

**AHMED MOHAMED ELARABY AWAILI**

**THE ANALYSIS AND BARRIERS IN  
GREEN BUILDING DEVELOPMENT IN LIBYA**

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# **THE ANALYSIS OF BARRIERS IN GREEN BUILDING DEVELOPMENT IN LIBYA**

**A THESIS SUBMITTED TO THE GRADUATE  
SCHOOL OF APPLIED SCIENCES  
OF  
NEAR EAST UNIVERSITY**

**By  
AHMED MOHAMED ELARABY AWAILI**

**In Partial Fulfillment of the Requirements for  
the Degree of Master of Science  
in  
Architecture**

**NICOSIA, 2017**

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GREEN BUILDING DEVELOPMENT :  
A CASE STUDY IN LIBYA**

**Approval of Director of Graduate School of  
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I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

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## ABSTRACT

The demand for green development around the world has escalated in the past few years, particularly in relation to environmental health and safety. Governments, institutions and private construction sectors have adopted green building development as their ethical responsibility in developed countries. Although construction is one of the principal industries in Libya, priority has not been given to green building, due to the lack of adequate awareness. The study aims to resolve this deficiency of knowledge related to the impact of green building in Libya, seeking to determine the reasons why Libya lacks sustainable construction and green building methods, thereby removing the barriers for sustainable building in Libya. Moreover, a mixed research approach was adopted with outcomes that will be beneficial to both researchers and construction engineers. Data was collected using a questionnaire and analyzed in SPSS. Findings show that the unsatisfactory level of expertise in green construction is the explanation for the poor implementation of green building in many construction projects. Results also demonstrated that current incentives are not sufficiently effective at promoting green construction in Libya; consequently, many construction firms are reluctant to participate in the green building market. Moreover, outcomes explaining the lack of green buildings in Libya include: price, unavailability, products, supply of green materials and ignorance about green buildings. Further discoveries revealed that government incentives and desirable subsidies, such as structural incentives, rebate programs, voluntary rating systems, tax incentive schemes, low interest mortgages loans, market and technology aid, can eliminate many barriers and motivate development.

**Keywords:** Architecture; construction; green building; Libya; sustainable

## ÖZET

Son birkaç yıldır, özellikle çevre sağlığı ve güvenliği ile ilgili olarak, dünyada yeşil kalkınma talebi artmıştır. Gelişmiş ülkelerde hükümetler, kurumlar ve özel sektör işletmeleri, yeşil bina gelişimini etik sorumlulukları olarak kabul etmişlerdir. İnşaat endüstrisi Libya'da başlıca endüstrilerden biri olmasına rağmen, bu konuda yeterli farkındalık olmaması nedeniyle, sektörde yeşil binaya öncelik verilmemiştir. Bu çalışma, Libya'nın sürdürülebilir yapılaşma ve yeşil bina inşa yöntemlerinden yoksunluğunun nedenlerini ortaya koyarak, konuyla ilgili bilgi eksikliğini gidermeyi ve böylece Libya'daki sürdürülebilir yapılaşma için mevcut engellerin kaldırılmasına katkıda bulunmayı amaçlamaktadır. Ayrıca çalışmada, hem araştırmacılara hem de inşaat sektörüne faydalı olabilecek karma bir araştırma yaklaşımı benimsenmiştir. Veriler anket kullanılarak toplanmış ve SPSS yöntemiyle analiz edilmiştir. Bulgulara göre, birçok inşaat projesinde yeşil bina uygulanmalarının bulunmaması, bu alandaki uzmanlık seviyesinin yetersizliğiyle açıklanabilmektedir. Sonuçlar, mevcut teşviklerin Libya'daki yeşil bina uygulamalarının gelişmesinde yeterince etkili olmadığını da göstermektedir; dolayısıyla birçok inşaat firması yeşil bina pazarına katılma konusunda isteksiz görünmektedir. Ayrıca, maliyet, ürünlerin bulunamaması, yeşil malzemelerin temin edilmesindeki zorluklar ve konu hakkında bilgi yetersizliği de Libya'daki yeşil binaların eksikliğini açıklayan sonuçlar arasındadır. Diğer bulgular ise, yapısal teşvikler, indirimler, isteğe bağlı derecelendirme sistemleri, vergi teşvik programları, ipotek karşılığı düşük faizli krediler, pazar ve teknoloji desteği gibi devlet teşvikleri ve sübvansiyonlar yardımıyla birçok engelin ortadan kaldırabileceğini ve gelişimin motive edebileceğini ortaya koymuştur.

**Anahtar Kelimeler:** Mimarlık; yapı; yeşil bina; Libya; sürdürülebilir

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## ACRONYMS AND ABBREVIATIONS

<b>%:</b>	Percentage
<b>BREEAM:</b>	Building Research Establishment Environmental Assessment Method
<b>CEO:</b>	Chief Executive Officer
<b>EIA:</b>	Energy Information Administration
<b>EMS:</b>	Environmental Management System
<b>GB:</b>	Green Building
<b>GBT:</b>	Green Building Technic
<b>GBL:</b>	Global Building Labeling
<b>GCC:</b>	General Construction Company
<b>GM:</b>	Green Mark
<b>HK-BEAM:</b>	Hong Kong Building Environmental Assessment Method
<b>LED:</b>	Light Emitting Diode
<b>LEED:</b>	Leadership in Energy and Environmental Design
<b>m<sup>2</sup>:</b>	Meter Square
<b>MOHURD:</b>	Ministry of Housing and Urban-Rural Development
<b>n:</b>	Number
<b>NDRC:</b>	National Development and Reform Commission
<b>NGOs:</b>	Non-Governmental Organizations
<b>REDP:</b>	Real Estate Development Process
<b>SPSS:</b>	Statistical Package for Social Science
<b>TCs:</b>	Transaction cost
<b>UAE:</b>	United Arab Emirate
<b>UBA:</b>	Umweltbundesamt
<b>UK:</b>	United Kingdom
<b>UN:</b>	United Nation
<b>VOC:</b>	Volatile Organic Compounds
<b>SPSS:</b>	Statistical Package for the Social Sciences

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Overview of Green Building**

One of the major components of the construction industry is the green building. It entails the construction of both residential and commercial properties. The premises that house people and facilitate various activities such as sports, commerce and entertainment among others affect the environment in a number of ways especially if they are not constructed in a manner that conserves the environment. There are various factors in the green building which affect the environment. These include the location where a premise is built, the design and demolition. All these can potentially affect the environment as well as the people who use them. Buildings produce carbon dioxide which is a dreaded greenhouse gas that has a chain of effects to the immediate environment. Sources of carbon dioxide from buildings include activities such as use of electricity and combustion of fuels among other activities (Wood, 2007).

Green building has gotten expanded consideration over the previous decade from both ecological financial specialists and policymakers. While there is no single meaning of "green structures" or its related arrangement, analysts and associations have a tendency to accentuate asset productivity in building and decreasing the effects of structures on human wellbeing and the earth. Therefore a developing exhibit of building division strategies have been actualized in the United States and different nations went for vitality proficiency and lessening ecological effects of the structure or site (Matisoff et al., 2016).

Construction literature reveals that green building have a chain of impacts to the environment in terms of unwanted climatic changes, use of energy and even human safety. Environmental management officials who are tasked with the responsibility of ensuring that there is environmental sustainability in all activities support for green building, according to them construction specialists should adopt an all rounded and a holistic model when demolishing, constructing and designing buildings. This will reduce the effect of construction to the environment and the life which it sustains (Alliance, 2016).

According to the US Environmental Protection Agency (2016) green buildings defines green is the creation of structures by practice with environmentally, resource sufficient and responsible processes all-through the building life-cycle. Green building also refers to a building which uses a process that is focused on reducing environmental impacts humans and nature and thereby reducing energy, water to avoid waste, pollution and environmental degradation (Gou & Xie, 2016; USGBC, 2009).

According to Robichaud and Anantatmula (2010) the four noteworthy mainstays of green building are listed as minimization of impacts on the earth, overhauling the prosperity of inhabitants, the arrival on speculation to engineers and nearby group, and the life cycle audit as far as stages prefer arranging and improvement forms. In China, green building begun with building vitality sparing. Since the issue of the central game plan standard in (Chmutina, 2010), China has issued more than 100 building vitality sparing gages and refreshed a couple of standards at times China Architecture and Building Press (2008). Nearby the further advancement of building energy effectiveness, green building was well ordered displayed and later utilized as a part of China.

The concept of green building cuts across disciplines. It entails an inter-connection of procedures and components that supports for healthy and sustainable building activities. Ideally, green building is a concept in environmental conservation. That favors for the use of environmentally friendly construction materials as well as designs that are eco-habitat friendly. It identifies architectural designs that do not destroy the natural resources. Use of materials that are locally available and eco-friendly in building and construction would go a long way in preserving the environment as well as reducing the usage of natural resources such as water and energy which are becoming scarce with time due to over-exploitation without proper preservation. Secondly, green building will minimize the impact of construction activities to ecology and create a safe indoor environment for the populations (Tamošaitienė & Gaudutis, 2013; Samer, 2013).

Various scholarly datum advocates for green building on account that it has a number of benefits. Scholars conducted studies through examination of the already existing buildings besides on-ground studies. Green building is associated with improved status of the environment. Therefore, the advantages are felt both at the health and aesthetic levels. Similarly, it reduces the expenses for the tax payers, cost of water and energy if

the construction designs are well crafted to utilize natural resources without depleting or degrading them (Allen et al., 2015). Similarly, buildings that are located near means of transportation such as roads cut down on the cost of transport for those who live in these buildings. Furthermore, green building reduces the cost of management of natural resources and cost of infrastructure to conduct activities such as water treatment and landfills are significantly reduced (Akadiri et al., 2012; Francesco & Levy, 2008).

A study conducted in Canada investigated the impacts of green building in the long run. The study revealed that there were both tangible and intangible advantages associated with green building and the health status of the population would be improved as the prevalence of respiratory illnesses would reduce. Furthermore, the economic welfare is likely to improve besides more employee retention in their workplace. According to the study, retention of employees would account to 85% of cost savings. 15 percent of savings emanate from savings in the utilities of water, energy and waste (Kramer et al., 2009).

## **1.2 Problem Statement**

Although the construction industry in Libya is a key player in national development, the country is yet to adapt to the growing trend of green building practices.

The concept of green building is poorly understood in Libya and therefore, it is critical that the government implement measures that ensure that the construction industry is sufficiently informed about the importance of green building.

## **1.3 Aim of the Study**

The study aims to fill in the information gap that has been created by the poor understanding of the potential impact of green building in Libya. It will also seek to determine the reasons why Libya is devoid of sustainable construction and green buildings. The study will determine the barriers preventing sustainable building in Libya.

## **1.4 Limitations of the Study**

This thesis has been successful in addressing the objectives of the study. An in-depth analysis has been conducted into the challenges faced by green building in Libya. Nonetheless, there are some limitations to this study. First, the study data was limited



as it only covered 20 major companies. Furthermore, much of the operating data of modern green buildings was not available. Consequently, in this study, the majority of the data was collected from architects, engineers and interior designers.

## **1.5 Thesis Overview**

**Chapter 2:** This chapter reviewed published articles, journals and other academic sources related to the study research area.

**Chapter 3:** This chapter proposes a theoretical framework for analyzing existing green building. In addition made some analysis of green building around the globe.

**Chapter 4:** This chapter discussed the adopted research methodology for the study and presents the barriers in green building development in Libya. The chapter rounded up by with research conclusion, making recommendations and suggestion for future research.

**Chapter 5:** This chapter provides the result and interpretation of the study and presents the barriers in green building development in Libya and conclusion of the entire research by summarizing the result and answer research question in green building development in Libya.

**Chapter 6:** This is the last chapter, the conclusion, recommendation and suggestion for future research was conducted.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Green Building**

Kamana and Escultura (2011) defined "sustainable building" or "green building" therefore of a blueprint which focuses on growing the efficiency of advantage use energy, water, and materials – while diminishing building impacts on human prosperity and nature in the midst of the building's lifecycle, through better zone, outline, improvement, operation, upkeep, and ejection.

Mona et al. (2013) conducted research in Malaysia that examined the attractiveness of green buildings for property investors. The author investigated whether investors have been observed to increase their enthusiasm for green office structures as a result of the possibly higher returns contrasted and non-green building. Besides, they found that the hidden elements of interest and supply may change after some time; resultantly, interest in green office properties is presented to the impulses of the market.

Green Building is the act of making structures and utilizing forms that is earth mindful and asset productive all through a building's life-cycle from siting to plan, development, operation, support, remodel and deconstruction. This practice extends and supplements the established building configuration worries of economy, utility, strength, and solace (EGBC, 2016).

Shafii et al. (2006) stated that sustainable development is a method for the building companies to move in the direction of achieving sustainable development, with regards to environmental, socio-economical and cultural issues. They also stated that the mixes of approaches and differing economic markets results to different priorities. Notwithstanding, they included that countries of South-East Asia confront not comparable manageable improvement challenges, but rather in the meantime go up against regular difficulties run of the mill of industrializing and urbanizing economies. These and diverse troubles make the mission for sensible change and improvement in South-East Asia particularly troublesome. The nonappearance of care, get ready and preparing and lacking securing structures are among the genuine impediments for

viable improvement in the region. In some nation open methodologies and managerial frameworks don't enable the change of the improvement part. Other than the prerequisites for breaking points, advances and gadgets, mean and energetic duty by all players in the improvement parts including the organizations and individuals by and large wherever are required with a particular ultimate objective to achieve viable advancement in South-East Asia.

Hoffman and Henn (2008) reported that green building development has defeat impressive, specialized, and monetary obstacles as of late, yet selection of green building rehearses inside the plan and development field stays low. Significant enterprises now offer items and administrations at a scale that is conveying costs down to aggressive levels, yet natural maintainability in building plan and conveyance stays at the early phases of the selection s-bend. They expressed that ecological advancement in the building plan and development industry will keep on stalling if the critical social and mental obstructions that remain are not solved. They demanded that by distinguishing social and mental hindrances, they can impact changes in social structures, prizes, and motivating forces.

Ashuri and Durmus (2010) attempted to accentuate once again that green building advantages are genuine, and furthermore demonstrates the choice producer that despite the fact that there are dangers components required of practicing environmental awareness, these can be overseen. Furthermore, they stated that the main reasons for the buildup, was a structure for advantages and dangers of retrofitting existing structures to green principles. Their study tried to add to the new association what's more, system of hazard and advantages elements with number of hazard methodology recommendations and tries to unite the data for consequent research offer assistance.

Chen and Huang (2012) proposes the foundation of an environmental well-being data administration stage giving private clients an agreeable, solid indoor environment by taking the house for instance, the review: (1) appointed ecological wellbeing execution pointers, (2) built up limitations to keep up natural conditions, and (3) gave streamlined administration control instruments and techniques. The ecological wellbeing data administration stage gives an upgraded control and arrangement pathway guaranteeing the nature of the indoor wellbeing condition and gear vitality protection.

## **2.2 Driving Factors for Green Building**

Darko et al. (2017) regarding the driving factors for green building stated that green building (GB) has been seen as a compelling intends to execute ecological, financial, and social supportability in the development business. For the selection of GB advancements green building technics (GBTs) to continue to succeed and pick up ubiquity, a superior comprehension of the key issues affecting its encouraging is crucial. While various reviews have inspected the issues impacting green developments reception in general, few have particularly done as such with regards to GBTs. They investigated the underpinnings of GBTs reception in the accompanying three areas: (1) the basic hindrances restraining the appropriation of GBTs, (2) major drivers for receiving GBTs, and (3) vital methodologies to advance GBTs selection. They stated that to accomplish these objectives, a poll overview was completed with 33 GB specialists from the United States. Ranking analysis was utilized to recognize the noteworthy issues related with GBTs appropriation. Imperviousness to change, a lack of information and mindfulness, and higher cost have been the most basic boundaries. They also stated that the major drivers for embracing GBTs are more prominent vitality and water-effectiveness, and organization picture and notoriety. The analysis comes about additionally show that the most essential systems to advance the reception of GBTs are financial and further market-based impetuses, accessibility of better data on cost and advantages of GBTs, and green naming and data dispersal. Their discoveries gave a profitable reference for industry experts and analysts to extend their comprehension of the significant issues that influence GB basic leadership, and for approach creators going for advancing the selection of GBTs in the construction industry to create reasonable arrangements and motivations. Their review added to extending the body of knowledge about the impacts that frustrate and those that cultivate GBTs usage.

According to Darko and Chan (2016) it was reported that the US is the most improved GB nation based on research. Since the rise of the GB idea in the mid-nineties (Kibert, 2012), the US has been dealing with GB improvement. Subsequently, the US has been proactive and has accomplished significant advance in GB. For instance, the LEED, created by the USGBC in 2000, is one of the generally utilized GB rating frameworks and has been instrumental in mainstreaming the improvement of GBs both in the US

and universally. As of now, there are around 75,000 tasks in the US and around the globe looking to achieve superior in key zones of ecological and human wellbeing by partaking in LEED rating frameworks, and 1.85 million square feet of building space gets LEED confirmations day by day (USGBC, 2016). Australia has additionally taken measures to advance GB improvement. For instance, the Australian government has propelled the Building Energy Efficiency Disclosure Act 2010, which sets compulsory necessities for enhancing the vitality proficiency of structures (Wilkinson, 2013). The discoveries of this review recommend that significant accentuation on manageability in development in the US and Australia has propelled GB drivers look into in those areas.

### **2.3 Green Building Councils and Rating Tools**

As indicated by a report by United Nations Habitat (2010) they expressed that a green building rating gadget is a settled parts used to rate and check the natural execution of a building. By remunerating model building execution, rating mechanical congregations gives an inspiration for the development of building, the proprietors are expects more by the state government institutions for laws improvements. The building proprietors are able to utilize some examinations which shows some methods for the structures which is blended with intrigued accessories, checking tenants, and money related specialists and people when all is said in done.

Furthermore, the United Nations Habitat (2010) expressed that the establishment of British Research that affects the imperative business for the rating of green building mechanical assemblies by the year 1990, this can be termed as the British Research Establishment Environmental Assessment Method (BREEAM). However, it was followed with what is termed as LEED, which some states later joined.

As stated by U.S. Green Building Council (2011) regarding green building councils and rating tools, they stated that the LEED rating instrument depends on U.S models. Any working on the planet can enroll for LEED accreditation utilizing the LEED rating tools. LEED gives building proprietors and administrators with a structure for recognizing and actualizing handy and quantifiable green building plan, development and operations that perceive ventures that actualize techniques for enhanced ecological and wellbeing execution. The LEED rating frameworks are produced through an open,

accord based process driven by LEED councils, different gatherings of volunteers speaking to a cross-area of the building and development industry.

The United Nations Habitat (2010) reported that the USGBC had some agreement based on (lawful and monetary) with a few GBC which utilizes LEED within the reach of their countries. By agreement the GBC's located in Canada along with India nations have permitted by rolling out improvements with LEED rating device to blend with some particular market framework, as a result of the early appropriation of the tools. Be that as it may LEED devices now rather have choices for "regionalization" where certain activities can be compensated distinctively as indicated by the area. The USGBC is thinking about modifying its LEED reception structure keeping in mind the end goal to take into account different nations to have some privilege to redo LEED. Wherever LEED is utilized, the USGBC will be responsible for the evaluation and affirmation of the ventures.

#### **2.4 Green Building Development in Libya**

Ali (2010) regarding the development of green building development in Libya reported that with the regards of the demand for green building has been observed to be high, it is not without its own difficulties. As stated, maintainable building development has risen which advocates for a harmony between nature and the economy. This development has picked up prominence inside the business as of late. Hypothetically, the development business in Libya has been in charge of an extensive extent of the social and monetary improvement inside the nation for more than six decades. In accordance with this statement, Libya has encountered a discernible ascent in development exercises. Shockingly, the nation faces different difficulties as far as its quick improvement and overdependence on exile gifted work. Resultantly, the Libyan development industry is unequipped for tending to the continually expanding requests for lodging in the present atmosphere. The components in charge of these troubles incorporate an absence of funds, poor development arrangements, poor administration and natural specialized difficulties.

## **CHAPTER 3**

### **THEORETICAL FRAMEWORK**

A detailed review of previously done studies in the domain of green building construction, momentum and related issues around the world has been done. First, the meaning and importance of green building in terms of sustainability is mentioned. Then an extensive search specifically focusing on barriers that affect green building development in various regions is also mentioned.

#### **3.1 Green Buildings Around the World**

The emphasis on green building is gaining more attention. In line with this, there are some factors that are synonymous with the building industry across the world. The following are the market statistics of green building.

##### **3.1.1 United States**

The United States of America is one of the countries that have majored in the green building market. Almost all construction projects in the United States use the metrics stipulated by green building. One of the major actors that have been responsible for the shift into green building in the United States is the advantages of green building in relation safety concerns associated with green building (Ashuri and Durmus (2010). The United States' Energy Information Administration (EIA) data reveals that buildings consume a significant volume of energy. It accounts for 42% of the energy uses in the United States. 23% is consumed in the residential premises while the commercial premises consume only 19%. Green building is the precursor to sustainable development both at the national and the international levels. The design of the buildings in an immediate environment affects the economy as well as the natural environment a great deal (World GBC, 2016).

For instance, Kahn et al. 2014 demonstrate that the premium for green-confirmed homes in California is upgraded by atmosphere related stuns. While fresher and amazing business structures may devour more vitality by and large than the current building stock, these structures are less touchy to climate stuns (Kahn et al., 2014).



**Figure 3.1:** The fortunate façade, Bank of America Tower (Pollak, 2004)

From Figure 3.1 in May 24, 2010 while designers over the globe are caught up with finishing outlines for the ultra-current green high rises in front of their circumstances, one specific elevated structure on New York's 42nd Street and Sixth Avenue has as of now wind up plainly one. Bank of America Tower has won the "platinum" affirmation from U.S. Green Building Council, the non-benefit gathering that advances ecologically well-disposed development and plan. Built by Cook and Fox Architects, the 54-story building finished in 2008 at a cost of \$2 billion won the green affirmation in light of its green qualifications. The tower utilizes ecologically well-disposed development materials, for this situation, 87 percent of it is raised utilizing reused material, and the solid arranged from 45 percent reused content — for this situation, impact heater slag. The building has its own 4.6-megawatt co-era plant, and its outsides wrapped with floor-to-roof windows that enhance characteristic lighting. The tower has its own particular water gathering framework other than wastewater reusing system set up. Not only that, the men's rooms even have waterless urinals and every one of these measures spare an expected 8 million to 9 million gallons of water for every year (Pollak, 2004).

### **3.1.2 Europe**

Constructions within Europe exhibit a broad range of diversity in their design. European constructors have embraced the concept of green building in various aspects and levels. This is an indication that culture can assert an impact on in the acceptance of green building technologies. It can be observed that, in general, green buildings have received a higher level of acceptance. Moreover, in the United Kingdom it has become a widely



embraced practice within the construction industry. As reported by, Wong and Fan (2013), the global building assessment scheme, the Building Research Establishment Environmental Assessment Method (BREEAM), was developed in 1990 and, since its inception, there has been growing interest in green building design in the UK.

The United Kingdom presents a large market for constructors. Therefore, those who satisfy the market expectations are more likely to be successful when bidding for construction contracts, and vice versa. Hence, it is generally accepted that experience in green building will improve the marketability of a firm in the construction industry in the United Kingdom. The greatest opportunities for green building lie in renovation projects. For instance, Dale Vince, CEO of the UK based energy organization Ecotricity, stated in his blog, 'I'm a Hippie, I maintain a business ... to convey change to the world'. Indeed, green business visionaries may often reject being considered entrepreneurial if this brings connotations of benefit expansion, realism and forceful conduct (Strauss, 2013). Nonetheless, the UK is attempting to augment its energy efficiency and natural execution of its building stock as a method of reducing greenhouse gas emissions. Green or eco-development is resultantly observed as a business opportunity, as well significant method of reducing harmful emissions. In the UK, buildings account for approximately 45% of carbon discharges and are consequently a key element of achieving the target of an 80% reduction in UK carbon emissions by 2050 (King, 2010).



**Figure 3.2:** Land Rover bar and BREEAM projects. Land Rover Bar (2014)

In this building, more than 400 sun oriented boards cover 100% of the accessible rooftop space, creating 130 Mwh/yr of energy, while normal ventilation is

accomplished through the focal chamber, which takes out the necessity for a mechanical ventilation framework. Common and low vitality (LED) lighting and water collecting have brought about a 25% change in water effectiveness over the current UK building control norms (Figure 3.2). Moreover, the building's imaginative texture wrap produces a warmth sparing air pad at around 4-5°C and controls the measure of daylight that enters the building, decreasing the measure of vitality utilized for cooling and in this way lessens the carbon emanations.

Construction firms based Germany has resorted to planning for green building mainly in the commercial industry and they use the provisions of green building even when renovating already existing buildings. The numerous benefits of green building methods have induced growth in many firms. Hence, many of these companies have seized the opportunity by marketing their green building skills to the public (Samer, 2013).



**Figure 3.3:** The net zero-energy house in Berlin Marienfelde UBA 2019: (Ascione et al., 2016)

As reported in a study by (Ascione et al., 2016) the building in Figure 3.3 was part of a project referred to as the new “net” zero energy building, designed predominantly to be used as office space for the German “Umweltbundesamt (UBA)”, (Federal Environment Agency), which was finished in 2013. The two-storey building, situated in the southern part of Berlin, has a unique design in The total annual energy demand is less than the on-site conversion from renewable energy. Monitoring of the efficiency of the project revealed that the following measurements for electric usage in various

areas. The construction was designed to be completely “green” and thereby the extremely low energy demand is complemented with energy converted from on-site renewable energy sources, which were predominantly achieved through the implementation of Solar systems for the production of local hot water and incorporation into heating systems, photovoltaic solar energy conversion to electricity, as well as the use of low thermal energy on the foundation of groundwater as a source of heat for heat drive and cooling purposes.

Norway is renowned for its green building development (Pinera & Reed, 2014). Many of its institutional and commercial premises have been constructed using green building recommendations. Both the private and public sectors have been increasingly targeted for green building (Morton et al., 2016). For example, the UN House (Figure 2.4) is a energy effective, carbon impartial building that sources sustainable power source from a sun oriented water warming framework and geothermal vitality from the ocean.



**Figure 3.4:** UN, House Norway: sustainability case studies. (Skanska, n. d.)

Sustainable development is one of the major concerns of the French society. Many agencies and authorities have made sustainable development an important factor in strategic decision making. They have taken a number of initiatives to promote a greener society. From these measures, it is evident that the French society understands the value of sustainable development through green activities that preserve the environment as well as natural resources. The evidence of this lay in its environmental protection measures that grace every project (CSTB, 2008).



**Figure 3.5:** Bouygues Immobilier inaugurates the largest positive tertiary building in France (Construction21, 2009)

The green building in Figure 3.5 is situated in the heart of a blended improvement zone in Rueil-Malmaison, west of Paris, and was outlined by the designer Jean-Michel Wilmotte. The Green Office Rueil is a positive vitality building and boasts a bioclimatic plan. Doling out need to common light and ventilation, it decreases the measure of vitality devoured by its inhabitants, while at the same time enhancing their prosperity. Highlights incorporate a focal vitality control framework that offers programmed administration of lighting, warming, blinds and cooling, while at the same time enabling clients to control their own particular condition, ceaseless data about the building's vitality utilization and generation, and in addition 4,000 m<sup>2</sup> of photovoltaic boards creating sustainable power source.

### **3.1.3 Middle East**

The United Arab Emirates is home to a number of firms that understand the value of being green. Many of them have adopted green strategies to conserve the environment. Many of them are increasingly shifting towards green building. The influence of green building technologies in the United Arab Emirates' firms cannot be overlooked. Green construction is transforming into a marketing tool for construction firms. Hence, the construction companies that are establishing a reputation of being reliable and green can reap the benefits of winning more contracts and receiving government endorsement. Consequently, it is pertinent to provide awareness to the public through seminars and training to ensure that stakeholders comprehend the value of being green. (Francesco & Levy, 2008).





**Figure 3.6:** Siemens Headquarters, Abu Dhabi (Laylin, 2014)

Siemens Headquarters (Figure 2.6), Abu Dhabi initiated its "grandstand" Middle East base camp in Masdar City, which is Abu Dhabi's first LEED Platinum building. The building possesses 18,000 square meters and diminishes vitality utilization by very nearly half contrasted with ordinary structures of a similar size. Opened in Q1 2014 and houses 800 workers. In light of the gigantic open doors in the locale for providers of vitality sparing and green items, including lighting, kitchen and lavatory fittings and common stone fittings, GCC governments have greatly intensified their support towards greener construction.

A 2014 report by Ventures Middle East authorized by The Big 5 development show in Dubai said that "Green structures saw a moderate take off in the GCC," however governments have acted quickly in the previous three years to grasp manageability through instruction and enactment. Designers have additionally perceived that structures need to exhibit manageability to be attractive. In the UAE, through associations, for example, Estidama in Abu Dhabi and Dubai Electricity and water Authority (Dewa) in Dubai, the nation has revealed the motivation to enhance vitality productivity in the development part.

The Egyptian government has been striving to improve the status of green building in the country. It has also remained conscious of the domestic emission of green-house gases such as carbon dioxide and has persevered to minimize the level of such emissions. The impetus behind these strategies is the knowledge that population growth

in Egypt is forecasted to place higher demands on almost all sectors of the economy. All these demands could potentially impact the environment's ability to sustain the natural ecosystem and, consequently, the growth of the Egyptian economy in the long run (EGBC, 2016).



**Figure 3.7:** Egypt's first solar-powered village rises from the desert in Bahariya Oasis (Cooke, 2016)

Egypt's first solar-power town emerged from the desert. Situated in Bahariya Oasis and powered by building-coordinated solar panels, KarmBuild's Tayebat Workers Village as currently provides accommodation to 350 individuals. KarmBuild says it is "the main organization in Egypt to incorporate solar technology into building plans", and its utilization of the environment and locally sourced materials guarantees a sensitive ecological and environmental footprint (Figure 3.7).

KarmBuild installs solar panels on the roofs of the buildings, and the solar power enables these buildings to function without the traditional dependence on fossil fuels. The rooftop solar panels additionally act as "thermal roof protection". KarmBuild's construction incorporates power generation that is ecofriendly as well as reasonable development strategies; for example, it uses energy-decreasing techniques and 90% of the materials it uses in construction are local sourced. In the locale where the Tayebat Workers Village is found, sandstone is regularly quarried with the end goal of developing buildings. Moreover, KarmBuild understood that the sandstone could be incorporated in the construction of buildings rather than being wasted, while the

utilization of the natural local sandstone also enhances the aesthetics of the buildings through coordination with the surrounding desert landscape.

Turkey's initially green building contextual investigation was directed at Middle East Technical University in 1975. The specimen house utilized as a part of this review joined an assortment of sun powered innovations, for example, coordinate warmed ventilation air, sunlight based level plate gatherers, photograph voltaic cells and aloof sun oriented warming frameworks (Korkmaz et al., 2009).

From multiple perspectives, green building in Turkey is not universally practiced. However, although it was previously a relatively unknown concept, now real business development promotes attention to environmental issues, or designs premised on feasible standards. Consequently, shopping centers and large office developments are engaging in green retrofit processes. For the eco-conscious visitor, the Turkish Ministry of Culture and Tourism has designed lodgings and resorts through its Green Star program, in order to promote green building measures. These current developments, although restricted in nature, signal the integration of green building practices into Turkey's standard building industry. The Turkish Green Building Association was developed to become the Green Building Council (GBC) in October 2007 (Erten et al., 2009).



**Figure 3.8:** Kanyon, Istanbul, Turkey (Kanyon, 2012)

In 2006 the Turkish-owned Kanyon Mall, engineered by a company that specializes in advanced green engineering (the project engineers were the London based firm ARUP), won an award from the Cityscape Architectural review Erten et al. (2009). Kanyon also

won the BREEAM In-Use Award in 2013 and the BREEAM Retail In-Use Award in 2016. This facility saves 11% energy consumption cost annually and also reduces water consumption and waste.

In this project, the solar panel system provides 10% of the space heating water demand while 35% of the hot water demand is met. Furthermore, the lighting system uses LEDs, while the rainwater and grey water are collected for use in public toilets and for irrigation purposes. There is a collection point for glass, paper and recyclable materials, along with a waste management system purely for food and electronic waste (Ilter & Ilter, 2011).

### **3.1.4 Africa**

South Africa is one of the latest countries that has shifted its focus towards green building. In the future, it is expected that more South African firms will adapt to the use of green building concepts in their operations. In general, the commercial market is likely to adopt more green measures through retro-fit and new projects. The firms also remain conscious of the fact that they have to engage with the government while making major decisions to expand the green construction market (Marker et al., 2014).



**Figure 3.9:** Living roofs at Forum Homini at the Cradle of Humankind (Gunnell et al., 2009)

In South Africa, cases of green rooftops incorporate the housetop tree outline of the stopping range at Nelson Mandela Square in Sandton, the Grace Hotel in Rosebank, House Westcliff, the library of Stellenbosch University, and Forum Homini at the



Cradle of Humankind (Figure 3.9). The main advantages of this type of roof is that it reduces heat through the addition of mass and thermal resistance values by using evaporative cooling to cool the loads on the building. It likewise diminishes storm-water overflow, sift toxins and carbon dioxide through of the air, and expands natural life environments in developed ranges, among different focal points. As per Gunnell et al. (2009) if 8% of material in a city is green, then the surrounding temperature in that city can be decreased by up to 2 degrees. That fundamentally decreases the impacts of an unnatural weather change and urban "warmth islands".

### **3.1.5 Asia**

An extent of the ranking with regards to green building structures, traditions, standards and gages which was duly provided since the past twenty years and almost 600 strategies for the presently existed assessment (Global B. R. E, 2011). However, in Singapore is the Green Mark (GM), with the Building Environmental Assessment Method (HK-BEAM) in the Hong Kong, while Green Building Labeling arrangement (GBL) in China and the Sweden respectively. A honest to goodness wander in Chongqing was picked which had happened to be the topped ranked with both GM and GBL. However, the factors had been the options for this wander which are proposed to get to achieve the strangest sum with the standards used by broad number of green headways. This utilization of broad assortment of headways had taken out subjective bumbles of potential scoring qualification in view of the lacking extent of green advances information. The wander is a gathering of multi-private structures which is a work in progress until 2017. Figure 3.10 exhibits the green components of the wander and the advancement location. The grouping of green headways were referred to the wander which had outpaced the GM pre-assessment dated in the year 2014 with the GBL setup arrange evaluation dated 2015.



**Figure 3.10:** Main Green features of the project and the construction site in August 2015 (Li et al., 2016)

### 3.2 Common Barriers Involve in Green Development

Trianni et al. (2016) reported that barriers to implementing Environmental Management Systems (EMS) incorporate wrong learning and strategies of usage, shortage of data, a negative hierarchical culture, and the absence of viable administration of monetary assets. These barriers are also common in the implementation of green buildings at higher education institutes. According to Bond (2011) issues experienced with a portion of the activities of actualizing backing for green working, specifically, the defective establishment of protection that brought about death toll which causes a detachment or substitution of Green Loans and Green Start programs which were shut, in February 2011. As expressed by Marker et al. (2014) the most significant obstructions to the selection of green building practices is Return on Investment (ROI) and professionals address these hindrances through cautious arranging and thoughtfulness regarding usage strategies that can diminish the trouble variable, for example, giving data, showing building systems, giving preparing on especially troublesome building techniques, or making arrangements of assets and other employment helps as proper. Government parts especially propelling instruments, for instance, essential sparks, endowment and discount program, force stimulus plan, impose motivation conspire, willful rating framework and market and innovation help are the basic drives for evacuating obstructions to green building change (Milad et al., 2013). Number of

barriers can affect the green building development; the most common barriers investigated by researches in this domain are shown in Appendix B.

### **3.2.1 High cost**

Chau et al. (2010) stated that the green building has been urgent for creating natural maintainability, being in charge of mass interests in new wellsprings of sustainable power sources, which go for elevating the movement to advances for sustainable power sources, for example, sunlight based cells, utilized for common development; and it is likewise bringing on a huge change in the ideas of configuration undertakings, obtaining and administration, gone for decreasing the effect on the earth brought about by building construction.

Choi (2009) summarize that one reason speculators abstain from putting resources into green office structures is the high beginning expense of development. He additionally clarified that the high cost is because of the learning hole in green advancement measurement and the absence of correspondence.

Milad et al. (2013) investigated the level of creating green working in Malaysia to discover essential key players and to distinguish the vital snags to green building improvement. A sum of 673 arrangements of survey were conveyed and 167 (24.81%) polls were gotten. In this review, the primary boundaries found can be recorded as: absence of credit assets to conceal front cost, danger of venture, absence of interest and in addition higher last cost.

Queena et al. (2015) developed a typology and order to inspect the new exercises that are related with exchange costs (TCs) in the land improvement prepare (REDP) of green building. Through inside and out meetings with delegates from the real designers in Hong Kong who have encounters, they found that the venture chiefs not just need to seek after general cost administration while winning more business, yet they additionally need to give careful consideration to maintainability so as to limit concealed societal expenses.

### **3.2.2 Government**

Adan et al. (2002) cites government obstructions as; unseemly structure of government (vertical), frail linkages among the approaches of metro and senior levels of government and feeble correspondence linkages amongst government and its constituents.

Samari et al. (2013) stated that the government is the key player as far as advancing green working in the development business. Governments can influence the development business utilizing an assortment of instruments. Administrative and motivation instruments are the foremost apparatuses utilized by governments to create green building practices.

Ashuri and Durmus (2010) stated that the advantages of making new green development will miss the mark concerning objectives and could be invalidated totally by the proceeded with abundance of existing structures in the event that they are not retrofitted utilizing green building techniques and practices. Notwithstanding developing natural worries from one perspective, and monetary motivations and support offered by government and other organization to engineers, financial specialists and private proprietors on the other, these same people and partnerships are reluctant to grasp green building.

Kong et al. (2012) give confirm that there is insufficient government support to quicken green building development as far as strategy usage and motivations. Be that as it may, despite the fact that absence of government support is appeared as deterrent to advancement of green structures.

### **3.2.3 Lack of knowledge**

Bond (2011) used data from Australia and New Zealand to find that the principle hindrances to the selection of green building rehearses in family units are introductory expenses of economical components and absence of data about the advantages and investment funds of joining vitality productive gadgets.

Shafii and Othman (2005), pointed out that there are numerous hindrances to creating reasonable advancement in Asia, for example, Lack of mindfulness (individuals), Lack of preparing and instruction about manageable plan, higher cost, unique materials, tenets and control, absence of exhibition, absence of innovation and absence of interest.

Ikediashi et al. (2012) determined that the principle hindrances to reasonable offices administration/green working in just about 60 Nigerian organizations incorporate absence of preparing and instruments, absence of pertinent laws and control, and absence of mindfulness. They found that top management must play a key role in promoting sustainable construction.

### **3.2.4 Barriers to green building from investors**

Williams and Dair (2007) analyzed five contextual investigations of private and blended utilize structures in the UK to decide the hindrances to green building. Four of the contextual analyses were arbitrarily chosen and the rest of the contextual analysis was decided for its "manageability accreditations" keeping in mind the end goal to think about the procedures of an effective green working with those of regular structures. Utilizing semi-organized meetings with partners and arranging reports, the creators utilized a systematic structure of supportability targets including ecological, monetary and social objectives as an agenda to look at the contextual analyses. Twelve hindrances were recognized to meeting the supportability goals. The most normally recorded boundary was that the partners did not consider the supportability measure. The other normally recorded obstructions incorporated an absence of customer request, controls, cost (or accepted cost), accessibility or exchanging one supportability measure for another.

Williams and Dair (2007) recommended in their review on hindrances to economical building that the most generally discovered issues were maintainability measures not being considered by partners. Marker et al. (2014) found that over half of hindrances to green building are identified with the impression of troublesome move or low rate of profitability.

Lutzkendoft and Lorenz (2005) argued that the parts of interest and supply concerning green structures are missing as the applicable drivers are still at the creating stage. Likewise required are further reviews concentrating on the distinguishing proof of components that can improve the nature of green structures. Speculators and engineers are reluctant about putting resources into green structures as the plausibility of adequate budgetary returns is still in uncertainty but then to be demonstrated generally by the valuation calling.

### **2.2.5 Other factors**

Hoffman and Henn (2008) recommended that social and mental hindrances at individual, hierarchical and institutional levels are in charge of moderate advancements in the outline and development field.

Samari et al. (2013) extensively inspected the expenses and advantages of green structures for the condition of California in the United State. As per them, the normal cost premium over simply working to code is under 2%. Samari et al. (2013) detailed that "insignificant increments in forthright expenses of around 2% to bolster green outline would, by and large, result in life cycle reserve funds of 20% of aggregate development costs more than ten times the underlying speculation".

Griffin et al. (2011) discovered what confines the capacity of building outline and development experts to utilize ecologically dependable materials in the auxiliary frameworks of structures. The scientists talked with building plan experts in Oregon with experience fusing auxiliary materials that are more naturally dependable than the materials utilized as a part of customary practice.

The examination recognized holes in data and also holes in access to or accessibility of manageable materials for basic utilize that will empower material makers to viably comprehend the necessities of originators who are in charge of green material determination, and additionally to distinguish future research openings identified with the advancement and assessment of green basic materials.

## **CHAPTER 4**

### **MATERIAL AND METHODS**

As the aim of this study is to find out the core reasons of why green building development is not demanded in Libya. In this study, surveys instrument was utilized to get the impression of the experts and architects inside the Libyan development industry. This section covers the details of research technique and methodologies used by explaining how data is obtained and analyzed.

#### **4.1 Research Model**

The thesis aims to analyze the factors that hinders the sustainable growth of green building in Libya at the time of conducting this study.

With regards to the aim, the research data used in this study was collected using a questionnaire survey which was collected from professionals and engineers working in different Libyan construction companies.

The questionnaire designed for this research was based on the literature covered in the previous section. The purpose of performing this detailed review is to determine the barriers that have been identified in previous studies. All observed barriers are grouped as follows: lack of knowledge, high cost, political issues, unavailability of required resources, unskilled engineers, and lack of communication, etc. The table in Appendix B shows the sources (references) and the barriers used in this study, based on previous research.

#### **4.2 Participants**

In case of this study, 20 construction companies were selected for data collection. The survey was conducted between September 2016 and December 2016 from these 20 Libyan companies.

**Table 4.1:** Participants demographic data in total (N = 20)

Characteristics	Frequency	Percentage
<i>Gender:</i>		
Male	17	85%
Female	3	15%
<i>Age:</i>		
20 – 30	9	45%
30 to 50	9	45%
50 or above	2	10%

#### 4.3 Data Collection Tools

The proposed questionnaire is categorized into three main sections namely, the demographical information, companies background and barrier analysis. The demographical information section was used for statistical analysis by categorizing gender and age. five items were assigned to the demographical information section, while three items were assigned to company's background and three items for the barrier analysis making a sum of eleven things on the whole. The hindrance examination segment have some sub-areas which was utilized as a part of noting the exploration inquiries of the parts of partners in green working in Libya, supportable improvement objectives in Libya and the components of absence of green building advancement in Libya. The members addressed these things on the size of five Likert going from "Basic" (5 point), "Significant" (4 point), "Direct" (3 point), "Impartial" (2 point), and "Minor" (1 point).

#### 4.4 Data Analysis

For the data analysis, first a normal frequency distribution and percentage analysis method has been done to evaluate respondent's personal data which includes their demographic details (age, gender), their profession and their years of experience in the field of construction. Later a statistical hypothesis test has been done to analyze



respondent's feedback based on Likert Scale of critical, major, moderate, neutral or minor regarding the each question. The most adopted statistical tool IBM SPSS version 20 is used to perform these analysis. Our analysis consists on following three phases:

1. Respondents' profile or background
2. Respondents' education level of green building
3. Development barriers of green building

Furthermore, independent sample t-test was utilized to decide the most reason influencing green building in light of sexual orientation contrasts in Libya in this review. Ultimately, measurable devices, for example, rate, mean, standard deviation and recurrence were utilized to depict the review discoveries.

Finally, to maintain a strategic distance from over speculation the review concentrated essentially on the components that effect the sustainable growth of green building `within construction companies such as AlSahem, RooMooz, and Al-faisal situated in Libya only.

#### **4.5 Research Questions**

The study investigates the core reasons of lack of green building development, in Libya and led to answer the following questions:

1. Which reason is the most affecting green building development, in Libya?
2. Which of the following stakeholders' have the greatest decision power (directly/indirectly) to influence on specifications for prospective green building development, in Libya?
3. What initiatives assist in incorporating sustainable goals into projects the most?
4. Which Reason is the Most Affecting Green Building Development Based on Gender Differences, in Libya?

#### **4.6 Questionnaire Layout**

The questionnaire contained three sections. The initial segment of the survey was identified with inquiries concerning the respondents' experience. The second part was intended to assess respondents' learning with respect to obstructions in green working in Libya. The Likert scale is utilized to demonstrate respondents' conclusion. The scale incorporated the reactions, Critical Reason, Major Reason, Moderate, Neutral or Minor.

The last and last some portion of the poll was made out of two open-ended inquiries where the respondents were free to share their own opinion. The questionnaire can be found in Appendix A at the end of thesis.

## CHAPTER 5

### RESULTS

This chapter presents the results and discussion of the questionnaires. To address the aim of this research and also answer the research questions, data obtained from the questionnaires are analyzed and their results explained. The researcher makes comments on the findings to clarify them in details.

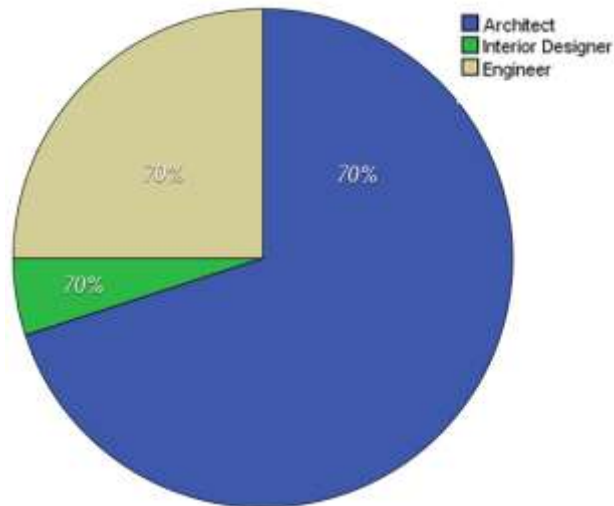
#### 5.1 Demographic Information

As shows in Table 5.1 below 17 out of 20 respondents were male and the 3 were female. Female can hardly be found working in construction companies, in Libya, thus the 85% ratio of survey respondents were male and the rest 15% were female. According to the frequency analysis most of the respondent was between 20 to 30 years of age, while 45% were between 30 to 50 years of age and the remaining 10% were older than 50.

**Table 5.1:** Respondents' Demographic Information (*n*)

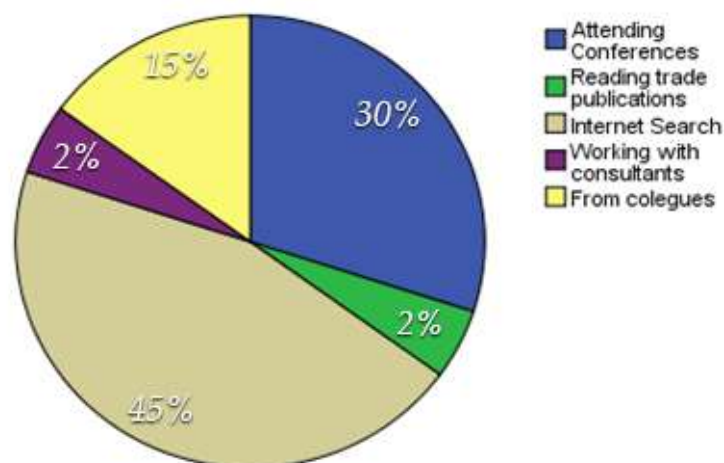
	Frequency	Percentage
<i>Gender</i>		
Male	17	85%
Female	3	15%
<i>Age</i>		
20 – 30	9	45%
30 to 50	9	45%
50 or above	2	10%

The figure 5.11 below shows the range of respondents' profession. According to the figure 1, by profession 70% of the respondents were architects, while 25% were engineer and the rest 5% were interior designers by profession.



**Figure 5.11:** Respondents' Profession

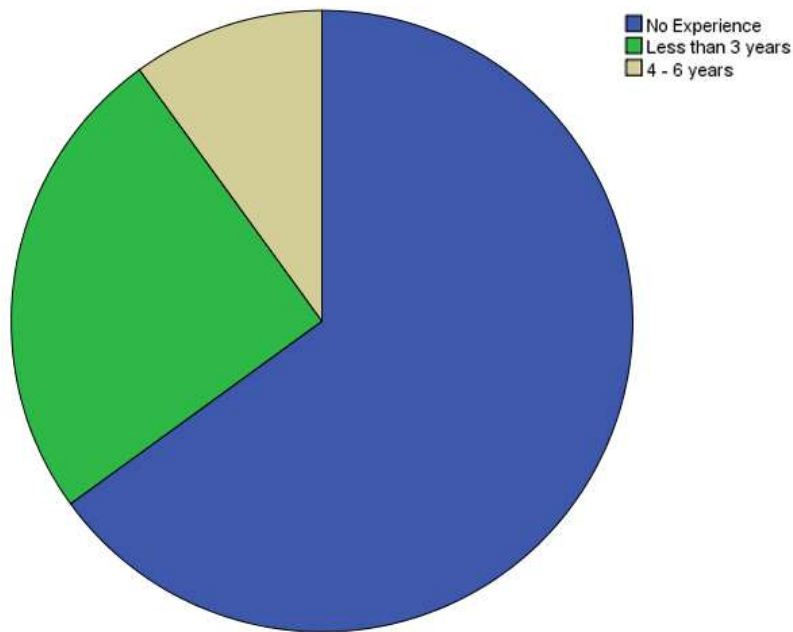
The figure 5.12 illustrates the most common ways respondent came to know about green development building. The higher ratio around 45% of respondents marked internet search as a most common source of learning. Attending conference has the second highest ratio of 30% as a second most common source of learning about green building. 15% respondents' claims that they learned about green building development from their colleagues while knowledge sharing. While the rest 2% affirmed that they either learned from publication and newsletters or working with consultants.



**Figure 5.12:** Respondents' Green building Awareness

**Table 5.2:** Respondents' Years of Experience in Construction Sector ( $n = 20$ )

Year of experience	Frequency	Percent
No Experience	13	65.0%
Less than 3	5	25.0%
4 - 6	2	10.0%



**Figure 5.13:** Respondents' Experience

The Table 5.2 and figure 5.13 presents the level of experience each responded has in their field of specialization in construction.

**Table 5.3:** Green Building Training ( $n = 20$ )

Response	Frequency	Percent
No	20	100.0
Yes	-	0

The Table 5.3 consists on the very important factor our study. This defines the level of green development skills among Libyan construction industry. All the respondents replied with having 'NO' (100%) training related to green building development.

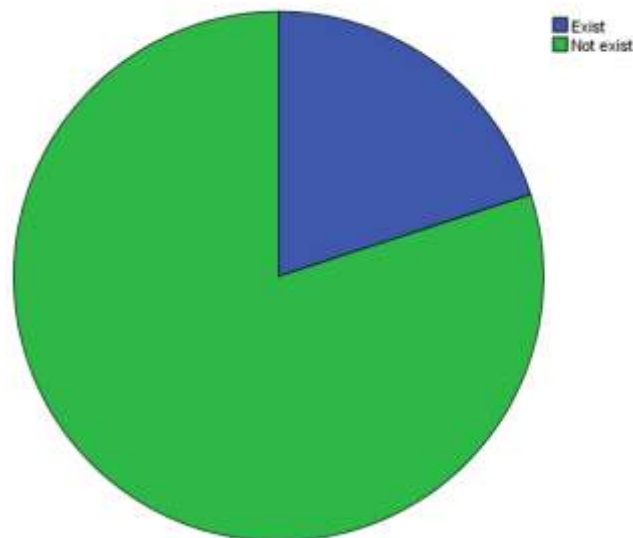
## 5.2 Company's Background

As shown in the Table 5.4 below only 4 (20%) of the respondents' companies had green building projects currently. On the other hand, rest of the 16 (80%) refused about having any green building project in their company.

**Table 5.4:** Green Building Projects

Response	N	Percent
Yes	4	20.0%
No	16	80.0%
Total	20	100.0%

The Figure 5.14 clearly illustrates the number of existing green building projects in Libyan construction companies. This implies that only 20 percent green building project exist while the remaining 80 percent green building projects does not exist.



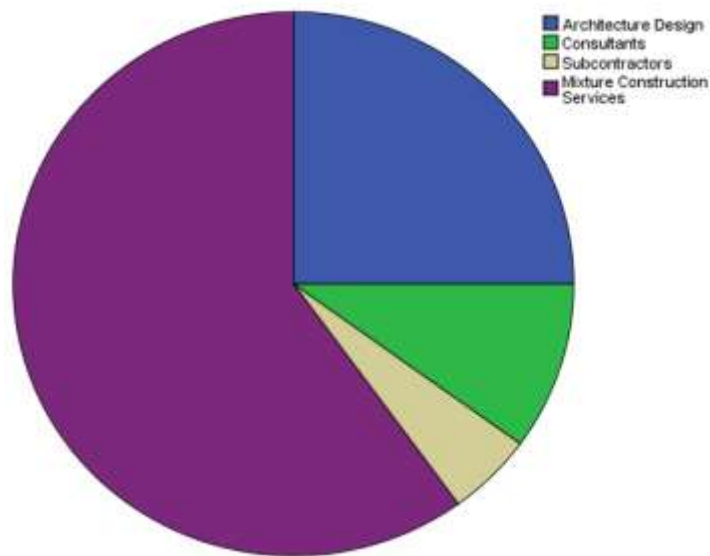
**Figure 5.14:** Current Green Building Projects in Companies

Moreover, in regards to know company's profile we also got to know the nature or main scope of the company in construction sector. Thus, the table below presents the frequency and percentage of major scope of companies.

**Table 5.5:** Main Scope of Companies

Companies scope	Frequency	Percent
Architectures	6	30.0%
Consultants	2	10.0%
Subcontractors	1	5.0%
Mixture Construction Services	11	55.0%

The Table 5.5 above shows that 6 (30%) of companies' main scope was architecture, 2 (10%) affirmed to be specialized as consultants, only 1 (5%) were involve as subcontractors, while the rest 11 (55%) has mixture of all construction services. The Figure 5.15 below clearly illustrates these figures in terms of main scope of respondents' construction companies, in Libya.



**Figure 5.15:** Company's Main Scope

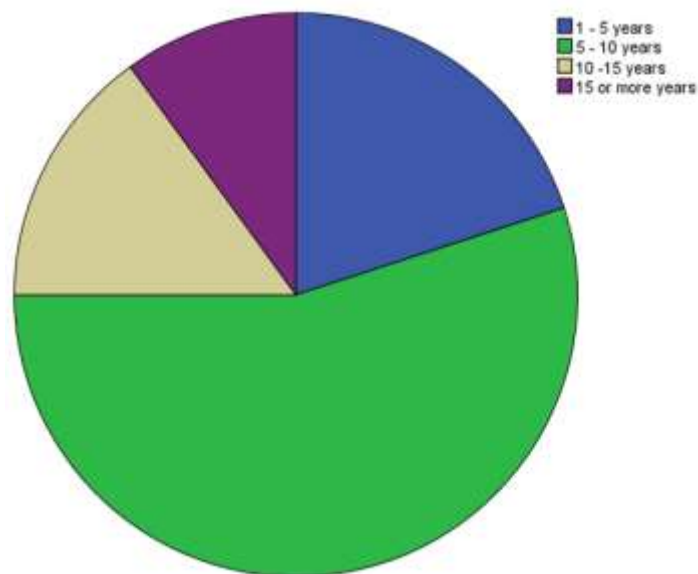
Companies' year of experience in construction sector is another essential factor to be considered while reviewing company's background. Thus, the Table 5.6 below consists on the figures 16 presenting companies' experience in this sector. Hence, as shown 4 (20%) had 1-5 years of experience, 11(55%) of them had between 5 – 10 years of

experience, while 3(15%) affirmed to have 10 – 15 years of experience. However, the rest 2 (10%) confirmed to have more than 15 years of experience in construction sector.

**Table 5.6:** Companies' Number of Experience in Construction Sector

No of Experience	Frequency	Percent
1 – 5	4	20.0%
5 – 10	11	55.0%
10 -15	3	15.0%
15 or more	2	10.0%
Total	20	100.0%

The figure 5.16 below clearly demonstrates the number of experience of respondents' companies in construction sector.



**Figure 5.16:** Companies' Number of Experience in the construction Industry, in Libya

### 5.3 Barriers Analysis

As the main purpose of this study is to evaluate the main causes, factors and influencers they lack the green building development. Thus, in this section, each factor is analyzed individually.



### 5.3.1 Role of stakeholders' in the green building, in Libya

The study shows that the stakeholders have either direct or indirect influence on each entity such as firms, project or individuals. In addition, other industries also have a significant impact on construction industries.

According to the Table 5.7, the results indicates that 'government' is the most influential stakeholder with a respondent scores of 45% critical and 35% major.

**Table 5.7:** Investor's Influence (n = 20)

	<b>Critical</b>	<b>Major</b>	<b>Moderate</b>	<b>Neutral</b>	<b>Minor</b>
Government	45%	35%	10%	10%	-
Client	40%	20%	5%	20%	15%
Architect	25%	45%	20%	5%	5%
Education	20%	35%	30%	10%	5%
Units (Universities...)					
Engineering	15%	25%	20%	20%	20%
(Civil, mechanical...)					
Non-Governmental	5%	25%	15%	20%	35%
Organizations					

The second most critical influencer was 'client' as marked by 40% respondents, 20% respondents marked it as major influencer. The third highest ratio for critical stakeholders' was architects as rated by 25% respondents. The ratio of 45% respondents also stated architect as the major influencer. 20% respondents marked education units as critical 35% influencer, while 30% of 20 respondents said that educational units have moderate impact on construction industry. Then 20% respondents marked the Engineering as moderate, neutral and minor influencer. In addition, respondents agreed that non-governmental firms (NGOs) have no influence on construction industry at all. Thus, government considered as critical stakeholder with highest influence, clients were second in critical ranking, and architects were on third. Accordingly, the case of major stakeholders, the scenario was vice versa. According to respondents Architects has the major role in construction domain while the government and education units has equally major role as well.

### 5.3.2 Sustainable development goals

The intention and willingness of sustainable development indicates the interest and efforts level of construction industry towards sustainable goal.

**Table 5.8:** Sustainable Goals ( $n = 20$ )

	<b>Critical</b>	<b>Major</b>	<b>Moderate</b>	<b>Neutral</b>	<b>Minor</b>
Educational programs	45%	15%	25%	10%	5%
Government policy	45%	40%	5%	10%	-
Increased awareness of benefits	45%	30%	20%	5%	-
Economic incentives (tax credits, utility rebates, etc.)	40%	25%	20%	15%	-
Greater availability of green materials	35%	35%	10%	15%	5%

If the sustainable development is not part of their business objectives, it shows one of the barriers that lack green development. The Table 5.8 above contains the respondents' feedback regarding green building goals. According to 45% of 20 respondents agreed that there is greater need of availability of green materials in Libyan construction industry. 35% respondents also marked green materials availability as major goal. The rest mark it as moderate but there was no any minor marking for this goal.

The similar ratio of respondents 45% claims that there is higher need of educational programs as well as government policy that can help in creating sustainable development awareness and produce skillful individuals (architects/engineers). Three respondents also chose educational program goal as major factor. 40% out of 20 respondents' mentioned economic incentives such as taxes, utility rebates and other incentives as critical goal. 25% out 20 respondents marked economic incentive as major factor as well while the rest chose it as moderate factor. However, no any single respondent marked it as minor goal. While 30% of them marked it as major factor and rest as non-important goal.

Awareness regarding benefit of green development needs to be creating in construction industry not just at professional level but at educational and government level as well and it was stated as critical goal by 45% respondents.

### 5.3.3 Reasons of lack of green building development

Despite the fact that the advantages of green buildings and exacerbating natural conditions are known by the development segment, there are still hindrances to selection of green building advances and frameworks.

**Table 5.9:** Reasons of lack of Green Building Development ( $n = 20$ ), in Libya

	<b>Critical</b>	<b>Major</b>	<b>Moderate</b>	<b>Neutral</b>	<b>Minor</b>
Lack of Knowledge	45%	30%	10%	10%	5%
Lack of training / education in sustainable design / construction in architectural and engineering schools	35%	35%	10%	20%	-
Lack of Skillful construction engineers	30%	30%	25%	10%	5%
Lack of infrastructure construction	30%	15%	40%	10%	-
Lack of technical understanding of "green" technology	30%	50%	20%	-	-
Lack of Skillful construction engineers	30%	30%	25%	10%	5%
Lack of communication between contractor, subcontractors, suppliers, manufacturers	25%	30%	40%	-	5%
Lack of interest of Construction Industry	25%	35%	15%	10%	15%
Political Issues	20%	20%	15%	25%	20%
Unavailability of sustainable resources	20%	30%	25%	10%	15%

High Cost	15%	30%	40%	10%	5%
Complicated design then traditional one	10%	15%	10%	45%	20%
Difficulty in maintenance	5%	20%	25%	20%	30%

In this study, the deterrents of green building are investigated in wording of individual to organizational factors. The Table 5.9 above consists on the respondent's feedback regarding the reasons or causes of lack of green building development in Libya. The all mentioned reasons or barriers were taken based on previous synthesis in this domain.

#### **5.3.3.1 Lack of knowledge**

According to the analysis lack of knowledge was marked as the most critical reason by 45% respondents. Two respondents marked it as moderate barrier while rest marked as neutral and minor.

#### **5.3.3.2 Lack of training / education in sustainable design**

Training or education is a continuous need of any organization to equip their employees or firm updated in their field or domain. Thus, the training is also important in construction industry especially for green development. In the research survey 35% respondents marked lack of training as critical reason. The similar ratio of respondents (35%) said it's a major reason. 10% respondents said it has moderate impact while only 20% said lack of training is not an important factor.

#### **5.3.3.3 Lack of Skillful construction engineers**

Skillful construction engineers plays essential role in the success of construction industry. The lack of these engineers can also be reason of lack of sustainable development. According to the data collected in this regard, 30% of respondents marked it as critical barrier and the similar number of respondents 30% marked it as major factor while 25% choose it as moderate factor. 25% said it neutral matters and only 5% of them said it has minor affect in the lack of development of green building.

#### **5.3.3.4 Lack of infrastructure construction**

If the Infrastructure of construction is effective and well formed, the industry will definitely succeed. Hence, the feedback from respondents in this regard were quiet

controversial. 30% out of 20 respondents stated that lack of infrastructure can be a critical factor, while 15% of them mentioned it as major reason. 40% respondents marked it as moderate factor, 10% marked as somewhat whereas there was no feedback received marking this factor as minor.

#### **5.3.3.5 Lack of technical understanding of "green" technology**

Technical understanding or expertise of green technology can bring more chances to develop green buildings. Thus, lack of technical understanding comes out as major reason in Libyan construction. 30% respondents marked this factor as critical and 50% of them said it's a major cause of lack of green development. However, only 20% respondents said it's a moderate factor.

#### **5.3.3.6 Lack of communication**

An effective communication considered as the backbone of any successful industry, firm, or an individual project. In construction sector lack of communication among contractors, suppliers, manufacturers and engineers can cause a huge loss which has 25% as critical, 30% major impact, 5% minor and the highest with 40% moderate indicates that lack of communication has a moderate impact in green building projects.

#### **5.3.3.7 Lack of interest of Construction Industry**

Regarding the lack of interest of construction industry in green development 25% respondents marked it as critical reason, while 35% marked it as major factor. 15% respondents choose it as moderate factor, 10% as neutral and 15% as minor.

#### **5.3.3.8 Political Issues**

Political issues were rated as critical by 20% respondents. Also similar number of respondents 20% marked political issues as major factor. 25% of remaining respondents were not sure either this is one of the barrier or not. While 15% marked it as moderate barriers and the rest 15% marked it as minor barrier.

#### **5.3.3.9 Unavailability of sustainable resources**

Unavailability of sustainable resources is also a one of important barriers. The feedbacks regarding this factor was as follows: 20% out of 20 respondent marked this

factor as critical, 30% of them marked it as major, while 25% marked it as moderate and the rest 25% said it either matters or not at all.

#### **5.3.3.10 High Cost**

According to the respondents high cost is not the main reason, as green development rather reduces the cost. Thus, only 15% out of 20 respondents considered high cost as critical factor, while 30% of them said it's a major factor. 40% respondents claimed high cost a moderate factor and the remaining 10% did not consider high cost as effective factor. Only 5% respondent chooses high cost as minor factor.

#### **5.3.3.11 Complicated design then traditional one**

According to two respondents complicated design of green development is one of the reasons of lack of green building. 15% of them sated it as major reason, while 10% marked it as moderate factor. The higher ratio of 45% respondents said complicated design can either be or not be an issue. Only 20% respondents said complicated design does not make any different to not go for green development.

#### **5.3.3.12 Difficulty in maintenance**

Maintenance difficulty was not considered an issue as responded by 30% respondents, 20% of them don't consider it as major issue while 25% marked it as moderate issue. However, 20% said it's a major issue and only 5% mentioned it as critical factor.

### **5.4 The most Reason Affecting the Development of Green Buildings, in Libya**

To fully understand the reasons that mostly affects green building development in Libya, an illustrative investigation was completed. The accompanying table exhibits the, mean and standard deviation of each got build, the outcome acquired of the vast majority of the develop was normal because of the way of mean, which was inside 3.0. The Table 5.10 beneath depicts the obtained study statistical result of standard deviation with the mean. However, the gathered analysis was depended on a scale type of Likert 5-point.

**Table 5.10:** Factors for the most affecting green building development

<b>Factors</b>	<b>Mean</b>	<b>SD</b>
1. Lack of knowledge	4.00	1.21
2. Lack of interest of construction industry	3.45	1.39
3. Political issues	3.00	1.41
4. High cost	3.40	1.04
5. Unavailability of sustainability resources	3.30	1.34
6. Lack of skillful construction engineers	3.70	1.17
7. Lack of infrastructure construction	3.68	1.05
8. Lack of training/education in sustainable design /construction in architectural and engineering schools?	3.85	1.13
9. Lack of communication between contractor, subcontractors, suppliers, manufactures	3.70	1.03
10. Lack of technical understanding of “green” technology	4.10	.71
11. Complicated design then traditional one	2.50	1.27
12. Difficulty in maintenance	2.50	1.27
<b>Total</b>	<b>3.43</b>	<b>1.16</b>

With regards to the above obtained statistical analysis ( $M = 3.43$ ;  $SD = 1.16$ ) from Table 5.10. The results shows the factors that affect green building development in Libya are very strong based on the Likert scales due to an average response of ( $>3$ ).

Table 5.1 happens to be the highest mean obtained from the item 10 “*Lack of technical understanding of green technology*” ( $M = 4.10$ ;  $SD = 0.710$ ). Hence, this indicates that, this is the reason that affects green building development the most out of the remaining reasons in Libya.

### 5.5 Stakeholders Who Have the Decision-Making Power (Directly/Indirectly) Which Effect on the Specifications of the Prospective Green Building Development, in Libya.

To fully understand the stakeholders' that have the greatest decision power (directly/indirectly) to influence based on specifications for prospective green building in Libya, a descriptive investigation was completed. The accompanying table exhibits the, mean and standard deviation of each got develop, the outcome acquired of the vast majority of the build was normal because of the way of mean, which was inside 3.0. The Table 5.11 beneath exhibits the standard deviation along with the mean of the gathered answers which depended on a scale type of Likert scale in this research.

**Table 5.11:** Stakeholders who have the decision-making power (directly/indirectly) to influence on specifications for prospective green building development, in Libya

Factors	Mean	SD
1. Client	3.50	1.57
2. Architect	3.80	1.05
3. Engineering (Civil, Mechanical...)	2.95	1.39
4. Government	4.15	0.98
5. Education Units (Universities)	3.55	1.09
6. Non-Governmental Organizations	2.45	1.35
<b>Total</b>	<b>3.40</b>	<b>1.23</b>

According to the obtained result total ( $M = 3.40$ ;  $SD = 1.23$ ) from Table 5.11. It can be seen that all the stakeholders' have the great decision power (directly/indirectly) to influence on specifications for prospective green building development in Libya with regards to the proposed scale type of Likert due to most of the respondents are above the statistical average of ( $>3$ ) except for Non-Governmental Organizations and Engineering.



The most obtained study mean according to Table 5.2 was item 4 “*Government*” ( $M = 4.15$ ;  $SD = 0.98$ ). Hence, this indicates that, this stakeholders’ have the greatest decision power (directly/indirectly) to influence on specifications for prospective green building development, in Libya.

### 5.6 The Most Initiatives Assist in Incorporating Sustainable Goals into Projects, in Libya

To fully understand the initiatives that will assist you in incorporating sustainable goals into projects in Libya, a descriptive statistical analysis was conducted. The accompanying Table 5.6 depicts standard deviation along with the mean and of each acquired develop, the outcome gotten of the vast majority of the build was normal because of the way of mean, which was inside 3.0. The Table 5.6 beneath depicts standard deviation along with the mean of the gathered answers that solely depended on a scale type of Likert.

**Table 5.12:** The most initiatives assist in incorporating sustainable goals into projects, in Libya

	Mean	SD
1. Economic incentives (tax credits, utility rebates, etc.)	3.90	1.11
2. Educational programs	3.85	1.26
3. Government policy	4.20	0.95
4. Greater availability of green materials	3.80	1.23
5. Increased awareness of benefits	4.15	0.93
<b>Total</b>	<b>3.98</b>	<b>1.09</b>

With regards to the research result obtained ( $M = 3.98$ ;  $SD = 1.09$ ) from Table 5.12. All the initiatives will assist to incorporate sustainable goals into projects in Libya regarding the proposed scale type of Likert due to the results are more than the average ( $>3$ ).

The result mean from Table 5.3 item 4 “*Government policy*” ( $M = 4.20$ ;  $SD = 0.95$ ) was the highest mean. Hence, this indicates that, this initiative will assist the most in incorporating sustainable goals into project in Libya.

### 5.7 The Most Reason Affecting the Development of Green Buildings Based on Gender Differences, in Libya

Independent samples t-test was used to determine the most reason affecting green building based on gender differences in Libya in this study.

Based on the Table 5.13 below, regarding the most reason affecting green building based on gender differences in Libya the result depicts that, there is no statistical significant difference amongst the genders ( $p > .05$ ) amongst most dimensions with the exclusion of “*Lack of interest of construction*” and “*Lack of training/education in sustainable design /construction in architectural and engineering schools?*” which showed a significant differences amongst the genders.

The female gender with respect to the result means depicts a higher mean values ( $M = 3.44$ ;  $SD = 0.94$ ) more than male gender students that depicted a mean of ( $M = 3.42$ ;  $SD = 1.15$ ).

**Table 5.13:** Differences across the two Genders between reasons affecting green building development

Dimensions	Gender	N	Mean	SD	Mean Difference	t-test	p
Lack of knowledge	Female	3	4.00	1.00	.00000	0.00	.59
	Male	17	4.00	1.27			
Lack of interest of construction	Female	3	4.00	0.00	.64706	1.78	.008
	Male	17	3.35	1.49			
Political issues	Female	3	4.66	0.57	1.96078	2.50	.111
	Male	17	2.70	1.31			

High cost	Female	3	3.00	1.73	-1.52941	-1.95	.093
	Male	17	3.47	0.94			
Lack of skillful construction engineers	Female	3	3.33	1.73	-1.52941	1.95	.361
	Male	17	3.76	1.17			
Unavailability of sustainable resources	Female	3	2.00	1.15	-.43137	-.57	.812
	Male	17	3.52	1.20			
Lack of infrastructure construction	Female	3	3.66	1.52	-.02083	-.03	.466
	Male	17	3.68	1.01			
Lack of training/education in sustainable design /construction in architectural and engineering schools.	Female	3	4.00	0.00	.17647	0.58	.008
	Male	17	3.82	1.23			
Lack of communication between contractor, subcontractors, suppliers, manufactures	Female	3	2.66	1.52	-1.21569	-2.0	.195
	Male	17	3.88	0.85			
Lack of technical understanding of “green” technology	Female	3	3.66	0.57	-.50980	-1.1	.586
	Male	17	4.17	0.72			
Complicated design then traditional one	Female	3	3.00	1.00	.58824	.726	.419
	Male	17	2.41	1.32			
Difficulty in maintenance	Female	3	3.33	0.57	.98039	1.24	.091
	Male	17	2.35	1.32			

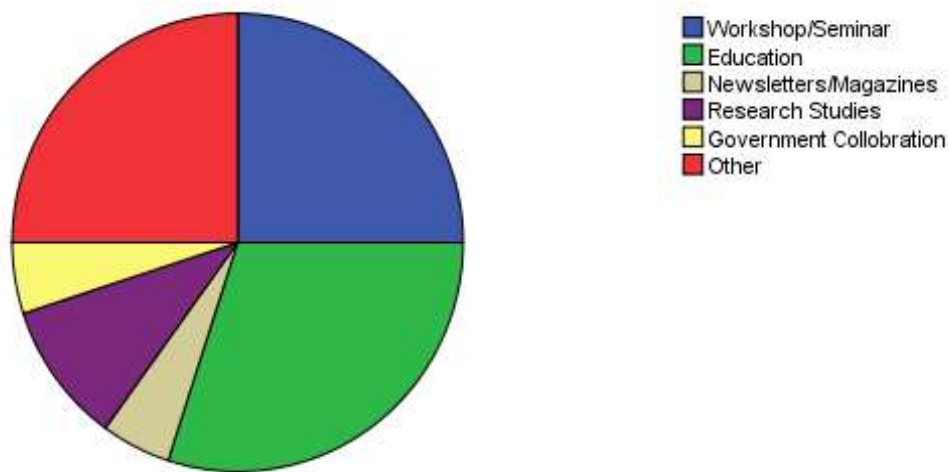
## 5.8 Green Building Awareness

According to the respondents based on current circumstances and need of sustainable development in aspects of environment and other factor, the awareness of green building development should be raised. In order to collect their suggestions regarding the best source to promote green development Libya, we mentioned following multiple sources that are shown in figure 7 and Table 5.11 below:

**Table 5.14:** Sources to promote Green Building in Libya ( $n = 20$ )

Sources	Percentage
Workshop/Seminar	25%
Education	30%
Newsletters/Magazines	5%
Research Studies	10%
Government Collaboration	5%
Others	25%

The Table 5.14 above demonstrates the most recommended sources that can be adopted in order to promote or increase awareness of Green building importance, in Libya. According to the feedbacks conducted from respondents, education can be the most effective source to equip individuals or professionals with green developments skills and knowledge. Thirty percent of respondents chose education as major source. Twenty five percent of respondents said workshops or seminar can be the best source. While from the remaining respondents 10 percent of them chose research studies as the best source for green building knowledge. Newsletters and Magazines were considered as the best source by 5 percent respondents. While the government collaboration were also chose as best source by the rest five percent of the respondents. The figure 5.17 below better illustrates the ratio of each source chosen by respondents.



**Figure 5.17:** Sources to promote Green Building in Libya

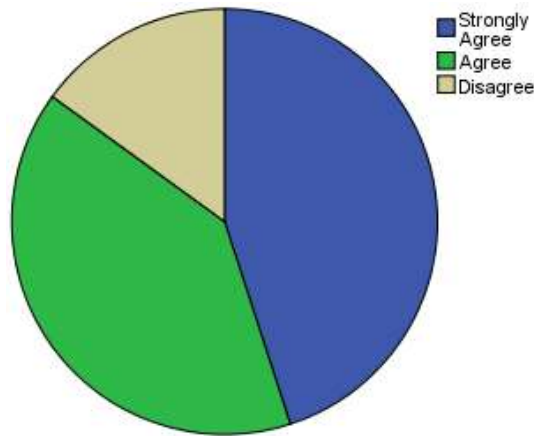
In short, education was counted as the most favorable source. Workshops and seminar were also considered as good source while the newsletter and research papers had a few favorable responses. The government collaboration had been the least choice for green building promotion. However, a few respondents mentioned some other sources to be considered in this regard.

### 5.9 Green Building Cost / Traditional Building Cost

Based on all above analysis we noticed the cost of green building development was one of the major issues or barriers in green development in Libya. Thus, we also requested our respondents' for their valuable opinion regarding the cost issue. According to the driven results, as shown in figure 5.18 below the 9(45%) of respondents were strongly agree on that green building development is more likely to reduce in 20 years of time period as compared to traditional way to development.

**Table 5.15:** Green Building / Traditional Method Cost

Response	Frequency	Percentage
Strongly Agree	9	45.0%
Agree	8	40.0%
Disagree	3	15.0%
Total	20	100.0%



**Figure 5.18:** GB / Traditional method Cost

Thus, based on above results, the green building development is highly favorable and recommended in terms of cost in contrast to traditional development methods.

### 5.10 Further Research Findings

After an in-depth descriptive analysis and research the following results were found: the analysis revealed that stakeholders have huge influences on how a construction is run. The influences vary depending on the immediate context. According to Rätty et al. (2016), it is the influence of the firm's stakeholders which determine the type of the environmental strategies that company decides to undertake. Some may decide to undertake either reactive or proactive strategies. Sometimes, firms may exert so much pressure from customers. In line with this, firms may be forced to adopt proactive green innovation strategies (Leonidou et al., 2015). The levels of influence from the groups of stakeholders differ. Notably, the corporate green innovation decisions are highly dependent on the internal heterogeneity exhibited by the groups of stakeholders (Eteokleous et al., 2016).

In this study, it was identified that the groups of investors/stakeholders who have more influence or lesser level influence on how a green building construction is managed. The attention of the study lay on the Libyan construction industry. Therefore, one of the objectives of the study was to determine the stakeholders of the construction industry in the Libyan construction industry and their influence on how construction firms in Libya are run. In the study, the influence of stakeholders such as engineers, case clients, education units, government authorities and non- governmental organizations were examined from the previous syntheses. In chapter four, Table 5.8

shows the responses of the respondents. These responses were used for the analysis of the influence of stakeholders in the construction industry, in Libya.

Other forces that exert pressure onto the firms include the government. Sometimes, government regulations may cause mayhem on how the firm is run. The case is worse for those companies which do not meet the government regulations. Sometimes, they face legal problems such as penalties and fines from government authorities for failure to comply with the set regulations. Hence, many firms have resulted to being law abiding to avoid such legal tussles with the government. In line with this, many of them adhere to the set environmental laws (Fraj-Andrés et al., 2009).

In all the cases that were examined, none of the projects had received any form of government support through funding. Similarly, the government did not provide any incentive to support sustainable development. The data collection exercise was bedeviled by some challenges. However, the most challenging of them all was laid in the questionnaire. Some of the problems cited revolved around:

- Price
- Problems over the unavailability
- Products or systems
- Supply of green materials

Of all the cases that were studied, these problems were found in five of them. This challenge was countered through consultancy. Alternative materials were also used to address the challenge of materials. Many of the suppliers in the case studied had very little or no knowledge at all of the material's volatile organic compounds (VOC) content, besides recyclability. It is important for them to be sure that the materials used for construction are of good quality and that they are durable to suit the intended purposes. Recyclable materials with low embodied energy across their life cycle are more preferable for construction purposes. It is important to stimulate the demand of such durable products so that manufacturers change their manufacturing methods to come up with better and more durable materials for the built environment.

The government offers financial incentives to encourage low risk yet cost effective resources to support green builders in both residential and commercial segments of the construction industry. It is; thus, important to foster public awareness on aspects of

green building so that the demand for such construction measures rise (Kubba, 2012). Public enlightenment on aspects of green building make consumers aware of the need to use good quality products as well as shift towards sustainable green building. Sustainable green home development is advantageous to both home owners and construction firms.

The previous observations of the situation of the green building reveal that the industry is yet to develop well. Results reveal that many construction firms are reluctant in joining the green building market. They attribute their reluctance to extremely high risks associated with investment in green building coupled with market insecurity should they opt to join the green building market. Unfortunately, even the government besides investors is unwilling to express little or any interest in undertaking green building projects. Although construction firms are expected to be the major drivers towards the development of sustainable green building, it is unfortunate that they are unwilling to venture into that industry anytime soon. This is so far the main bottleneck towards the development of green building industry in Libya.



## **CHAPTER 6**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 Conclusion**

The construction industry is one of the principal generators of revenue for local governments, in Libya. The impact of this sector on the economy is substantial due to the fact that it is a significant consumer of many of the local natural resources. Unfortunately, some of these natural resources are not renewable. This makes it significantly important that firms in the construction industry adopt sustainable building practices in order to achieve sustainable development.

In addition, sustainable construction practices have a wide array of advantages. Unfortunately, the implementation of such practices has been beset by a series of challenges, predominantly in third world countries such as Libya. To foster sustainability in the construction industry, it is critical that a robust plan for sustainable development in the construction industry is developed. This research paper is primarily a report based on a questionnaire survey that was conducted in Libya to determine the bottlenecks that have negatively impacted the green construction industry.

The findings of the study reveal that the level of expertise in the green construction industry has been behind the poor implementation of green building in many construction projects.

Also the study also revealed that the current incentives were not effective to promote the green building industry among construction firms based in Libya. In addition, the already existing financial incentives have not been able to fully address the hefty cost of green building. Therefore, construction firms in Libya find it being utterly expensive to adopt green building practices. Azad and Akbar (2015) conducted studies to determine the major impediments to green building. They found out that high upfront costs (construction methods, design and technology) were a major bottleneck for the development of a culture of green building.

Thus, some of the findings revealed that government incentives can eliminate many of the barriers. The following are some of the desirable government subsidies that could aid the industry's development such as structural incentives, rebate programs, subsidies voluntary rating system, tax incentive scheme, low interest mortgage loans, market and technology aid.

Regarding also some findings of this study indicate that respondents believed that construction firms avoid green building for the following key reasons, the process of acquiring contracts and tenders predominantly centers on reducing cost and time, when compared to the quality of the building states that government incentives are too limited to sustain green building also the available regulations do not sufficiently emphasize standardized building design and construction.

However, the different obstructions to the accomplishment of supportable building rehearses included generous advances, material cost, nonattendance of protection strategies, considerable introductory cost, poor experience of development firms in green building, trouble in discovering green materials lastly the boundaries to framework and item development all together of significance.

Additionally, the lack of technical understanding of green technology is the primary factor affecting green building development, in Libya, where no significance gender difference significant which can be addressed by the government. Furthermore, the Libyan government has the greatest influence on specifications for prospective green building development, in Libya.

Many of these obstacles to the development of sustainable green building can be addressed through adequate research and government support besides education. Many construction firms who have expressed a preference to invest in green building have complained that the government does not support them appropriately. According to them, support in the form of tax abatements, fiscal incentives and policy instruments would be an important step in encouraging green building practices.

Based on the respondents' comments, it is important for the government of Libya to establish important yet mandatory regulations to encourage green building. Moreover, there should be policies in place that will increase the market demand for green building. The Libyan government could also fund education and research in green

building. Construction firms that utilize non-environmentally friendly materials, such as fossil fuels, should be taxed heavily, while those who engage in green building should be incentivized accordingly. The government should also foster competition in the green building industry.

Conclusively, it is recommended that stakeholders in the construction industry understand the challenges encountered in green building. This will aid them shift their attention towards safe and sound green building. Hence, their relevance in the green building will be relatively higher (Chan et al, 2009). One of the major challenges associated with the development of green building is poor expertise or rather knowledge of the parameters of green building. Therefore, the development time frame becomes longer due to this challenge (Choi, 2009). Expert knowledge in green building is the key to sustainable building practices. Unfortunately, the knowledge that stakeholders have on the aspects of green building is below average. They are yet to understand the benefits associated with the green building industry.

Finally, the respondents recommended that more studies may be conducted to provide further insight on external parties as insurance firms, tenants and banks, as they may contribute to supporting sustainable green building to foster market demand.

Conclusively, with regards to the results it was found that, amongst several certificate for green building the LEED is the Most suitable, in Libya because LEED is intensive on resident repose. (Liang, S. 2012).

## **6.2 Recommendation**

If the study was conducted among more market actors and more participants, the analysis would have covered a wider scope. Thus, the future research should extended beyond the aim of this study and perform in-depth analysis in this domain.

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## **APPENDICES**

## **APPENDIX A**

### **The Questionnaire**

**NEAR EAST UNIVERSITY**

**DEPARTMENT OF ARCHITECTURE**



Company's Questionnaire about:

#### **THE ANALYSIS OF BARRIERS IN GREEN BUILDING DEVELOPMENT IN LIBYA**

Dear Company's,

I am undertaking a research for my dissertation which aims to the Green Buildings Development in Libya. Please kindly forward the questionnaire back to **ame501k@gmail.com** upon completion. Also, please do not hesitate to contact me if you have any queries regarding the survey questions. Please be assured that your responses will be kept confidential and will only be used for academic purposes.

Thank you for your participation in this research study.

Ahmed Mohamed Awaileh

Master Student in Architecture

Supervisors: Architect: Dr.Sema Uzunoglu

Ecologist - Assoc. Prof.Dr. Özge Özden Fuller

**1. Gender**

☐ Male ☐ Female

**2. Your age: .....**

**3. What is your profession?**

☐ Architecture

☐ Interior Design

☐ Engineering

☐ Other Specify:

.....  
.....  
.....

**4. Company's main scope of service:**

☐ Architecture (design building)

☐ Interior Design

☐ Consultant

☐ subcontractors

☐ Mixture construction services (Architecture, interior design, consultant).

**5. Company's years of experiences in the construction industry**

☐ Less than 5 year

☐ 5 to 10 years

☐ 10 to 15 years

☐ More than 15 years, please Specify:

.....  
.....  
.....

**6. How did you first learn about "green building"?**

☐ Television

☐ Magazine

☐ Education

☐ Conference

☐ Other Specify:

.....  
.....  
.....

**7.** Where did you get green building knowledge?(Mark all that apply)

- |   |   |
|---|---|
| <input type="checkbox"/> Attending conference                 | <input type="checkbox"/> Reading trade publications |
| <input type="checkbox"/> Internet research                    | <input type="checkbox"/> working with consultants   |
| <input type="checkbox"/> Sharing knowledge with my colleagues | <input type="checkbox"/> Other Specify:             |

.....  
.....

**8.** Do you have any projects of green building?

- |                              |                             |
|------------------------------|-----------------------------|
| <input type="checkbox"/> Yes | <input type="checkbox"/> No |
|------------------------------|-----------------------------|

**9.** Your experiences in green building construction:

- |  |  |
|--|--|
| <input type="checkbox"/> No experience about green buildings | <input type="checkbox"/> Less than 3 year          |
| <input type="checkbox"/> 3 to 6 years                        | <input type="checkbox"/> More than 6 years, please |
- Specify:

.....  
.....

**10.** Have you received any training inside or outside Libya to work on green building?

- |                             |                                       |
|-----------------------------|---------------------------------------|
| <input type="checkbox"/> No | <input type="checkbox"/> Yes Specify: |
|-----------------------------|---------------------------------------|

.....  
.....

**11.** Which of the following stakeholders' have the greatest decision power (directly/indirectly) to influence on specifications for prospective green developments?

Rating Scale:					
	5 – Critical Reason	4- Major Reason	3-Moderate	2-Neutral	1- Minor
Client	5	4	3	2	1
Architect	5	4	3	2	1
Engineering (Civil, mechanical...)	5	4	3	2	1
Government	5	4	3	2	1
Education Units (Universities...)	5	4	3	2	1
Non-Governmental Organizations	5	4	3	2	1

**12.** What initiatives do you think will assist you to incorporate sustainable goals into projects?

Rating Scale:					
	5 – Critical Reason	4- Major Reason	3-Moderate	2-Neutral	1- Minor
Economic incentives (tax credits, utility rebates, etc.)	5	4	3	2	1
Educational programs	5	4	3	2	1
Government policy	5	4	3	2	1
Greater availability of green materials	5	4	3	2	1
Increased awareness of benefits	5	4	3	2	1

**13.** What reasons you think cause the lack of green building in Libya?

Rating Scale:					
	5 – Critical Reason	4- Major Reason	3-Moderate	2-Neutral	1- Minor
Lack of Knowledge	5	4	3	2	1
Lack of interest of Construction Industry	5	4	3	2	1



Political Issues	5	4	3	2	1
High Cost	5	4	3	2	1
Unavailability of sustainable resources	5	4	3	2	1
Lack of Skillful construction engineers	5	4	3	2	1
Lack of infrastructure construction	5	4	3	2	1
Lack of training / education in sustainable design / construction in architectural and engineering schools?	5	4	3	2	1
Lack of communication between contractor, subcontractors, suppliers, manufacturers	5	4	3	2	1
Lack of technical understanding of "green" technology	5	4	3	2	1
Complicated design then traditional one	5	4	3	2	1
Difficulty in maintenance	5	4	3	2	1

**14.** Do you agree the idea that Green Buildings total lifecycle costs can be lower than traditional buildings long-term cost over 20 years' time period?

- ☐ Strongly agree
 ☐ Agree  
☐ Neither agree nor disagree
 ☐ Disagree  
☐ Strongly disagree
 ☐ I do not know/ not applicable to me.

**15.** Which of the following sources you think will be best to create green development awareness? (you can select more than one)

- ☐ Workshops / Seminars
 ☐ Education  
☐ Newsletters / Magazines
 ☐ Internet  
☐ Research Studies
 ☐ Radio & Television programs  
☐ Government collaboration
 ☐ Others Specify:

.....  
.....  
.....

---

Thank you for your valuable time

For any requirements:

.....  
.....  
.....

## APPENDIX B

### Common Barriers Involve in Green Building Development

Barriers	References
Lack of Knowledge	Bond (2011) Shafii et. al. (2005) Ikediashi et al. (2012)
Lack of interest of Construction Industry	Williams and Dair (2007) Marker et. al. (2014) Lutzkendoft & Lorenz (2005)
Political Issues	Moore (1994) Yung et. al. (2002) Alev & Baabak (2010) Zhang et al. (2010) Wood (2007)
High Cost	Chau et al. (2010) Choi (2009) Milad et. al. (2013) Queena et al. (2015)
Unavailability of sustainable resources	Miriam (1999) Francesco & Levy (2008)
Lack of Skillful construction engineers	Griffin et. al. (2011)
Lack of infrastructure construction	Miriam (1999) Francesco & Levy (2008)
Lack of training / education	Shafii et. al. (2005)

	Ikediashi et al. (2012)
Lack of communication	Hoffman & Henn (2008)
Lack of technical understanding of "green" technology	Griffin et. al. (2011)
Complicated design then traditional one	Kats et. al. (2003)
Difficulty in maintenance	Kamana and Escultura (2011)
Government	Adan et al. (2002)
	Samari et al. (2013)
	Ashuri and Durmus (2010)
	Kong et al. (2012)