivators which affect the implementation of green design in Libyan building projects.

Table 12. Ranking of Social Motivators

Social Motivators	Mean	Test value = 3.037			Rank
		Mean Difference	t	Significance	
Providing improved comfort, health, and well-being of occupants	3.418	0.381	6.261	0.000	**1**
Creation of better future opportunities	3.202	0.164	2.214	0.030	**3**
Getting the satisfaction from doing the right thing	3.351	0.313	4.819	0.000	**2**
Libyan government policies and regulations support the green design concept	2.432	- 0.605	- 4.360	0.000	**5**
Religion, customs and tradition support the green design concept	2.783	- 0.254	- 2.107	0.039	**4**

The mean values of all motivators are higher than the average rating scale which was (2.5). These results indicate that the 24 motivators considered in this study play an important role in pushing the adoption of green design in Libyan building projects.

From the mean value listed in both Table 10, Table 11, and Table 12, 'Protection of the environment and ecosystem' (M1), with mean value = 3.5135, was the highest ranked motivator for developing green buildings in Libyan projects. 'Control of climate change' (M2), with mean value = 3.4324, was ranked by experts as the second major motivator to adopt the concept of green design in the building projects. It is worth noting that both the first and the second motivators belong to the environmental motivators.

The results of this study provide evidence that the third major motivation behind adoption of green buildings is 'Providing improved comfort, health, and well-being of occupants' (M20, mean value = 3.4189). While the 'Energy cost reduction' motivator topped the list of the motivators and ranked first in the potential motivators of green building adoption in most earlier studies, the motivator 'Providing lower annual energy cost' (M14), with a mean value of 3.4054, ranked fourth in this study. This may be because the low cost of energy in Libya which are almost free due to the government subsidies to the General Electricity Company through operational fuel subsidies as well as financial support.

Other top ten ranked motivators for green building adoption as ranked by the experts, include; 'increasing indoor air quality' (M4); 'recycling and waste reduction' (M5); 'getting the satisfaction from doing the right thing' (M22); 'compatibility with environmental regulations' (M3); 'increasing building quality and value' (M7); and 'providing lower water and waste cost' (M15), respectively. All of these advantages are generally known and associated with green buildings, and it is convenient to note that the industry can help drive the construction of green buildings.

'Libyan government policies and regulations support the green design concept' (M23), with mean value = 2.4324, and 'having a good market for green buildings in Libya' (M19), with mean value = 2.3514, were ranked as the last two potential motivators for adopting green buildings in Libya. Despite the fact that the Libyan environment is very suitable for the implementation of the concept of green buildings successfully due to its climate and geography, there is no market up to now for green buildings in Libya as confirmed by experts involved in the semi-structured interviews. This may be due to the lack of support for government policies to adopt the concept of green design in building projects as well as to the reluctance of the private sector to adopt this concept. Time should be taken to come up with strategies to widely promote these motivators in society in order to influence people to have interest in green buildings.

4 CONCLUSIONS

Despite the wide spreading of the concept of green building in many developed and developing countries around the world, it does not possess a similar status in Libya and is still in its early stages. This is noted by the absence of strategies, policies, and regulations that encourage the adoption and implementation of green design concept in building projects of Libya.

This study examines the main issues affecting the adoption of the concept of green buildings from the views of construction experts in Libya. Thus, given the limited empirical studies on issues affecting the adoption of green buildings, this study contributes to the knowledge body by identifying key issues for decision makers of adopting the concept of green buildings in Libya. It concluded that many issues affect the implementation and formation of green buildings.

A wide range of motivators of green building adoption were identified and examined using a combination of research methods which included literature review, and questionnaire survey. Issues that affect the adoption of green buildings have been analyzed using ranking technique, thus providing a clear understanding of key issues that deserve further attention in efforts to promote the adoption of green buildings. The factors that affect the adoption of green buildings in Libya have been analyzed using ranking method utilizing the quantitative statistical analysis package software (SPSS) version 25, thus providing a clear understanding of key issues deserving more attention in efforts to promote the adoption of green buildings. The study examined 24 motivators from the views of construction experts.

The results indicated that the 24 motivators considered in this study play an important role in pushing the adoption of green design in Libyan building projects, with the top ten motivators being 'Protection of the environment and ecosystem', 'Control of climate change', 'Providing improved comfort, health, and well-being of occupants', 'Providing lower annual energy cost', 'Increasing indoor air quality', 'Recycling and waste reduction', 'Getting the satisfaction from doing the right thing', 'Compatibility with environmental regulations',

'Increasing building quality and value', and 'Providing lower water and waste cost', respectively.

The results of this study are expected to contribute valuable information to policy-making in the building industry and to the implementation of green buildings in Libyan projects in the future. The results contribute to a deeper understanding of key motivators that encourage adoption of green buildings. Although, the results are relevant to green building adoption and implementation in Libyan projects, it might also be useful for policy makers in other developing countries.

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محفزات اعتماد التصميم الأخضر في مشاريع البناء في ليبيا

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الملخص

تهدف هذه الدراسة إلى تحديد المحفزات المهمة لاعتماد التصميم الأخضر في مشاريع البناء في ليبيا. المباني الخضراء لا تحظى بشعبية في ليبيا ولا تزال في مراحلها الأولى. قد يكون هذا لأسباب مختلفة. عليه ، ركزت هذه الدراسة على تحديد المحفزات الرئيسية لاعتماد التصميم الأخضر. اربع وعشرون محفزًا تم تحديدها من خلال مراجعة الدراسات السابقة ومن ثم اختبارها من خلال الاستبيان. تم إجراء التحليل الإحصائي لعدد اربع وسبعون عينة من ردود الاستبيانات التي تم استلامها وذلك باستخدام حزمة برامج SPSS. تبين أن المحفزات الاربع وعشرون التي تم تناولها في هذه الدراسة تلعب دورًا مهمًا في دفع وتبني التصميم الأخضر في مشاريع البناء الليبية. تقدم النتائج دليلاً على أن الدوافع الخمسة الأولى لاعتماد المباني الخضراء حسب تصنيف الخبراء ، تشمل ؛ التحكم في تغير المناخ ، توفير الراحة والصحة ، رفاهية المستخدمين ، توفير تكلفة طاقة سنوية أقل؛ وزيادة جودة الهواء الداخلي ؛ على التوالى. اعتمدت هذه الدراسة نهجا كميا لجمع البيانات. وكان المستهدفون بالاستبيان في نطاق العاصمة طرابلس فقط نظرا للتغير المناخي وقضية الاحتباس الحراري ونقص الموارد الطبيعية ، اصبحت قضية التصميم "الأخضر" من ضمن المعايير المطلوبة في صناعة البناء. في ليبيا ، ساهم النمو السريع بشكل كبير في انبعاث غازات الاحتباس الحراري في البيئة. وقد حفز هذا الممارسين في مجال البناء على تبني مفهوم التصميم الأخضر في المشاريع الانشائية. سلطت هذه الدراسة الضوء على الدوافع الرئيسية لاعتماد وتبني التصميم الأخضر في مشاريع البناء في ليبيا والتي ستمكن المهتمين بمجال البناء من المضي قدمًا للاستفادة من تلك المحفزات لتشجيع تنفيذ المباني الخضراء. أخيرًا ، اوصت هذه الدراسة بضرورة الاستفادة وتكييف معايير البناء الدولية وأدوات التقييم العالمية كدليل لإنتاج القوانين والتعليمات الإرشادية لممارسات المباني الخضراء في ليبيا.

الكلمات الدالة:
المحفزات.
التصميم الاخضر.
مشاريع البناء.
ليبيا.

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