

IMPLEMENTATION OF GREEN BUILDINGS IN AFGHANISTAN, BARRIERS  
AND SOLUTIONS

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## **DEDICATION**

To my beloved father and mother, and siblings, thank you for all your support  
in terms of spiritual and encouragement

To people who guided and helped me

Dr. Shamila Azman and Dr. Siti Rahmah Omar (Supervisors)

To all my fellow friends, thank you for all your support.

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## ABSTRACT

Green building (GB) is receiving full acceptance as a workable option in the construction sector to meet the increasing demands for environmentally sustainable. Green standards are one of the most relevant energy-saving strategies, which define best practices in sustainable building. They also have significant impacts on resource conservation as well as on the saving of the climate. The demand toward a more sustainable construction has prompted, and green specifications are the best way to emerge and adapt. However, in industrialised economies, there are several types of problems due to green building implementation, including high costs, lack of green products, information, and awareness. The difficulties of adopting sustainable buildings in Afghanistan presently include original costs associated with construction. Construction companies also face a massive hurdle in understanding and applying the World Green Building Council Rating System. Implementing green building understanding in Afghanistan is not widely practised and most providers do not have appropriate training. This study evaluated the feasibility of green building implementation in Afghanistan, identifying green building implementation for indoor air pollution control, and assess barriers as well as green building solutions in Afghanistan. Thirty-three (33) sets of questionnaire were distributed to project stakeholders including consultants, contractors, real estate developers, and project management consultancies. The responses were analysed quantitatively using SPSS and Ms Excel Software. Findings showed that 75% of the participants had knowledge about green building and declared that green building could reduce the negative impact of climate change on the environment. Majority of participants construction firms acknowledged that the green building implementation procedure was excellent therefore green building implementation in Afghanistan is feasible and can be one of the most effective ways for reduction of the negative environmental impacts as the participants pointed out. Similarly 38% of respondent acknowledged that green building implementation effectiveness is eminent for the healthy and comfortable built environment. Green buildings implementation is also believed to reduce indoor air pollution related sicknesses of the residents due to controlled indoor air pollution. Result showed that knowledge of green building advantages among the Afghan construction firms was not adequate. Therefore, awareness, mutual benefits and establishing an award as an incentive for construction firms to apply green building characteristics in their projects are crucial. The findings of this study useful to all related parties towards improving green building implementation in Afghanistan.

## ABSTRAK

Bangunan hijau (GB) mendapat penerimaan penuh sebagai pilihan yang dapat dilaksanakan di sektor pembinaan untuk memenuhi permintaan yang semakin meningkat untuk bangunan yang mampan atau sihat. Piawaian hijau adalah salah satu strategi yang paling relevan untuk penjimatan tenaga, yang menentukan amalan terbaik di bangunan lestari. Mereka juga mempunyai kesan yang besar terhadap pemuliharaan sumber serta penjimatan iklim. Permintaan terhadap pembinaan yang lebih lestari telah mendorong, dan spesifikasi hijau adalah kaedah terbaik untuk muncul dan menyesuaikan diri. Namun, dalam ekonomi perindustrian, ada beberapa jenis masalah kerana pelaksanaan bangunan hijau, termasuk biaya tinggi, kekurangan produk hijau, informasi, dan kesedaran. Kesukaran untuk menggunakan bangunan lestari di Afghanistan pada masa ini merangkumi kos asal yang berkaitan dengan pembinaan. Syarikat pembinaan juga menghadapi rintangan besar dalam memahami dan menerapkan Sistem Penarafan Majlis Bangunan Hijau Dunia. Menerapkan pemahaman bangunan hijau di Afghanistan tidak tinggi dan kebanyakan pemaju tidak mempunyai latihan yang sesuai. Tujuan kajian ini adalah untuk menilai kemungkinan pelaksanaan bangunan hijau di Afghanistan, menentukan pelaksanaan bangunan hijau untuk pengendalian pencemaran udara dalaman, dan menilai halangan dan solusi untuk bangunan hijau di Afghanistan. Kaedah kajian adalah tinjauan soal selidik yang dikirimkan kepada pihak berkepentingan projek (perunding, kontraktor, pemaju harta tanah, dan perunding pengurusan projek). Respon dianalisis secara kuantitatif menggunakan Perisian SPSS dan Microsoft Excel. Hasil kajian dari soal selidik yang dianalisis menunjukkan bahawa 75% peserta mempunyai pengetahuan tentang bangunan hijau dan menyatakan bahawa bangunan hijau dapat mengurangkan kesan negatif perubahan iklim terhadap alam sekitar. Sebilangan besar peserta syarikat pembinaan mengakui bahawa prosedur pelaksanaan bangunan hijau sangat baik oleh itu pelaksanaan bangunan hijau di Afghanistan dapat dilaksanakan dapat menjadi salah satu cara yang paling berkesan untuk mengurangkan kesan negatif terhadap alam sekitar seperti yang ditunjukkan oleh para peserta. Begitu juga 40 (38%) peserta mengakui bahawa keberkesanan pelaksanaan bangunan hijau sangat kuat untuk persekitaran binaan yang sihat dan selesa dan pelaksanaan bangunan hijau akan mengurangkan penyakit yang berkaitan dengan pencemaran udara penghuni kerana pencemaran udara dalaman yang terkawal. Pengetahuan kelebihan bangunan hijau di antara syarikat-syarikat pembinaan Afghanistan tidak mencukupi dan dapat ditingkatkan dengan menyebarkan kesedaran dan memberikan penghargaan bagi syarikat-syarikat pembinaan yang menerapkan ciri-ciri bangunan hijau dalam projek mereka. Hasil kajian ini akan membantu semua pihak yang berkaitan untuk meningkatkan pelaksanaan bangunan hijau di Afghanistan.

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## LIST OF ABBREVIATIONS

Adb	Asian Development Bank
AIA	American Institute of Architects
A-SDG's	Afghanistan Sustainable Development Goals
BREEAM	Building Research Establishment Environmental Assessment Management
CASBEE	Comprehensive Assessment System for Built Environmental Efficiency
CO <sub>2</sub>	Carbon Dioxide
EPA	Environmental Protection Agency
GB	Green Building
GBD	Global Burden of Disease
HAP	Household Air Pollution
HVAC	Heating, Ventilation, and Air Conditioning
IAP	Indoor Air Pollution
IAQ	Indoor Air Quality
kWh	kilowatt hour
LEED	Leadership in Energy and Environmental Design
LPG	Liquefied Petroleum Gas
Ms Excel	Microsoft Excel
NEPA	Afghanistan's National Environmental Protection Agency
°C	Celsius is a unit of temperature
SPS	Statistical Package for the Social Sciences
TRCA	Toronto and Region Conservation Authority
U.K	United Kingdom
UN	United Nation
UNEP	U.N environment program
US	United States
USA	United State of Amireca
USGBC	Green Building Council of the United States
WHO	World Health Organization

WorldGBC World Green Building Council



## LIST OF SYMBOLS

Kwh - Kilo watt hour

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## **CHAPTER 1**

### **INTRODUCTION**

Increasing efficiency of buildings by using the practice of green buildings to decrease the consumption of water, energy, materials and to decrease the buildings impacts on human health and environment via better planning, design, construction, maintenance, operation, and elimination (Esa, et al., 2011). The environmental effect of the building design, construction, and operations sectors is massive (Tam & Zeng, 2012), (Shafiei, et al., 2013). Buildings use over 30% of the overall energy yearly and above 60% of the electricity used in America. In 2006, the industrial sector produced over one billion metric tons of CO<sub>2</sub> which was 30% higher than the levels of 1990. Just for flushing the toilets, daily five billion gallons of treated water are consumed. An average North American commercial construction worker produces around 1.6 pounds of waste materials every day. For a building which has 1500 employees, the amount of waste per year will be 300 tons. The negative environmental impacts can be substantially eliminated or reduced by high-performance, market-leading design, construction, and operation practices and also by applying green buildings practices. (U.S Green Building Council, 2009). Green operations and management, as an added benefit, reduce operating costs, increase the productivity of workers, enhance the marketability of buildings and reduce the potential liability resulting from issues with Indoor Air Quality (IAQ). (U.S Green Building Council, 2009).

Meanwhile, Green building is not just about preserving the biosphere and natural resources against the over use of excessive consumption, but also about rescuing energy to reduce heating costs, taking into account the impact of the building and materials on the occupant community and how our lives will have an effect on the future of the planet. (Woolley, Kimmins, 2005).

## **1.1 Background of Study**

The diverse geography of Afghanistan which has grasslands and planes in the north side of Afghanistan, central mountain part, east fruitful mountain valleys, deserts and semi-deserts in the southwest and west. Afghanistan has a temperate climate. Most of the time, summers are dry and hot, but the winter of Afghanistan is very cold with a lot of snow. Some of the provinces of Afghanistan have very high temperature in the summer while the other provinces are inverse with these provinces in winter. For example, the temperature of Nimroze province can rise over 50°C, while the temperature of Ghore province can drop to -45°C. This variation in climate makes Afghanistan vulnerable to climate change and natural disasters which happens most of the time in Afghanistan in almost every season. Afghanistan is ranked the second country amongst the most affected countries in the world by weather related events like floods, droughts, storm etc. in 2016. The most significant challenges that Afghanistan is facing now are not just landslide, droughts, and floods but also air pollution is another most dangerous problem that not only affects Afghanistan but also the whole world. The rapid urbanization and population growth together with climate change can rise the weakness and undermine measurable ability of any urban system of Afghanistan. It is crucial to adopt future cities planning and house development with climate change and other disaster management to keep the people safe (Majale & Michael, 2017).

Afghanistan has rapid urbanization because of development and also climate change which brings many problems to the people. To overcome and solve this serious issue, one of the effective solutions is the implementation of green buildings in Afghanistan which is not an option but a serious exigency. Implementation of green buildings concept for countries like Afghanistan is the main priority for approaching Afghanistan Sustainable Development Goals (A-SDG's) (Czerwinska & Dominika, 2017). During implementing of construction projects, there are high amount of materials, water, energy and other resources wastes which are not acceptable and should stop. For this purpose, investment and implementing in green infrastructure is inevitable for the country economically and sustainably improvement (Czerwinska & Dominika, 2017). The concept of environmental

sustainably improvement is increasing throughout the world. However, unfortunately, in Afghanistan, there was no any official or private organization that applied this concept until 2001.

### **1.1.1 History of Green Buildings**

Over the past decade, green building has scored enormous popularity. However, it is not new. The early beginning of green buildings goes back to the nineteenth century. David Gissen, a person who was the custodian of architecture and style at the National Building Museum in Washington D.C., used passive systems like roof ventilators and beneath the surface of the ground air-cooling chambers at mild indoor temperatures in Milan's Vittorio Emanuele II Gallery and London's Crystal Palace (Feltes, 2007).

In the starting point of the 20<sup>th</sup> century, there was revolution in building construction techniques. The cooling approach was one of these new techniques which get involved in construction industry. Not just these, but also the air conditioning system, reflective glass, and the wide spread of use of glass enclosed structural steel were the special invention in the urban and rural building construction companies (Mohammed, et al., 2014). The buildings which were made within this new method were easy to cool and heat with this big heating, ventilation, and air conditioning (HVAC) system by using less and inexpensive amount of easy available fossil fuels.

The American Institute of Architects (AIA) organized a Committee on Energy which was divided into two groups. To get environmentally friendly materials, one of the two groups tried to find passive methods such as materials which can reflect in the roofs and to site the buildings with the method to be useful for the buildings environmentally, meanwhile, the second group focused on technology solutions like the use of three layers of glass in windows. All of these efforts were conducted to save energy in buildings construction industry. To bring the green build/sustainable idea to the center of the dialogues tables, the green

build/sustainable communities start their work from White House when Bill Clinton was elected as a president of the United State in 1992. After twenty-three years on the initial Earth Day, White House took place as a model of building which was in the first category of less energy consumption and waste produce buildings, which was announced by president “Bill Clinton” (North American Insulation Manufacturers Association, 2003). By greening White House, according to a report in March 1996, they saved \$150,000 per year after two years by saving energy, water, and landscaping costs. There were other expenses related to the waste management which was also saved. Due to some others additional projects, the savings amount reached to \$300,000 in 1996 (North American Insulation Manufacturers Association, 2003). The savings were due to reducing the loss of energy, through the windows, roof, and walls by using natural lights and energy-saving lights in the White House which was one of the “green” implementation concept. They rent-out the cleaner-burning fuels cars and starting to use the energy savings equipment in the offices and begin recycling program in the White House.

Other governmental agencies like Pentagon, the Presidio and the U.S. Department of Energy also made a decision to follow the White House the greening program because of its great success by becoming green (Mohammed, et al., 2014). One the most important green building program is Leadership in Energy and Environmental Design (LEED) published in 2003 in the current form which is the major resource for evaluating a building for its greenness in the construction and design communities (Mohammed, 2015). It was not the last effort for greenness, many others countries start to change their construction industry to green construction.

The world green building movement started in 1993 by formation of the Green Building Council in the United States (USGBC). The council was founded by Rick Fedrizzi, David Gottfried and Mike Italiano to develop the practice of sustainability in the industry of building construction. It was the first time for producing advance green buildings. The movements of green industry were watched by other green leader industries everywhere in the world. When they realized the

effect of U.S. Green Building in the construction industry, they also decided to begin alike USGBC-led movement around their own countries. (WorldGBC, 2018).

Green buildings movement got more and more interest around the globe which was supported by USGBC. David Gottfried then prepared a formation of the UN of the Green buildings Councils to the mission of supporting green buildings development around the world and to bring all of them together with the common voice and purpose (WorldGBC, 2018). By taking these action, the World Green Building Council was founded and held the first founding meeting in 1999 in California, US. Three years later in 2002 the WorldGBC was officially formed under the name of Green Building Councils in Australia, Brazil, Canada, India, Japan, Mexico, Spain, and USA. In 2007, a Secretariat for WorldGBC was formally established in Toronto, Canada, and vital support was provided by the Toronto and Region Conservation Authority (TRCA) (WorldGBC, 2018). Many countries in the world have already developed green buildings guideline and some of them are starting to develop the guideline for their countries including Canada, Korea, Australia, U.S., U.K, Japan, and India. USGC is the one of the fast runner because they launched the Leadership in Energy and Environmental Design (LEED) guideline for the first time in 2000 which is one of the most accurate and trustable guideline around the world. Leadership in Energy and Environmental Design (LEED) has more than 12,659 certified project in all 50 U.S provinces and 85 or than that registered project around the world (Korkmaz, et al., 2009). Implementation of these guidelines can help to reduce usage of non-renewable resources which is not a solved issue yet. Green buildings movement similarities and differences in different countries will be helpful for taking first step on building framework for green buildings to assess the system adoption in the international arena.

It is clear that building construction industry is one of the waste having industry in the world. The green buildings movement effort has started to increase the recycling and reuse process of construction materials in construction industry to reduce cost and increase the efficiency of the energy of the buildings and save money (Kibert, 2016).

### **1.1.2 Green Buildings in Afghanistan**

The rapid development time for green buildings was the start of twenty first century. Most of the countries start to implement the idea of green building around the globe. As the nature is facing many problems, implementation of green buildings is one of the best strategies to eliminate and reduce the destruction of nature. One of the most affected countries in the world from climate change and air pollution (indoor/outdoor) is Afghanistan. The first building that was built in Afghanistan and certified by LEED was the World Bank local branch in Kabul city. In spite many challenges and concerns due to security, lack of materials and minimal understanding of local contractors, the World Bank project team tried to pursue LEED and join this building with the landmark project in the region. This project is the first emulation project in the region and should be develop in the future (Byrne, 2020).

Kabul Homes Project was another project which has been implemented in 2018. This project applied solar passive energy in 15 districts of Kabul city where the pollution problem is higher (Geres, 2015). However, unfortunately, the concept of green buildings in Afghanistan is still not as popular as it should be. There are many works that should be done to improve the idea of implementation of green buildings in Afghanistan.

## **1.2 Problem Statement**

Afghanistan is one of the countries which are suffering from climate change on the planet. Among the most susceptible countries, Afghanistan is ranked number 14 to the impact of climate change (Islamic Republic of Afghanistan, Ministry of Economy, 2017). Pollution and other disasters that the country is facing in the recent years are more dangerous. According to World Health Organization (WHO) ranking report, Afghanistan is the lowest country among non-African nation in deaths due to environmental problems. War can kill thousands of people in Afghanistan while environmental hazards are more deadly. According to a report, air pollution is the silent killer of Afghans people (Salahuddin, 2019).



Brick kilns, factories, bathhouse, and others pollutants producers must be standardized and push out from the cities to other places. A big part of this air pollution is created by fossil fuel. These fossil fuel have been used for many purposes. By implementation of green buildings concept in Afghanistan, a big amount of energy will be saved and the consumption of fossil fuel will be reduced to lower levels (Conflict and Environment Observatory, 2018).

### **1.3 Objectives**

The followings are the objectives proposed for this study: -

- (a) To evaluate the feasibility of green buildings implementation in Afghanistan.
- (b) To study the effectiveness of green buildings implementation in order to control indoor air pollution.
- (c) To recommend the barriers and solutions in the implementation of green buildings in Afghanistan.

### **1.4 Scope of the Study**

The main focus of this study is to evaluate the application of green buildings in Afghanistan and also issues regarding green buildings implementation. However, it is not as easy task as there is no literature regarding green buildings in Afghanistan. It will be the first research regarding green buildings in Afghanistan. This study will cover the positive environmental effects of green buildings application in Afghanistan. The study will also discuss indoor air quality (IAQ) for buildings in Afghanistan. As mentioned before, indoor air quality pollution is very serious problem in Afghanistan. There are many issues related to respiratory system that is affected by exposure to Indoor Air Pollution (IAP). Among others issues, respiratory infections can often spread, where there are different sources of infectious agents indoors as the reduced amounts of indoor mixing enable infectious diseases to

convey more quickly from one individual to another. The latter mechanism is operational especially in schools, nurseries, etc. (Berglund et al., 1991). Afghanistan is one of war-torn countries in middle Asia. As the war is still continuing, this is the main problem for research or any other related topics. Collecting information or data is the difficult task because of the security issues. The other problem is due construction companies as there are huge competitions between construction firms and they don't like to share information about their projects.

### **1.5 Significance of the Study**

Today, green building in the world represents one of the most important and most exciting prospects for sustainable development at both the national and global levels. Green building represents an intelligent approach to energy. At any point in the life cycle of a building, it affects the minimization of energy use, ranging from concept creation and realization to final use, thus making new and revamped buildings more pleasant, less costly to maintain, and more suitable for the environment (Gambatese & Behm, 2007). At the same time, it helps building occupants learn how to use natural resources that become secure.

The energy sources' absence is one of the significant problems in Afghanistan. According to the Asian Development Bank, electricity usage is at the lowest level in Afghanistan. Due to their estimation, electricity consumption is almost 100-kilowatt hours (kWh) per capita per year(Asian development bank, 2014). Most of the times during electricity cutoff, generators fill the gap. These generators use fossil fuel which is the main source of greenhouse gas. By implementing green buildings, Afghanistan can reduce the big amount of fossil fuel energy.



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