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THESIS

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Ahmed ALFAKIH

POST-OCCUPANCY EVALUATION OF LANDSCAPES OF HIGH- RISE GREEN BUILDINGS in DOHA

THESIS ADVISOR

Assist. Prof. Dr. Bahar KALYONCUOĞLU

ISTANBUL, August 2022

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YÜKSEK LİSANS TEZİ
MİMARLIK ANABİLİM DALI

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PREFACE

At the outset, I want to say that the thesis in general is a collection of data to be a basis for starting the next projects. For the high-rise green buildings. Because the main goal is to make green high rise buildings that attract the largest number of residents, and cities need them to be in an environment similar to green buildings of normal height. Which is the closest to the environment to make the buildings comfortable and healthy.

Even the words I'm about to write are insufficient to describe even a part of my respect to my supervisor Dr. Prof. BAHAR BAŞER KALYONCUOĞLU, for the patience, guidance, and support during this process. also like to thank the members of the jury who helped me with their questions that helped me develop the research.

I would like to express my deepest gratitude and sincere appreciation to my beloved family, for their constant support, patience and understanding, I’d want to express my appreciation to everyone who has helped me in Doha. Especially Leonard and Mohammed and my classmate Abdulrahman, without their assistance, this study would not have been possible.

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DOHA'DAKİ YÜKSEK YEŞİL BİNA PEYZAJLARININ KULLANIM SONRASI DEĞERLENDİRİLMESİ

Yeşil bina, binaların sürdürülebilirlik uygulamalarından biridir; binanın çevre ve insan sağlığı üzerindeki olumsuz etkilerini azaltan inşaat uygulamalarının kullanımını temsil ediyordu. Bu makale temel olarak, yüksek katlı yeşil binalarda çevre düzenlemesinin etkinliğini, kullanım sonrası değerlendirme yöntemleri ile gerçekleştirmeyi amaçlamaktadır. Peyzajların yüksek katlı binaların işlevsel, teknik ve sosyal performansı üzerindeki etkilerini ölçmek için ayrıntılı bir anket hazırlamayı da amaçlar.

Bu çalışmanın amaçlarına ulaşmak için nicel analitik yöntem benimsenmiştir. Olguyu açıklayan en fazla bilgiye sahip tam bir arka plan sağlamak için nicel anketi kullanacaktır (doha'daki yüksek katlı yeşil bina peyzajlarının meslek sonrası değerlendirmesi). Göstergeler kullanıcılarla görüşmeler yapılarak sosyal performans, seçilen binalar izlenerek iş performansı ölçülecek ve teknik performans göstergeleri profesyonellerle görüşmeler yoluyla ölçülecektir (cresswell, 2008).

Araştırmanın evrenini doha şehrinde peyzajlı yüksek katlı yeşil binaların sakinleri oluşturmaktadır. Bu yeşil binalardan ikisinde mimar, sakin, ziyaretçi ve inşaat işçilerinden oluşan (270) kişiden oluşan rastgele seçilmiş basit bir örnek çalışma örneklemi olarak seçilmiştir. Çalışmanın sonuçları, yeşil yüksek katlı binaların peyzajının

doluluk sonrası dönemde sosyal performans açısından etkinliği konusunda büyük bir anlaşma olduğunu göstermiştir. Ayrıca, peyzajların yüksek binaların işlevsel, teknik ve sosyal performansı üzerinde olumlu bir etkisi olduğu sonucuna varmıştır.

Anahtar Kelimeler: yeşil bina, kullanım sonrası, peyzaj, fonksiyonel, teknik, sosyal performans, doha.

ABSTRACT

POST-OCCUPANCY EVALUATION of LANDSCAPES OF HIGH-RISE GREEN BUILDINGS in DOHA

Green building is one of the buildings sustainability applications; which represented the use of construction applications that reduce the negative effects of the building on the environment and human health. This paper basically aims to realize the effectiveness of landscaping in high-rise green building with post-occupancy evaluation methods. It also purposes to prepare a detailed survey in order to measure the effects of landscapes on functional, technical and social performance of high-rise buildings.

In order to achieve the aims of this study, the quantitative analytical method was adopted. It will utilize the quantitative survey in order to provide a full background with the most knowledge that explains the phenomenon (post-occupation evaluation of high-rise green building landscapes in doha). Indicators will be measured for social performance by conducting interviews with users, and for job performance by monitoring the selected buildings, and indicators for technical performance will be measured through interviews with professionals (cresswell, 2008).

The study population consists of the occupants of high-rise green buildings with landscape in the city of doha. A simple randomly selected sample which composed of (270) individuals from architect, residents, visitors, and construction workers in two of

these green buildings, was selected as the study sample. The results of the study indicated that there is great agreement on the effectiveness of the landscape of green high-rise buildings in the post-occupancy period in terms of social performance. It also concluded that there is a positive impact of landscapes on the functional, technical, and social performance of high-rise buildings.

Keywords: green building, post-occupancy, landscapes, functional, technical, social performance, doha.

SYMBOLS

α **:** Alpha, the probability of making a Type I error
β **:** Beta, the probability of making a Type II error
R **:** The multiple correlation coefficient
R^2 **:** The coefficient of determination (proportion of data explained by the model)
F **:** The significance of the effect (proportion of data explained by the model)
Sig **:** (0.00)
T **:** Test statistic for signed-rank test (proportion of data explained by the model)
H1 **:** first hypothesis

ABBREVIATIONS

POE : Post-Occupancy Evaluation

HRB : High -Rise Building

IV : Independent Variable

DVs : Dependent Variables

GSA : General Services Administration

LI : Landscape Institute

GSAS : Green Sustainability Assessment System

LEED : Leadership In Energy And Environmental Design

BIPV : Building Integrated Photovoltaic

PV : Photovoltaic

Std.D : Standard Deviation

IEQ : Indoor Environmental Quality

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CHAPTER 1: INTRODUCTION AND PUPORSE

1.1 INTRODUCTION

The building industry is one of the most energy-consuming industries worldwide (Rizqa, 2016), around (40%) of the global energy Consumed on construction and operation of building (Umar, Tukur, b, & Alkali, 2012). The concept of sustainability is one of the most important concepts that used widely in the architecture and construction sector. This concept refers to meeting the current population needs without compromising the needs of the future generation. In addition, the efficient use of natural resources, reduces the negative impacts of the construction materials on the environment, and improves the quality of life (Rizqa, 2016).

Green building is one of the applications of sustainability in buildings, it refers to the use of construction applications that reduce the negative effects of the building on the environment and human health. Green buildings also achieve the efficiency of resource use during the building's life cycle, which begins with the determination of the site, design, implementation, operation, Maintenance until the demolition proses (Vatalis, Manoliadis, Charalampides, Platias, & Savvidis, 2013).

Green buildings save about (30-60%) of the energy used by traditional buildings (Pandey, 2016). It reduces the demand for non-renewable resources and which have negatively affected the environment (Isopescu, 2018). It operates within (5) basic dimensions that include; (1) Sustainable site planning, (2) water efficiency, (3) energy efficiency and renewable energy, (4) conservation of materials and resources and (5) achieving the internal environmental quality of the building (R.Radwan, Kashyout, ELshimy, & Ashour, 2015).

The large increase in population density in many countries of the world affected the architectural style of buildings in them, as many countries found the use of high-rise buildings as one of the solutions to overcome the large increase in population numbers and high land prices (Fenga & Xingkuanb, 2011). High-rise Buildings are considered to be a great consumer of energy. Thus, improving the environmental performance of these buildings and reducing their negative effects on the environment and human health are among the most important modern architectural trends. Architects use many green technological techniques and apply of sustainable architecture principles to improve the its environmental performance (Ali & Armstrong, 2008).

With the orientation to high-rise buildings and the emergence of environmental challenges, the-landscape in high-rise building was appeared. It is a man-made ecosystem of the external and internal environment of a building, and includes; green roof, sky garden, podium parks and greenery that integrate with the natural ecosystem in buildings and urban infrastructure (Xue & Lau, 2013). The-landscape in high rise building improves the shape of the buildings, and it also contribute to improving the air quality inside the building, as it produces large amounts of oxygen and absorb carbon dioxide and suspended particles in the air. On the other hand, it optimizes water and energy efficiency (Golasz-Szolomicka & Szolomicki, 2019; Moor & Erysheva, 2018).

Green high-rise building's users notice several problems with the efficiency of project performance. This study is based on the use of the post-occupancy evaluation approach. In that context this approach focuses on assessing the efficiency of building performance after implementation and operational processes. It provides feedback on the current state of the green diminutions of high-rise green buildings (after use) and proposes solutions to current problems in addition to developing design principles and standards to obtain future projects of higher quality (Hadjri & Crozier, 2009).

In view of the foregoing, this study is based on the use of post-occupancy evaluation approach on landscaping of high-rise green buildings in the Qatari capital, Doha.

1.2 AIM AND DEFINITIONS OF THE RESEARCH

1.2.1 Problem Statement

A building is responsible for around (25-40%) of total energy use, (30%) of raw material use, (30-40%) of global greenhouse gas emissions and for (30 to 40%) of solid waste generation (Vatalis, Manoliadis, Charalampides, Platias, & Savvidis, 2013). High-rise buildings are among the most energy-consuming buildings (Ali & Armstrong, 2008). Thus, building these buildings according to sustainability standards greatly helps reduce their negative impact on the environment and human health. High-rise buildings are built using green principles to save energy, improve indoor air quality, reduce non-renewable energy depletion and reduce building operation and maintenance costs.

With the advent of the industrial and technological revolution, the need of create new societies, cities, suburbs and projects was appeared to suit quickly with the development of the times and the needs of society. Furthermore, there was a big gap between the designer's thinking and the needs of the user, especially after the supply and demand market controls the construction process and the formation of the final product without actual participation of the user, whether in the planning, design or implementation process. Accordingly, the importance of using the post-occupancy evaluation approach appears clearly to know how efficiently the projects are performing after the implementation and operation processes by the users.

Post-occupancy evaluation approach can be considered in terms of three broad categories of performance elements. Functional performance which deals addresses the functionality and efficiency level of the features, it includes accessibility, spatial capacity for activities, adequacy of necessary facilities, utilities, telecommunications, responsiveness to change overtime, and efficiency of communication and circulation. Technical performance which deals with survival attributes, such as structure, sanitation, fire safety, security, ventilation, and health, and behavioral performance which importance in create a link between occupants' activities and the physical environment, it includes the occupants comfort level and how functional divisions, spaces, and environmental conditions affect their behavior within the building (Mustafa, 2017).

Despite the paramount importance of managing and maintaining buildings and facilities in Doha, there is no systematic and organized mechanism to do so. Many complaints from users of these buildings relate to defects and defects after occupation, such as performance and functional efficiency, accessibility, distribution and configuration of spaces, ventilation and daylighting, thermal comfort, productivity, security, and safety, among others that require caution and thoughtful handling. Post-occupancy assessment can be adopted as a multi-tool in solving building and facility management problems, as it provides the ability to regularly assess the performance of buildings and facilities. In addition, POE can also be applied as an effective and systematic method of collecting data and information about a specific building. Among the benefits that can result from POE is the identification of successful design features that can be frequently verified. These include identifying problems to mitigate or reduce building and facility defects, improving building performance and the environment, identifying redundant and unnecessary building features, enabling users to negotiate the construction issue and reducing maintenance and cost. Numerous intersection points have been made in a variety of building and facility types. Some of the solutions involved increasing the involvement of the organization involved, achieving better results, and better targeting the information to the right decision makers. Due to the relatively slow change in the evolution of building types in the past, knowledge about their performance has been passed down from generation to generation of building professionals. Therefore, construction performance standards are an expression and translation of the customer's goals, objectives, functions, activities and required environmental conditions.

Locally, little factual evidence exists to ascertain the main problems and determinants of “unsuitability” or “dissatisfaction” in existing university buildings and facilities. The outcome of this study will provide a database for the construction industry on buildings in use and capabilities to determine how well a new concept for POE's business is of the landscape of high-rise green buildings in Doha, as well as contribute to building improvement and building handovers. POE has become an important tool for improving building design and operations to resolve misinterpretations and bridge the gaps that often exist between customer expectations and design for a given performance level. The POE process is related to the integration of the requirements of people (users) and their

workplace. Hence, POE is described as the best applied strategy that must be adopted in evaluating the performance of the landscape of high-rise green buildings in Doha.

Existing studies have seldom associated users' satisfaction with the performance of the landscape of high-rise green buildings in Doha and therefore, this study is an attempt to fill this research gap. Buildings are created to satisfy, provide and satisfy the needs and desires of users. In view of the foregoing, the Problem in this study is to evaluate landscapes of high-rise green building by post-occupancy evaluation approach.

1.2.2 Question of the research

The study seeks to answer the following main research question; “To what extent effective landscapes of high-rise green buildings during the occupancy period?” In addition, the following sub-questions:

1. What are the functional performance indicators of high-rise green building's landscapes?
2. What are the technical performance indicators of high-rise green building's landscapes?
3. What are the social (user-oriented) performance indicators of high-rise green building's landscapes?

1.2.3 Aims of the Research

The study aims to understand the effectiveness of landscaping in high-rise green building with post-occupancy evaluation methods. Furthermore, with this thesis, it is aimed to prepare a detailed survey in order to measure the effects of landscapes on functional, technical and social performance of high-rise buildings.

1.2.4 Significance of the Research

The significance of research appears in the importance of the green buildings and their capabilities to improve energy efficiency, raise the level of the building's environmental performance, and reduce operating and maintenance costs. Given the large amounts of

energy consumed in high rise buildings, green trends are very important to control their environmental performance.

On the other hand, the research uses a post-use evaluation approach, which is an important evaluation approach that helps reduce the gap between designs and user needs, provides feedback to designers about the performance of their designs, helps to suggest solutions to problems and direct design standards and foundations for the development of future designs. In addition, it helps to Know the extent to which projects achieve their objectives, extent of user satisfaction, determine the needs and reactions of the user of the place to its surroundings, understand the impact of planning and design decisions on venue users, evaluate Project, Policy and Program, and improve planning and design performance to achieve a better urban environment (Hadjri & Crozier, 2009).

Furthermore, when reviewing the literature, a lack of information on the landscaping performance of high-rise green buildings is appeared, there are no studies evaluate the performance of these buildings after the occupancy process. Therefore, it is important to evaluate its performance after occupancy, and this is what the current study focuses on.

1.3 HYPOTHESIS

The study seeks to find the major indicators of the effectiveness of landscaping on high-rise green buildings through post-occupancy evaluation methods.

The Hypothesis of the study are;

1- The functional, technical and social performance of high-rise green buildings can be evaluated by using landscape indicators with post-occupancy evaluation techniques.

2- Post-occupancy evaluation promotes surveying the building performance by measuring the effects of landscaping on the users of high-rise green buildings.

CHAPTER 2: THEORETICAL BACKGROUND OF RESEARCH

2.1 NTRODUCTION

Today's global issues such as climate change, energy shortages, increasing environmental pollution, increasing population and rapid urbanization pose enormous challenges to the sustainable development of human society (Sharma, 2018). Environmental sustainability standards and green products play an important role in determining the level of sustainability or the level of performance of the building as a whole, and the building classification and evaluation system requires an integrated design to achieve environmentally responsible and efficient projects in the use of energy, water and various materials throughout the entire life cycle of the building, starting from site selection through The building is designed, operated, maintained, renovated, and eventually demolished (Taha, 2014).

To ensure the implementation of the principles of sustainable green architecture in buildings through a set of tools, and to confirm whether the building is green or not, it was necessary to develop tools and methods for evaluating these buildings, and it is considered one of the most important and famous of these systems and the most common at the global and local level such as: LEED, (USA) BREEAM (UK), GPRS (Egypt), ESTIDAMA (Abu Dhabi) (Ahmed, Abd El-Rahim, & Abdel-Wahab, 2020).

High-rise buildings play an important and great role in the spatial structure and formation of the city's image, as they are important elements of the cultural landscape. The sustainable development of the cultural landscape includes adherence to certain principles

for the inclusion of high-rise buildings in the urban context (Golasz-Szolomicka & Szolomicki, 2019; Moor & Erysheva, 2018).

Numerous ongoing investigates provide a broad field of current ideas on the principles, methodology, and strategy of sustainable development of the urban landscape of the modern city. Despite the overwhelming amount of work in this direction, post-occupancy evaluation in high-rise green building has not been sufficiently studied; therefore, this chapter will focus on a theoretical framework for studies on the topic of post-occupancy evaluation in high-rise green building.

2.2 GREEN BUILDING

A green building is one that has environmental considerations an important and necessary part in every stage of construction, from design to implementation, maintenance and operation, and the main considerations that take into account are energy and water efficiency, space design for the building, resource efficiency, indoor environmental quality, and even the impact of the building with all its elements on the environment. Moreover, the main difference between traditional buildings and green buildings is the concept of integration in the construction of the building in its entirety, where a multi-tasking and multidisciplinary team of construction professionals work together from the pre-design phase to the post-housing phase to improve the environmental sustainability characteristics of the building, good implementation and provision costs and improve performance (Alzubaidi, 2013).

Green buildings provide several benefits to various building industry stakeholders, comprising the residents of these buildings and the community at large. It is known that green buildings include better air quality than traditional buildings, availability of landscaping, abundant lighting in the building, and high noise control that benefits the occupants of the building, so in light of those features green buildings become a better place and environment to live or work. A key feature of green buildings is to focus on protecting the current ecological balance, and improving environments that were badly damaged in the past. Therefore green buildings are erected on extensive and environmentally sensitive lands, with many measures taken to restore the plant life in the construction area. In addition, green buildings benefit from the least amount of materials

in order to save them, through professional design and removal of unnecessary materials in the final stages of finishing. Therefore, the construction of these buildings greatly saves on the use of materials as well as water recycling (Davis, 2007).

The concept of "energy efficiency" refers to consuming less energy to do the same work. If we compare two devices with different energy efficiency to do the same work, we will notice that the device with the highest efficiency will consume less energy to do the required work, and there is an energy label that gives us the amount of consumption in each electrical device Compared with the devices available in the market, in addition to its technical specifications and energy classification, this label is of important feasibility for implementing the concept of raising energy efficiency. When talking about achieving energy efficiency in buildings, there are several countries that have devoted great attention to the quality of materials used in construction, in terms of providing greater insulation, and thus saving energy used in heating and cooling, but there are other countries that have tended to pay attention to raising the efficiency of equipment used in ventilation, air conditioning and heating or by relying on renewable energy to secure these requirements instead of traditional energy, whether using solar heaters or photovoltaic cells to provide the energy necessary for the devices to operate (Begec & Hamidabad, 2015).

Energy efficiency in green building design is one of the most significant issues. The huge increase in the demand for energy and the quest to secure the necessary resources to cover this large consumption is of great importance, in order to enhance the concept of "energy security" in any country in the world, and as it has become clear, the grinding wars and global conflicts are not Most of them are only a goal to control energy resources and resources, and this is not new, especially since these countries are striving to maintain their energy security, and it is considered a strong card in the hands of governments to play a key role in global policies, and therefore, it was necessary to develop basic plans and strategies to manage this energy by extending its consumption period for traditional sources, and at the same time moving towards relying on renewable and environmentally friendly sources. From careful choice of windows, insulation in order to maintain air temperature, insulation of air-conditioning pipes, right placement of air and steam insulators, and clean energy use in cooling and heating, it makes the building energy

efficient. Using renewable energy, for example bioenergy, solar or wind, in order to meet energy requirements greatly decreases the carbon of buildings. Green houses emphasize water conservation through the use of highly efficient water pumping and reuse systems. Water rationalization is additional distinctive feature of green buildings that helps decrease the damaging impacts of the water use on the surrounding environment, such as marine environments, for example (Begec & Hamidabad, 2015).

The trend towards the application of energy efficiency in green buildings is important and necessary with the large increase in consumption, but it is necessary at the outset to break the barriers that hinder the application by raising awareness of the importance of improving efficiency and seeking to develop practical plans for improving energy management and collecting the necessary data for its application. We also do not forget to encourage the use of equipment and devices that provide high-efficiency lamps and building materials, and to impose the use of energy labels on electrical appliances, contributing to rationalizing consumption and reducing carbon emissions that are harmful to the environment and humans. The increase in allergies and respiratory illnesses from chemicals that release gases into the air has led to an increased awareness of the importance of indoor air inside a building. In addition, green buildings focus on reducing the occurrence of any respiratory diseases and asthma for building occupants by improving indoor air quality by controlling sources of pollution and working to reduce and eliminate them permanently through filtering and purification processes.

Green Globes, BREEAM (BRE Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design) are the most famous evaluation and assessment organizations in the world. Sustainability has become one of the most important goals in the Middle East. Countries such as Qatar, the United Arab Emirates and Lebanon have issued their own systems for evaluating green buildings, which include social, cultural, environmental and economic characteristics in architecture. The Qatar Comprehensive Sustainability Assessment System (GSAS) is one of the most comprehensive global assessment systems, while the Abu Dhabi PRS system has gained a special place in the global green building sector (Harmon & Truby, 2019).

There are many advantages of green buildings, including (Alzubaidi, 2013):

I. Cost: Green building costs are the same as regular buildings, and sometimes they cost a little more because they need special materials to build them. However, you must know that the normal construction costs will not stop after the construction process as it will always require spending money on maintenance, renovation, operation or even demolition. This does not mean that green buildings will not need maintenance or renovation as well, but since those buildings were built from natural resources, all those cosmetic or operational works of the building will take more time to be done, so the investment in green buildings is 10 times more profitable than those regular buildings.
II. Efficiency: Green buildings recycle rain and gray water. These buildings also save more energy than brick ones. It relies solely on all renewable energy resources such as wind energy, hydropower and solar energy, which are usually used for electricity and heating, all of which are directly working to improve indoor air quality. In addition, green buildings are built from non-toxic, natural and recycled materials and thus are of low cost.
III. Preserving the infrastructure: green buildings are characterized by absolute efficiency in energy use and water supply, which helps to greatly extend the capabilities of the local infrastructure and extend its life.

Green buildings greatly affect the environmental, economic and social level. One of the environmental benefits of these buildings is their dependence on biological and recyclable resources or renewable materials. The design of the building depends on the use of renewable energy such as “geothermal energy, solar energy and wood,” energy and water efficiency, and the use of good insulation methods.

The benefits of green buildings on the social level are due to the fact that they improve the quality of the environment and life by enhancing the health and comfort of the surrounding individuals due to the use of sound and heat insulation techniques and improving lighting and energy management (GBI, 2017).

2.2.1 Green High-Rise Building

The term "green" in buildings refers to the architectural vocabulary, treatments, and environmentally friendly technologies that exist at the interior or exterior design level of a building (Leskinen, Vimpari, & Junnila, 2020). Green architecture can be referred to as building practices that reduce the building's negative impacts on the environment and the health of users during the building's life cycle, and is characterized by the efficiency of resource use and the quality of the internal environment (Agyekum, Adinyira, Baiden, Ampratwum, & Duah, 2019). In addition, green building was defined as "a building that is energy-efficient, resource-efficient and environmentally responsible" (Saad, 2016).

The use of green, environmentally friendly building materials (with little or no negative impact) affects the building's sustainability. The concept of green buildings is not limited to building materials alone, but rather includes all strategies, treatments, architectural vocabulary, and technological techniques associated with renewable energy that enhance the user's health, well-being, and reduce the building's operating cost (Agyekum, Adinyira, Baiden, Ampratwum, & Duah, 2019). The studies confirm that and on the offense of the high initial costs of green buildings however, it helps to achieve significant economic savings in operating and maintenance costs in the long-term (Singh C. S., 2018).

Green building is defined as a Buildings which designed according to quality and safety standards through the principles of scientific management and technical progress in the field of construction, which aim to conserve resources, reduce negative impacts on the environment and user health, save energy, land, resources, and protect the land (Rizqa, 2016).

Green buildings aim to reduce energy demand, protect natural resources from depletion, enhance the economic effectiveness of buildings, and improve the health and welfare of their users (Lavasani, 2018; Singh, Mahapatra, & Atreya, 2010).

High-rise buildings have a great impact on drawing the features of cities and defining its architectural identity, it has greatly affect the surrounding buildings (Moor & Erysheva, 2018). With the large increase in population density in cities and the increase in land prices dramatically, a high-rise buildings has been made s as a new architectural style that

deals with these problems (Begec & Hamidabad, 2015). The mechanism of the functioning of these buildings and the nature of their structural structure affects the amount of energy consumed in them, as they consume large amounts of energy during their life cycle (Ali & Armstrong, 2008).

With the emergence of problems in the performance of high-rise buildings, the green design principles started to employ in its design. as a result of that, landscape in high-rise building was appeared as man-made ecosystem of the external and internal environment of a building, and includes; green roof, sky garden, podium parks and greenery that integrate with the natural ecosystem in buildings and urban infrastructure (Xue & Lau, 2013) which able to enhance the environmental efficiency of the building and affect positively in the comfort and well-being of its users (Golasz-Szolomicka & Szolomicki, 2019).

2.2.2 Landscaping Green High-Rise Buildings

The term "landscape" refers to an area, as people see it, whose character is the result of the action and interaction of natural and / or human factors (European Landscape Convention). The Home Quality Mark defines 'landscape' as 'an area, as people see it, whose visual features and character are of environmental, social and economic value, usually as a result of the interaction and interaction of natural and human factors, such as aesthetic, heritage, landscape, cultural and recreational. Landscaping is much more than just planting shrubs and trees and mowing the lawn. It consists of a variety of services such as masonry works, installation of retaining walls, driveway meshing, and other services that can help enhance attractiveness. It can also increase the value and functionality of property (Abdel Maaqoud, 2010).

Landscape design, also known as landscape architecture and landscape, is the arrangement and modification of features in a landscape, urban area, or garden. It involves the planning, design and management of open spaces to create urban and rural environments. Landscape design can be incorporated into a variety of projects, from parks and green spaces to parks, sports venues and large real estate such as residential projects, commercial complexes, universities, hospital complexes, etc. It can be used to regenerate or improve sites such as abandoned field sites or polluted sites and may be part of a

biodiversity compensation program to help mitigate habitat loss that may result from new development (Arcitects, 2005).

Among the many benefits, landscaping can help soften spaces between buildings, can provide connections between spaces, can provide a path for people, water and animals, can provide a space for meditation, can help improve environmental quality, etc. Well-designed and maintained landscaping can attract people to a site and can have a positive impact on property value and personal well-being. The Landscape Institute (LI) works to protect, conserve and enhance the natural and built environment for the public good. He suggests that `` landscape architecture is rooted in understanding how the environment works and what makes each place unique. It is a mixture of science, art, vision and thought. It is a creative profession skilled in strategic planning, delivery and management. (Landscape Architecture: A Guide for Clients, 2012).

This can be attributed in part to the increased lifespan of green roofs. Deterioration of standard surfaces occurs due to the stress of materials on the surface of the skin, and the aging of the waterproofing is accelerated due to ultraviolet radiation and high ozone levels. The extreme fluctuations in temperature that occur over a 24-hour period also accelerate the aging of the roof. According to the International Green Roofs Association, green roofs provide a natural waterproofing, and a bio-protective roof layer protects against natural elements and varying temperature levels (John, 1998).

Dense building landscaping is an effective factor in reducing the effect of urban heat islands. According to the International Green Roof Association, “Natural air conditioners such as green spaces and gardens can absorb up to 80% of the energy input. Landscaped roofs also reduce the urban heat island effect through the process of transpiration and humidify dry air.” The adverse health effects of indoor city pollution have also been shown to last for years, and studies have shown that vegetation is natural filters and air quality improvements for many common urban air pollutants such as nitrogen oxides, carbon monoxide, volatile organic compounds and diesel exhaust gases (Catherine, 2001).

Furthermore, building landscaping has higher thermal insulation values (increased building energy efficiency), providing heat shielding and cooler temperatures for indoor occupants, and reducing noise levels.

Towering landscapes are still relatively new to the design and development industries, and as such they lack many much-needed financial research and analysis. However, a report from the General Services Administration (GSA) highlights several cost impacts associated with dense building vegetation for conditions such as green roofs. The increasing popularity of tall landscapes among designers and developers will increase local, regional and national regulation. The industry can expect to navigate changes in land use plan or zoning codes, enforce regulations that can mandate new projects that incorporate plant landscapes into developments, or adhere to new design guidelines that require specific environmental performance values. The towering landscape has the potential to transform the entire cityscape after it has evolved into more than just vertical gardens (Ismat & Abdel Qader, 2006).

While some remain skeptical about the viability of these types of buildings and the maintenance work involved, the benefits that the buildings can provide if they are successful cannot be ignored. These include absorbing dust in the air and creating a microclimate to filter sunlight. Fehrenbacher says "Live plants clean the air and produce oxygen, help humidify indoor air, reduce rainwater runoff and urban heat island effect, and help insulate the building". "All of these trees and plants will be beneficial to the building's occupants, neighbors and the local environment." (Jasim, 2020)

2.3 THE ROLE OF HIGH-RISE BUILDINGS IN URBAN-SCAPE

High-rise buildings are strong in form and architectural height with the city structure. Their influence on the development of the planning structure is twofold. On the one hand, they provide spatial orientation for the city's residents and visitors, and visually guide public places and tourist attractions. On the other hand, spacious buildings do not dilute the perception of already existing buildings adjacent to them. The second aspect of the

effect - high-rise buildings (HD), in many cases are a negative factor, this is especially noticeable in cities with historically developed buildings (Jasim, 2020).

Moreover, high-rise buildings play an important role in the city's image, composition and spatial structure due to their apparent expression in the surrounding buildings. It also represents spatial features and is certain symbols that are original to the urban landscape in the perception and understanding of the city. So, in the absence of a specific landscape structure, it does not affect the high-rise structure of the city, which is formed based on other considerations (economic, constructive, functional, etc.) (Erysheva & Moor, 2018).

Nevertheless, if the original landscape includes a well-defined geomorphological structure, it greatly affects the shape of the building, and the problem of coordination between them arises. In this case, the landscape has a clear influence on the image and structure of this city, and sets some “rules of conduct” that the architect must take into account if it seeks harmony between the landscape and the buildings (Razumovskiy, 2016).

Basic concepts and methods of urban landscape development are formulated in the works. As well as, the landscape effect on the image and structure of this city, counting its vertical formation, has been considered in other works (Generalov, 2009). Recently, high-rise buildings are increasingly being studied for the sustainable development of the city's cultural landscape. Therefore, this problem is reflected in the works of some of foreign and Russian authors (UNESCO, 2011).

Modern urban area has become more intense. In many parts of the world, many of the major cities experiencing numerous urban phenomena namely urban sprawl. Urban public space has become more stratified over recent decades and is now developing on the surface, creating vertical gardens as well as introducing public spaces into buildings (Widiastuti, Prianto, & Budi, 2016). The green space systems in the architectural design element are significant in several projects in the modern world. It is necessary when developing megacities; considering that it greatly compensates for the loss of biologically active areas, and decrease the flow of rainwater into the sewage system and the cost of the exploitation of the building. The coverage of the walls of the building with greenery has an environmental influence of a potential larger than the green roof, because the

surface of the walls of the building is always larger than the surface area (Golasz-Szolomicka & Szolomicki, 2019). There are some examples High-rise buildings below

Figure 1: . High-rise buildings in conditions of unexpressed relief by the example of Singapore

Figure 2: High-rise buildings in a complex terrain based on the example of Hong Kong

Figure 3: High-rise buildings in difficultly dissected hilly terrain on the example of San Francisco, USA

Most often, complex structural, architectural and morphological analysis of urban landscapes of cities located in the water area and clearly defined topography are utilized as the basic research procedures. The methods for analyzing urban planning of urban landscapes have been taken into account in the works of some of authors. Thus, the analysis and generalization of the works, in addition to the conduct of experimental work and theoretical studies, allowed formulating methods of urban landscape analysis, to reveal the main principles of green high-rise buildings comprising in the urban landscape structure clearly defined topography, and to ensure their harmonious interaction (Moor, Gavrilov, & Erysheva, 2013).

Green high-rise buildings may play a dissimilar role in the architectural image and spatial structure of the city based on the condition of the initial landscape. The main natural factors that determine the role of green high-rise buildings in the spatial formation of the city include the nature of the geomorphological landscape structure, the presence of the water and the nature of the coast. As for the nature of the geomorphological landscape structure, it is mainly determined by the topography (Moor & Erysheva, 2018).

2.4 SUSTAINABLE HIGH-RISE BUILDINGS AND APPLICATION EXAMPLES

The environment in which people live is constantly changing as a result of globalization developments, to influence the social and physical environment, as a result of globalization, developments and social, material, and environmental impacts. Rapidly growing countries, uncontrolled energy consumption, all living things and ecosystem are being destroyed and causing the destruction of the energy resources of the world. The concept of sustainability in architecture, which lives in to reduce the use of energy, water and electricity will be able to control the use of resources, such as the socio-economic structure can provide continuity, and it will protect the health and comfort of people, cite some approach. In this context, the life of "sustainable design" and the lifeless in an ecosystem encompasses together all the assets that make health and aim to find solutions for safe engineering. "The simplest definition of sustainable high-rise buildings, sensitive to the use of resources in every asset period, does not cause environmental pollution, protects users' health and comfort, economically meets these standards and also builds a community that wins a positive opinion" (Begec & Hamidabad, 2015). Nowadays, the sustainable design of building construction is viewed in different directions. These are renewable natural resources emerging as active and passive sources with these trends. In this context, sustainable building construction applications may be grouped as passive and active systems under two main headings (Begec H. , 2013).

Negative systems, materials, and climate can be explained according to data from natural sources that make effective use of the structure because it is active, because the energy performance of the passive system of buildings and the building of mechanical, electronic systems, and the energy efficiency, thus the building is related to the design of architectural of the parameters. Within these criteria, the most significant is the building location, according to the location of the other building, its orientation, shape and the building shell that can be taken into account. In building energy efficiency, renewable energy sources can be evaluated, utilizing sufficient passive systems, without using any mechanical and electrical system components as a layout created with. Passive regulations that can be given for the first example in 1982, the National Commercial Bank in Jeddah is the building. Triangle plan scheme on the atrium and fields of the sky garden,

and the exterior facade of stone, while the tiger sky overlooks the glass-covered courtyard facades, and the chimney effect Vertical layout of the courtyard in the sky by creating the movement of air and heat in the internal temperature of the building is 10 ° C, which reduces of cooling costs (Begec & Hamidabad, 2015).

In recent years, the use of wind energy in buildings has become increasingly important. The rate of carbon dioxide emission from wind energy is very low and it is one of the most economical sources of renewable energy, to take advantage of wind energy in the construction of buildings if it is using wind turbines. The structure height increases the wind directly deprived of interruption if it is in interaction with the structure, the wind speed increases in direct proportion to the heights and taking advantage of high-rise buildings with this feature, turbines can produce large amounts of electricity. In designing high-rise buildings, it is necessary to take into account parameters such as building aerodynamics, wind velocity density, wind turbines in planning the application design stage site plan, wind in the form of local wind patterns, wind speed distribution frequencies and prevailing wind direction, Therefore, each building has very different features from the other. The application forms of wind turbines in composite building and independent and integrated building in building can be studied in three groups of them. Wind turbines are mostly applied in high-rise buildings in an integrated way. When tall structures equipped with a wind turbine are examined, three methods are applied, roof sealing, under roof sections or between blocks (ALI & ARMSTRONG, 2010).

Figure 4: National Commercial Bank

It is also possible to produce thermal and electrical energy in the building using solar energy. Equipment such as photovoltaic panels, solar collectors and building integrated photovoltaic (BIPV) can help us in this context. Potential implementation of a photovoltaic panel in high-rise buildings is higher than in low-level buildings; for the reason that adjacent buildings are higher; they are more capable of directing solar radiation. PV is the most important issue regarding the use of structure aesthetics and high efficiency to receive a large amount of PV panel arrangement when necessary (Begec & Hamidabad, 2015).

2.5 LANDSCAPE OF HIGH-RISE BUILDINGS

One of the most significant features that distinguishes sustainable buildings from traditional buildings is the application of the integrated and interconnected design system, through which the building is treated as an integrated system and not only a construction process, starting from the pre-design stage until the end of the building life cycle. Working in green buildings with a coherent design system requires all team engineers to have knowledge of many technical techniques related to engineering disciplines other than their main field of work. For example, an architect has a lot of details about electromechanical works, maintenance, operation and facilities management, because all the tasks of those disciplines are discussed during the pre-design phase. Such as increasing daylight to achieve an improvement in the quality of the indoor environment,

it will have a positive effect on energy conservation in order to reduce lighting loads, but it will have a negative effect due to the increase in air conditioning loads (Arcitects, 2005).

Integrated green space building systems allow green space to be provided outside the traditional garden, into the building itself and even become an important part of the building. Moreover, these techniques are suitable and give a noticeable change in urban areas with high population density. Consequently, in the technological aspect, the construction performance of green space systems has been improved, thanks to the provision and development of a new base system, automatic irrigation systems, and integrated drainage systems. All of these previously mentioned techniques help a lot to make landscaping lighter in terms of weight, more efficient and quality in water use, and most importantly, they reduce maintenance work, and eliminate problems in water leakage that could occur in the building (Jasim, 2020).

Rooftop cultivation is a technology that provides a wide range of tangible and intangible benefits to communities interested in improving and promoting a good environment. Green roofs have many benefits, as they regulate the heat of the building, heating it during the winter and cooling it during the summer, and also contribute to reducing rainwater leaking from the roofs; this is because it acts as a sponge that absorbs water and at the same time plants benefit from this water.

Green roofs also reduce pollution as they act as a filter to purify the air. One of the benefits of green roofs is that they play an important role in reducing noise, which is one of the problems of the modern era, especially in cities. In recent years, green roof infrastructure has been very popular in Europe, and has also gained significant popularity in North America, Australia and Singapore. Obviously, green roofs are more suitable for existing buildings in urban areas. This is because its inaccessibility does not add significant loads to the roofs, does not pose any dangers and its system is light in weight. In order for the roof of the building to be suitable for the green roof, it must be relatively flat, and fairly wide with easy access for installation and maintenance to avoid periodic breakdowns. As it is known that every green roof is distinguished from any other green roof because in most cases it is designed with objectives to reach multiple performance results. Currently, green roofs are at the forefront due to their ability to mitigate many common environmental problems in urban areas as follows:

Storm water runoff

In urban areas, natural areas that are well adapted to rainwater capture are replaced by impermeable surfaces, such as roads or buildings. Thus, during major storm events, water flows rapidly from these streets and fortified rooftops, overburdening storm sewers, treatment plants, and nearby streams and lakes. Therefore, green roofing systems capture rainwater directly, filter it well, and release it slowly when compared to traditional roofing materials, significantly reducing total rainwater runoff volumes. Therefore, many of the benefits of natural rainwater control are restored through the installation of green roofs in buildings. If implemented on a large scale, green roofs have the high potential to decrease rainwater run-off and many pollution problems that occur from a non-point source in suburban and urban environments.

Urban heat island effect

Most cities are built largely of concrete, asphalt, and bricks - materials that absorb and store heat during the day. As it is known, the higher the temperature in an area, the more people will use air conditioning. In fact, air conditioning technology exists all over the world, and it is expected that about two-thirds of the world's households will have an air conditioner by 2050, not to mention that the energy demand to cool buildings will triple, but unless the energy comes from renewable sources, this the additional demand will generate more greenhouse gas emissions that contribute to global warming. Logically it's like a vicious circle, but smart building design can keep buildings cool without air conditioning and contribute to climate change. Conventional roofs also absorb heat and can reach temperatures of 80°C. Therefore, re-radiation of heat in buildings can lead to higher air temperatures in large cities compared to rural areas and neighboring small cities, an effect that is especially evident at night. This phenomenon is known as the "Urban Heat Island" effect. As a result of rising temperatures, the use of air conditioners has increased, which in summer puts pressure on local electricity distribution networks. Green roofs can help reduce the urban heat island effect, as flowing vegetation lowers air temperatures, traps soil and vegetation, and absorbs heat, and trapped storm water allows for many of the remarkable benefits of evaporative cooling. The heat island phenomenon, in short, is the increase in temperature in certain areas in cities due to various factors such as heat generated by asphalt made of cement. Therefore, planting plants on the roofs of

buildings that can store a large amount of heat helps reduce the effect of "Urban Heat Island." Knowing that this solution will not be effective unless it is implemented on a large scale and must be through careful study of all environmental variables, we only see one building that contains a plant roof among a large number of buildings, which means that its impact may be unnoticeable from the ground up, and officials must intervene to issue laws that oblige owners of buildings, especially large ones, to plant plants on roofs. The cultivation of roofs also contributes to reducing the effect of the phenomenon of heat accumulation in the built environment, which is also known as the urban heat island effect, which is clearly evident during the summer months, through the shading that plants do on the roof of the building or house.

Air quality

Green roofs indirectly help mitigate air pollution problems e.g., smog and ozone formation that increase health complications. Rooftop plants can directly contribute to improving air quality by trapping and absorbing nitrous oxides, volatile organic compounds and particulates. There are many positive effects of rooftop cultivation on the environment and quality of life in cities, as rooftop cultivation reduces the amount of pollutants in the air, as it was found that cultivating one square meter of rooftop throughout the year leads to the removal of 100 grams of pollutants from the air annually, which purifies the air of cities. Green roofs increase oxygen, reduce carbon dioxide, clean the roofs of buildings and various facilities, and get rid of trash and dirt stored on roofs that negatively affect public health in the long run. Green roofs also help improve air quality by capturing airborne pollutants on leaf surfaces and filtering harmful gases.

Energy conservation

The cultivation of gardens on the rooftops of buildings goes beyond the limits of achieving aesthetic goals to include achieving psychological and functional goals such as protecting the building from sudden climatic changes, saving energy consumed inside the building as well as reducing air pollution, it aims to move the garden from ground level to higher levels in an attempt to provide the natural environment Suitable for human growth and contributing to his psychological balance and his connection to the land from which he was separated as a result of his residence in the city with its densely populated

population, one of its negatives is the lack of green spaces. Green roofs help reduce energy consumption and costs. Green roofs are most effective when the roof of the structure is flat or slightly sloped. Moreover, garden plants will spread which will reduce the temperature of the inlet air and reduce the building's air supply cooling costs. Green roofs reduce rooftop temperatures, and as such the achieved cooled roof is ideal for solar panels that have become more efficient, reducing overall energy costs (Editorial Staff, 2015).

Landscape plays a major role from the physiological point of view of the human being and thus improve the condition of society as a whole. They have an effective role in achieving psychological and physical balance for the user, providing fresh air and natural scenery. It also opens the way for contemplation of natural beauty and the ability of God to achieve psychological calm and tranquility, and interaction with nature reduces Constant pressures of work (Hussain, Ramzi, & & Nizarudin, 2014)

The design of Landscape is a significant part of the broader design process as it is a beautiful addition to a building, allowing interface between all building elements and details such as building design, building orientation, site conditions, and landscape proposal development. This presents the best opportunity to maximize the landscape benefits of the buildings and their occupants. It should not only be seen as an aesthetic review, but should be well understood as a feature that provides many important green services to a building including water efficiency, indoor air quality, energy efficiency, pollution reduction and other benefits. Landscaping contributes to broader efforts to reduce the negative impact of buildings on human health and the natural environment. Its design encourages efficient use of energy, water and land while minimizing waste and pollution. Landscaping in particular helps address the "heat island effect," which occurs when temperatures in urban environments are higher than in surrounding rural areas for urban wildlife. To this end, it is widely believed to enhance productivity, improve physical health, and create a greater sense of community. (Morsella, 2009).

The green wall is referred to as landscape design. There are many terms used by earlier academic researchers such as bio façade wall (Sunakorn, 2008), vineyard on wall, bio-shading, living wall, green façade (Köhler, 2008), greenery, the Vertical Garden as well as the Vertical Garden (Blanc, 2008). Sonakorn (Sunakorn, 2008), a green bio façade wall is a biological building skin in which it displays a mixture between the natural and

the built environment. In addition, green wall Australia reports that a green wall in buildings is a system for attaching plants to all walls of buildings, workplaces and homes. This system can be distinguished into two categories; Carrier system and support system (Wong, 2003). A transport system refers to plants that are packaged and contain growing media on vertical surfaces fixed to a wall, while a support system refers to plants that are directed to climb through structures such as cables or wires. In addition, there are two main types of green walls which are living walls and green facades. For the living wall category, there are three subcategories under which modular living walls, plant mat wall as well as horizontal wall fall. Also, within the category of green facade, there are two sub-categories that include modular trellis panel system in addition to cable and wire network system (Abdul M. A. Rahman, 2011).

Studies have confirmed that cultivating the rooftops of buildings and facilities instead of using them to store trash has many positive effects on the urban environment, quality of life, protection of natural resources, combating poverty and increasing income. The area's efforts to develop more green walls may provide useful insight. They are created by planting climbing plants at the base of the wall. They have been around for centuries and are widely recognized for reducing the temperatures of walls and buildings. To date, studies have focused on the performance and design required to integrate green walls with gray water treatment facilities. Nevertheless, modifying prototyping solutions to reflect the needs of green roofs is by no means impossible.

Qatar seeks to promote and enhance sustainable development as it grows. Qatar is a country with a vested interest in climate change mitigation, given the extreme and irreversible changes. It would render life in Qatar uninhabitable if temperatures exceeded those specified in the Paris Agreement (Jeremy, 2016). Given that inefficient buildings are a largely contributing issue to the country's emissions levels (40% in the European Union), targeting this contributor is an effective way in order to mitigate climate change. These developments may then be taken into account in the Paris 4 Assessment Report for Qatar (Jon M. Truby, 2018). Qatar has an opportunity for energy efficiency in residential homes, but there are few incentives or regulations available for homeowners to make necessary upgrades to their properties. Moreover, legal obstacles may in some cases

prevent such investment (Harmon & Truby, 2019). Here is example of building with green roofs (Editorial Staff, 2015):

Figure 5 Punggol Breeze: Singapore: 2012

To realize Punggol Breeze's vision as a lush and serene getaway, a concerted effort has been made to integrate the vast green spaces and integrate them with the residents' communal spaces. One of the highlights is a 270-meter rooftop garden above a multi-story car park, which is currently the longest roof garden in Bongol. While the expansive green space helps reduce heat and glare, the central location of the area's rooftop garden allows residents to enjoy stunning views of lush foliage from their homes. To facilitate the strengthening of family bonds, as well as encourage interconnectedness and community interaction, social and recreational spaces have been designated for facilities such as children's playground, fitness corners and rest shelters for informal gatherings.

2.6 POST-OCCUPANCY EVALUATION APPROACH ON GREEN BUILDING PERFORMANCE

Construction is one of the contributions to the environment. The world continues to search for a way to reduce the environmental impact of a building through the implementation of green buildings. Green buildings can reduce the impact on the environment because they are designed, constructed and operated according to an environmentally friendly concept (EPA, 2016). Green spaces are one of the urban means to achieve ecological balance within the urban mass, taking into account the environmental design of green

spaces within the city, it is possible to find spaces that do not constitute an additional heat load and thus achieve a comfortable field for human activities within these spaces (Hassin & Azlani, 2018).

Green spaces improve the general health of the population as they give people oxygen and absorb what is expelled from carbon dioxide, and therefore they play the role of improving air quality and thus maintaining population health. It plays an important role in achieving the non-material needs of the users through his practice of different types of activities and sports such as running and walking, which achieve his physical balance. Green areas play on achieving security, as reports and scientific research confirm the link between the crime rate in a region and the extent of environmental deterioration for this region, and on the contrary, when the region is supported by plant elements. Green spaces improve and soften harsh climatic conditions, as their use within urban spaces increases the thermal balance of the urban mass and helps reduce and mitigate high temperatures in the summer and prevents them from dropping sharply in winter as a result of radiation. It reduces the emission of carbon dioxide and thus controls climate changes at the level of the percentage of harmful gases. It also affects fresh water sources in quantity and quality through the balance they do and the production of oxygen that dissolves in water, and therefore it is considered one of the necessities of life on Earth. The Green Building Index is a tool provided by the Malaysian Institute of Architects to assess the green aspect applied in the building and the building will be awarded according to this point. Some of the criteria that will be used in the assessment are energy efficiency, sustainable site planning and management, indoor environmental quality, materials and resources, water efficiency and innovation (GBI, 2017).

Some consider post-occupancy evaluation to be one of the basic design stages, whose role comes after the building is occupied and then results in the entire design process (Hamada & Fawi, 2015). The post-occupancy evaluation period depends mainly on its existence automatically, as the post-occupancy evaluation is in fact always and unintentionally by the building users always, because there must be an interaction between the user and the building after which the user makes a change in the building by changing the furniture or suspending by feeling Comfort or lack thereof when using it for a specific space, but this evaluation is done without a method and without organization, so it does not have real

benefits, and at the basic level there are three main purposes for building design, which are (Federal Facilities Council, , 2002):

- Protecting people and equipment from external factors.
- Providing the interior space that matches the furnishings, and the interior colors that suit the activities that take place inside the building.
- Providing the necessary infrastructure to implement the activities according to the type of activities performed inside the building.

At the present time, individuals and organizations strive to ensure that the building does not achieve the best results in all the desired objectives of their building (Hamada & Fawi, 2015). Some studies have shown a relationship between high rates of asthma and respiratory diseases and air quality, especially in indoor spaces. In the past twenty years, data has revealed that increases of seventy percent of childhood respiratory diseases cases were caused by indoor air pollution. That child who resides or occupies a building with poor indoor air quality will tend to develop more illnesses. Michel rule, indoor air quality is more polluted than outside air and is more affected by the outdoors. This is because the air is trapped in space and does not get enough ventilation. Then the air will be polluted (Hassin & Azlani, 2018).

Tuhus (2010) noted in her studies that although the building received the platinum award in the Green Building Certification, it still scored zero out of fifteen points in indoor environmental quality. Pesticide applications in the building may result in poor indoor air quality. Because there is no requirement to inform the passenger of the chemicals that have been used, the potential health effects, or the rate at which they disappear into the air. This happened due to the lack of experience necessary to monitor the air quality in the building. Hence, this proves that not all green buildings are well maintained and have great environmental value, nevertheless instead green buildings focus more on decreasing the building cost. To solve the problem, the post-occupancy evaluation method is used (Hassin & Azlani, 2018).

Moreover, Anna (2014) notes in her study that POE is important to ensure that performance is built through appropriate assessment tools. POE can be the most effective way for the contractor, clients and design team if they implement this way in which this

method can reduce the environmental impact of the building, and in another way, it can solve the above problems and problems. POE can also reduce the cost of construction by reducing the environmental problem of the building. Anna (2014) also stated that POE is useful for gathering information and providing information to the client, contractor, and design team. By doing this work, they will also review critical problems and issues that affect the building's performance and design. On the other hand, it will encourage them to find a solution for the building and work on its development and improve the performance of the existing building well (Hassin & Azlani, 2018).

There is a scarce way that have been advanced to evaluate the performance of many buildings and one of them is Post Occupancy Assessment. Barlex (2006) stated POE is a method to provide feedback throughout the building's life cycle from initial concepts to the profession. The information from the comments can be used to inform future projects, whether they relate to the handover process or the technical performance of the building. Whereas Preiser (2006) noted that POE is an analytic tool and a system that allows facility managers to systematically assess and identify aspects necessary to a building's performance (Preiser, 2006). According to Preiser (2001) citing Turpin- Brooks and Viccars (2006), the level undertaken will depend on availability of financial resources, manpower, time and the result required. Thus, the general approach for each level will include planning the process, conducting the study, and interpreting the results. POE level is diagnostic, investigative and indicative. As well as the standards of buildings generally mentioned in POE are materials used, services rendered, cleanliness, ergonomics, noise, thermal comfort, facilities, lighting and ventilation. All of these criteria will be used to gauge the level of satisfaction of the building's occupants (Preiser W. , 2003).

CHAPTER 3: METHODOLOGY & CASE STUDY

3.1 METHODOLOGY

Research methodology is considered as a systematic approach, in order to achieve the aims and objectives of this study, the quantitative analytical method will be adopted for this research study. A post-occupancy evaluation approach will be used, where three dimensions of performance will be evaluated including functional, technical and social of landscapes in green high-rise buildings. An assessment tool will be built based on the three axes (functional, technical and social). It will utilize the quantitative survey in order to provide a full background with the most knowledge that explains the phenomenon (post-occupation evaluation of high-rise green building landscapes in Doha).

Indicators will be measured for social performance by conducting interviews with users, and for job performance by monitoring the selected buildings, and indicators for technical performance will be measured through interviews with professionals. The Study population consists of the occupants of high-rise green buildings with landscape in the city of Doha. A questionnaire designed by the researcher will be used to evaluate post-occupation of high-rise green building landscapes in Doha, the data will be approximately three divided into three parts: workers, public visitors, and residents of the place or students. This survey will be used to collect primary data for this study and to test the study hypotheses.

Two of the buildings will be selected as a sample for the study and will do a survey and compare the buildings on a table, then it will be circulated after the confirmation of results in order to lead the researcher to obtain the targeted results.

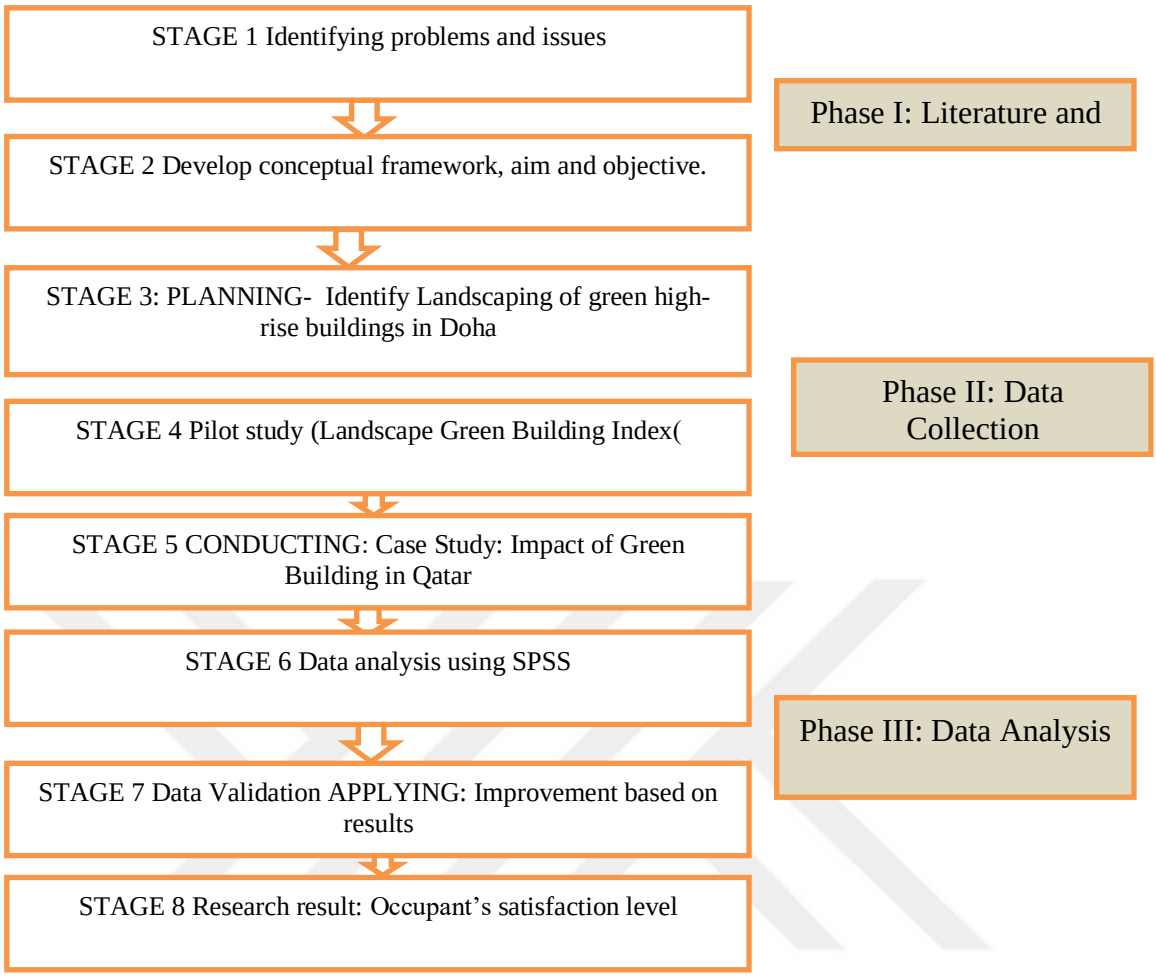

Figure 6 :Research design digram

Research methodology can be defined simply as the way of thinking that a researcher, explorer, thinker, or even scientist uses to search for various phenomena, and the way he shapes his thinking and actions while exploring his research topics, which are organized and arranged in a sequential manner, in order to lead him in The end is to reach the results in his various research plans, and they are in the form of arranged and studied steps, through which ideas are organized and analyzed, therefore, the methodology is developed according to the researcher's ideas and attitudes (Cooper, 2006). This chapter will address the methodology used in this study and explain the steps for preparing and developing the study tool, as well as providing a description of the population, the study sample, the procedures that took place in the study, the sources of access to information, and the statistical methods used in data processing and analysis.

3.1.1 Research strategy

The research strategy is all the steps that the researcher follows from the beginning of the study and after determining the objectives or purpose of the study until the completion of all the objectives of the study, which may be by testing a hypothesis or finding solutions to a problem or a number of problems studied by the researcher.

One of the important points that the researcher must pay attention to is to justify the research strategy that he will adopt in his study, where the researcher justifies his choice of the research strategy that he or will follow in his study and why he chose this strategy. Of course, this justification must be based on a strong foundation so that the researcher uses the various references that explain the reason for choosing this strategy and not others. Sanders et al defined the search strategy as the criteria upon which the researcher relies, in order to accomplish his tasks (Saunders, 2007). One important fact to mention is that each strategy can contain a different type of approach such as case study research, empirical research, surveys, interviews, etc.

Therefore, the main strategy used in this study is the survey, which is considered the most appropriate method for data collection. This method is important in the case of collecting information related to a particular research topic, so it is resorted to inventory all the concepts and vocabulary of this community, so the researcher seeks to attract data related to the individuals of the research community without an exception, and this method is unique in its comprehensiveness, accuracy and impartiality, but what is wrong with it is the urgent need for time, effort and high cost. In order to accomplish this research in a professional manner and with a high degree of realism, a large number of samples are needed to be surveyed, and surveys are the most effective and best way to do this.

3.1.2 Data Resources:

To achieve the objectives of the study, the researcher sought to use two main sources of data collection:

Secondary Sources: Secondary sources are defined as documents that treat primary sources, describe them, discuss them, analyze them, evaluate them, and summarize them; Where it is used in order to determine the appropriate primary sources for research; It

contributes to providing useful information to access it, such as providing the researcher with important dates and places, and the names of people, organizations, associations, government bodies and others related to the topic of the research, and it also contributes to providing the researcher with information about the topic of research, and to achieve this the researcher must use some reference materials such as encyclopedias, and research In books and other documents using the library catalog, in addition to using databases to search for scientific articles.

Primary Sources: Primary Sources is defined as the oldest material on a subject, and in another form it can be defined as all that was written by the authors themselves of documents and studies or by people who witnessed an event and recorded what was seen in order to benefit others from what was recorded and be a source them to obtain information; Primary sources help to document the link between the present and past events by identifying the achievements of people who lived in the past in various fields, and giving contemporary researchers a realistic sense about those past achievements and events, which helps in understanding them in greater depth. The researcher used a questionnaire for the study, which was developed for the purpose of collecting information from primary sources. The questionnaire comprised some questions related to the variables, and hypotheses of this study. Thus, for this study, the primary data will be collected through a Likert scale questionnaire (Kennedy.A, 2015). This data will be used as a primary source because this is the data that is collected for the first time for this research only and no data from the other research will be used. The primary source of the data will be helpful in the research as it will be without any influence (Hage J, 2011).

3.1.3 Study tool

The tools of the study in scientific research are all that the researcher uses of information collection and data analysis tools, with the aim of obtaining the questions raised in the scientific research related to the research problem. It is posed by the human mind about the phenomena that surround it, whether they are social, behavioral or cosmic. The researcher used the quantitative analytical method by using the questionnaire tool for the study by referring to a set of previous studies in order to measure the variables of the study and to answer their questions.

3.1.3.1 Quantitative Research

In quantitative research, a structured and closed-ended questionnaire is made. Quantitative research is based on numbers and the analysis will be based on these numeric data. Quantitative data is mostly used in the exploratory research in which data in the forms of numbers will be collected from the respondents (Blake, 2015). The variables that are used in the study are quantified and then the analysis is carried forward.

In the current study also, quantitative data will be collected from the workers, public visitors, and residents of the place or students in Doha, the variables will be quantified and then it will be analyzed (Fagerberg, 2014).). Quantitative research will minimize the subjectivity of the research as it minimizes the understanding of problems and possibilities. Quantitative data is easier to understand and interpret as there is no subjectivity in it. In contrast, if the data is more toward subjectivity and qualitative so too will create ambiguity in understanding and interpreting the data. The Likert scale questionnaire will be designed as statements and it will be quantified as 5 will represent strong agreement with the statement, 4 will represent agreement, 3 will show a neutral response, 2 will show disagreement with the statement and 1 will show strong disagreement with the statement.

3.1.3.2 The advantages and disadvantages of Questionnaires

Questionnaires are methods of collecting data that can be create support hypotheses or help them (Cohen, 2011). The main aim of the questionnaires in this study is to evaluate the post-occupation of the high-rise landscape of green buildings in Doha.

Gill explained that the main properties of survey are its capability to focus, build, and work to ask a different of questions in a way that is easy and clear to all participants. Furthermore, the data collected should be simply examined and the questions should be impartial. So, when designing the questionnaire, five topics should be considered such as; Questionnaire focus, answers type, complete order, questionnaire gradation, and question type (GILL, 2002)

The researcher will make inquiries directly related to the research topic, which can allow an easy understanding of the post-occupation evaluation of the high-rise green building

landscape in Doha. The researcher makes sure that all the questions are related to the topic and that the correct nomenclature is used in the questions. One of the benefits of using the online questionnaire is that this method will ensure transparency in the answers due to the lack of communication between the participants, while the main disadvantage of the online questionnaire is that the response rate is low when compared to other methods (Cohen, 2011).

3.1.4 Statistical methods used

The questionnaire is one of the most important tools that researchers rely on in collecting data for scientific research, because the questionnaire was the only tool in the old days to obtain data, and therefore the interest in statistical analysis of data, and before the emergence of the SPSS program, researchers were manually analyzing the data contained in the questionnaire, This method was cumbersome for the researcher and does not provide accurate results due to the huge amount of data that the researcher needs to analyze and process, and sometimes the researcher may need to use some complex functions that take periods of time and great effort in order to obtain their results accurately, and therefore the results that will Obtaining it as a researcher will not contribute significantly to achieving the goals of your writing for scientific research. Therefore, to achieve the objectives of the current study and analyze the collected data, several statistical packages for the social sciences (SPSS) program were used, and in general, the following main statistical methods were used:

1. Standards of descriptive statistics:
    - Standard averages and deviations
    - Duplicates and percentages:
2. Analytical Statistics:
    - Alpha Kronbach test.
    - Single sample testing (One- Sample T Test)
    - Multiple regression analysis.

3.1.5 Impact of Green Building in Qatar –A case study

Qatar has witnessed rapid and visible growth in the construction sector, and has confirmed its willingness to go green and focus on designing more sustainable buildings. The reasons for this decision are due to the country's desire to improve the environment by reducing carbon dioxide emissions and reducing energy consumption, as sustainable development is one of the important principles stipulated in the Qatar National Vision 2030 published in July 2008. It calls for concerted efforts from two important sectors. The private sector and the public sector participate in realizing the country's future vision by participating in sustainable development initiatives side by side with the government (Davis, 2007).

The green building sector is one of the developed sectors. Qatar ranks among the most developed countries in the green building sector in the Middle East and North Africa region, especially as it has the second largest number of green buildings in the region, and many projects have been constructed for the Public Works Authority, the Ministry of Municipality and Environment, Qatar Foundation projects and the Msheireb Qalb project. Doha, Lusail, and all government projects follow green building standards, whether related to local regulations such as the "GPRS" system, or international systems such as the "LEED" system.

In the United States, LEED® is the dominant green system on the market and is currently being adapted to multiple markets around the world. Because of its ease and simplicity as a third-party rating and accreditation system, LEED has become an internationally accepted and recognized standard for the operation, construction and design of green buildings. However, relying on this system to assess a building's sustainability may cost more in the Middle East than in the United States. Therefore, cost is an important challenge in achieving this transition to sustainable buildings, especially when it comes to private sector investments. The main concern of many developers and building owners is the potential increase in initial costs (Fowler, 2006), because they believe that the cost of switching from the traditional buildings, they use for construction to buildings with a new sustainable design will have a significant cost impact and can add further burden to the building. their investment in Qatar. Several studies have been conducted to compare the cost incurred due to the application of the USGBC LEED rating system to certify

buildings for conventional designs (Dorgan, 2002). These studies concluded that the largest parts of these costs result from the following (Gregory, 2003):

- Improved Architectural design.
- Use of sustainable and conservative mechanical and electrical systems.
- Commissioning consultant and commissioning agent fees.
- Employ specialized green Design Consultant

In Qatar the cost effect may vary and the items to consider may differ from the USA for many reasons, such as implementation of energy policies, local legislation and availability of local manufactures, materials and resources. All of this could have a different cost impact of green building implementation in the region compared to green building in the United States. These factors will be investigated and presented. The study will not investigate the cost impact of operating green buildings (Alzubaidi, 2013).

The vision of the Qatar Green Building Council is completely in line with the inspiring vision of His Highness Sheikh Tamim bin Hamad Al Thani, Emir of the State of Qatar, who can help the country to support the path of the State of Qatar to transform from an economy dependent on vibrant natural resources such as oil and gas to an economy based on knowledge and sustainable development. It shows the importance of green buildings that are totally linked to the economy, especially as they work to save the state's resources from fossil energy and achieve huge financial savings and contribute to rationalizing and controlling expenditures because green buildings rationalize energy consumption by between 20 to 60 percent according to the classification used in the building. The state has very large quantities of subsidized energy that is directed to individuals, which means exploiting that energy in various industries or benefiting from its financial revenues if exported abroad (Alzubaidi, 2013).

Green buildings were a growing priority for Qatar. Both QNV 2030 and QNDS explicitly incorporate sustainability principles. In addition, Qatar was one of the first countries in the Middle East to establish a Green Building Council to promote LEED® certified projects and education. It also independently developed one of the region's first green building certification systems, the Qatar Sustainability Assessment System (which later became the Gulf Sustainability Assessment System and is now the Global Green

Sustainability Assessment System or GSAS). More importantly, Qatar has included green buildings in the latest version of the Qatari Building Specifications (QCS), and has imposed the achievement of some sustainability standards in all new government construction projects. Some large development projects have voluntarily included green building technologies, most notably as the city projects. Lusail, Qatar Railways (metro), World Cup 2022 stadiums, Ashghal projects (schools and mosques), new port and new naval base. In 2012, the Qatar Green Building Council developed the first passive house experience in the region, in partnership with the Qatar General Electricity and Water Corporation (KAHRAMAA) and Barwa Real Estate Company, with support from engineers from Texas A&M University in Qatar (Tamouq). Sustainable villas were developed features next to a villa using traditional building features. Two similar families were moved to each villa. Operating expenses and building resources were monitored for each villa. During the winter, the dormant house generated an excess of electricity, which was reconnected to the electrical grid

Qatar's National Development Strategy includes goals related to green buildings, including the implementation of the Green Building Law to improve efficiency in building design, which will include standards for "elements as better insulation and increased shading and reflection". After the introduction of the "Qatar Estidama" green building rating system, which will be applied to public buildings, it is also scheduled to later include new residential and commercial buildings (Harmon & Truby, 2019).

Nonetheless, many market-based incentives have led to the development of green buildings in other markets not found in Qatar. While government policy making is focused on the executive branch and entrepreneurs are predominantly Qatari, other stakeholders in the process are diffuse. Many organizations and individuals from multiple countries participate in the creation, planning, development and implementation of development projects. This leads to non-uniform approaches to development, even within the same project. Likewise, there is currently no standardized system for sourcing materials. The current shortfall in building stock allows rental or purchase prices to inflate, regardless of the build quality or the cost of operating and maintaining the facility. This is exacerbated by the fact that expatriate residents are only allowed to purchase real estate in certain parts of the country. Due to the inelasticity of demand, owners can

transfer operating costs almost exclusively to tenants. As such, there is no incentive on the part of the owner to voluntarily incorporate green building features. Moreover, the lack of property and personal income taxes and lower utility prices remove the incentives for deduction and tax credit that exist in other markets to voluntarily adopt green building strategies (Harmon & Truby, 2019).

This study will be conducted on a number of buildings, including a residential part of the city of MSHEIREB and AKIG HERMAS PROJECT is located in Lusail.

3.1.6 Population and Samples

The study population in the current study consists of all the occupants of high-rise green buildings with landscapes in the city of Doha in, construction workers, architects or visitors to these buildings. Due to the impossibility of covering the entire study population, in terms of cost and time consumption, a simple random representative sample was selected from the study population consisting of (270) individuals from architect , visitors and workers in two of these green buildings as a sample, and electronically designed questionnaires were distributed online via google forms for the target sample because it is considered the easiest, fastest and highest coverage data collection technique (Cooper et al., 2006).

3.1.7 Research Validity and Reliability

Validity and reliability are concepts used to evaluate research quality. Validity and reliability refer to how well a method, technique, or test is at measuring something. It is important to consider honesty and consistency when creating your research design, planning your methods, and writing results, particularly in quantitative research. Validity and reliability are closely related, but they mean different things. A measurement can be reliable (constant) without being valid (true). However, if the measurement is valid, it is usually also reliable.

3.1.7.1 Research Reliability

This concept expresses the ability of any research to generate the same outputs when continually utilising similar methods for different research fields, eras, or different kinds of responders. Validity refers to how accurately a method measures what it aims to measure. If the research is highly valid, it means that it produces outputs that correspond to real characteristics, traits, and changes in the physical or social world (Garson, 2001). Reliability refers to how consistent a method is in measuring something. If the same result can be achieved consistently using the same methods under the same conditions, the measurement is considered reliable i.e. it is constant. The main objective of the benchmarking tool is to realize that the same outputs of this research can be generated when using the same inputs. Depending on the fact that respondents have different ideas and morals, responses to any survey vary, not because the survey items are confusing or unclear.

The methods and tools used in this research are almost reliable, as they are directly investigated according to several previous research. The study was followed by a discussion of the data and analysis of the collected data, in addition to presenting recommendations for future research in the following chapters. It also aims to include "the comprehension of all the elements that must be included in the analysis on the one hand and the clarity of its paragraphs and vocabulary on the other hand, and the validity of the study tool has been confirmed as follows: The veracity of the questionnaire was confirmed in two ways

1. Virtual honesty of the tool (sincerity of arbitrators).
2. Confirm the internal consistency of the questionnaire paragraphs.

Assessing validity is more difficult than assessing reliability, and is actually more important. Since the researcher in order to obtain useful results, he must use honest and valid methods of data collection, meaning that the research must measure what it is supposed to measure, which ensures the final validity of the results of this research, and this is the goal of the validity and reliability tests (obtaining correct results that can be generalized).

Moreover, the questionnaire reliability was verified by conducting a pilot study on a sample of 30 individuals from residents, students, visitors and workers in high-rise green buildings with landscapes in the city of Doha, other than the members of the original sample. The reliability of the tool and its components was determined by SPSS' Alpha Cronbach test before distributing the tool to the study sample members and conducting the real study. Table 3.1 shows the Cronbach alpha values for the overall questionnaire and its different parts.

Table 3.1: The results of Cronbach' alpha reliability test

No.	Variable	Number of Items	Cronbach's alpha value
1	Functional performance of high-rise buildings	17	0.878
2	Technical performance of high-rise buildings	19	0.889
3	Social performance of high-rise buildings	18	0.921
Overall, Tool's Items		54	0.910

As shown in Table 3.1, Cronbach's alpha was determined to be (0.878) for elements of the first dimension (functional performance of high-rise buildings), (0.889) for elements of the second dimension (technical performance of high-rise buildings) and (0.921) for elements of the third variable (social performance of high-rise buildings). Moreover, it was (0.910) for the overall instrument elements, which means that the reliability of the questionnaire is acceptable as long as Cronbach's Alpha values for each of the variables as well as the whole questionnaire's elements are higher than (0.7) (Graham, 2006).

3.1.7.2 Research Validity

The validity of the research can be estimated by referring to the accuracy in measuring the required research topics and according to the possibility of any kind of errors, especially with the collected data and research results (Garson, 2001). The survey questions in the current study have been formulated in a rigorous manner based on relevant previous theories. The data sources collected are reliable, as most survey respondents have good knowledge of post-occupation evaluation of the high-rise landscape of green buildings. Survey statements were designed based on literature reviews and other existing references that are relevant to the research topic. The

questionnaire was tested by the respondents before the start of the survey in order to ensure the clarity and objectivity of the questionnaire. Furthermore, several professional academics have revised the content of the prepared questionnaire and the final version of the questionnaire has been modified with reference to their instructions. The motives and objectives of the study were also presented before collecting any data in order to get to know the respondents about the idea of this project, and all the strategies mentioned previously confirmed the validity of the research.

3.1.8 Summary

This chapter provides an overview of the methodology used in the current study, a description of the community and a sample of the study. It also explained the steps of developing and preparing the study tool, the procedures implemented, the sources of access to data, and the statistical methods used in data processing and analysis in the study.

The next chapter will review the findings of the field study, describing the characteristics of the sample members of the study. It also describes the responses of the members of the study sample to the sections of the study tool and its variables. The following chapter also includes the test of the hypotheses that the study seeks to answer.

3.2 POST-OCCUPANCY EVALUATION OF CASE STUDY

3.2.1 The Location and General Characteristics of Doha City

Doha is the capital of Qatar and was established in 1825, it has more people than the rest of Qatar combined, with a population of 2,382,000 and a square coverage 132 km² off in 2018. The city is located on the coast of the Persian Gulf in the east of the country, north of Al-Wakrah and south of Al-Khor.

At the beginning of the twentieth century the city of Doha was a small fishing and pearl harvesting city. Doha is now considered one of the most developed cities, after Qatar witnessed a great economic boost in the discovery of oil and gas reservoirs. At the present time, Doha has many civilized and modern areas, and the reasons for urbanization in the

buildings were because the population of Doha includes many people from different cultures. We are aware of Qatar's inclusion in the 2022 World Cup, which is considered one of the largest sports events in the world, this infused the development of Qatar and in particular the city of Doha into a major international city.

Figure 7 :Qatar - doha city

3.2.2 Introduction of The Case Study Area and Selected Buildings

Qatar, the winning country to host the 2022 World Cup, is one of the countries most interested in green buildings, and there are many buildings that have LEED ratings for sustainable buildings. The climatic classification of the State of Qatar is in the dry, hot and dry zone, according to the Köppen Geiger classification system. The average annual temperature is about 25 degrees Celsius. The hottest month is July, when the temperature reaches 45 degrees Celsius, while the coldest month is January, when the temperature drops to 10 degrees Celsius.

The green building sector is considered one of the developed sectors. Qatar ranks among the most developed countries in the green building sector in the Middle East and North Africa, especially as it has the second largest number of green buildings in the region, and many projects have been established for the Public Works Authority, the Ministry. Municipality, Environment, Qatar Foundation projects and the Msheireb Heart project. Doha, Lusail and all government projects follow the standards of green buildings, and the buildings selected for the case study, one of them is located in the city of Msheireb (MSHEIREB CITY) and the other is in Lusail. (AKIG HERMAS PROJECT).

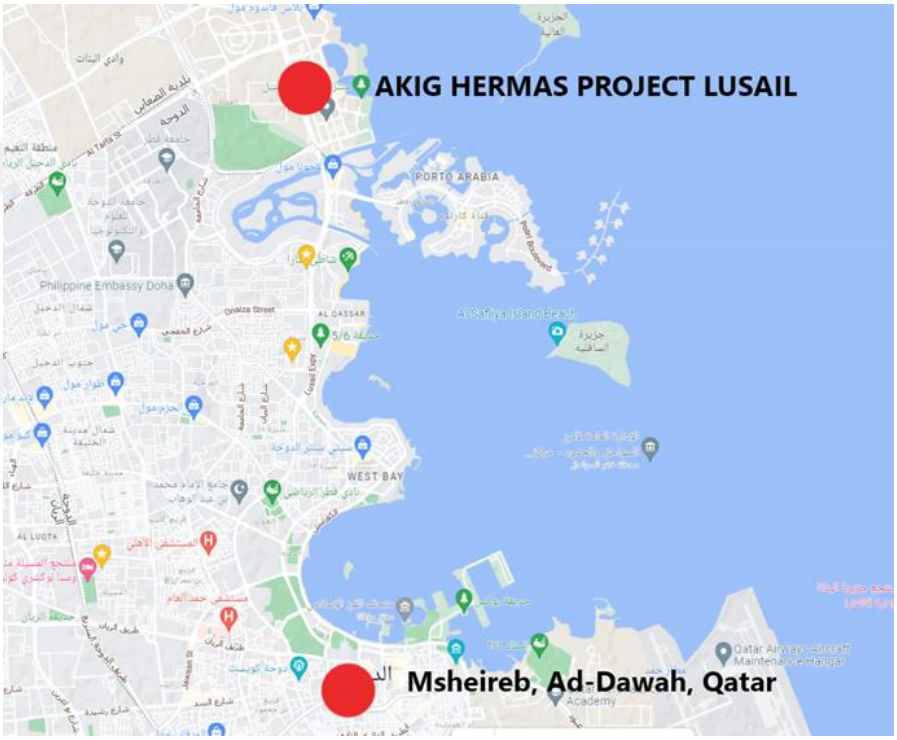

Figure 8: Case Study Area and Selected Buildings in doha city

3.2.3General Features of The Selected Buildings

1- The AKIG HERMAS PROJECT is located in Lusail, one of the modern areas in Doha, Qatar. The building is recently completed, and the questionnaire has been allocated to the workers and engineers in charge of it. The building is a high-rise green building with a height of ten floors and contains many trees and green areas from the

ground floor to the third with a beautiful area in the middle of the building Also, green areas and trees on the roof.

Figure 9 : The AKIG HERMAS PROJECT located in Lusail

In (figure 9), we see the facade of the building and from the foreground we can see the trees and green landscape clearly, and we also notice the presence of some trees on the fourth floor above the entrance to the building and on the roof of the third floor to create a green landscape as well as cooling the ventilation of the building

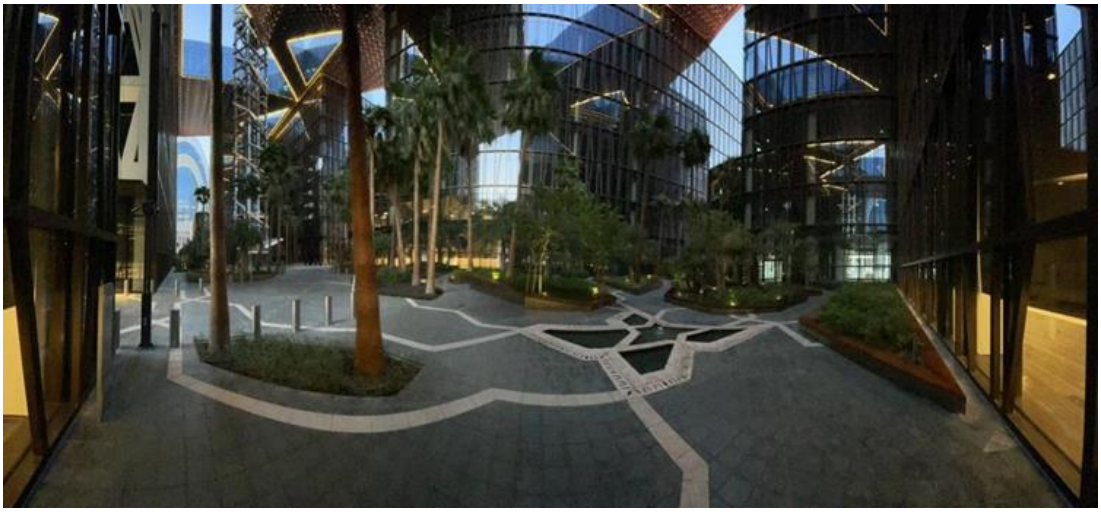

Figure 10 : The AKIG HERMAS PROJECT the landscape from inside

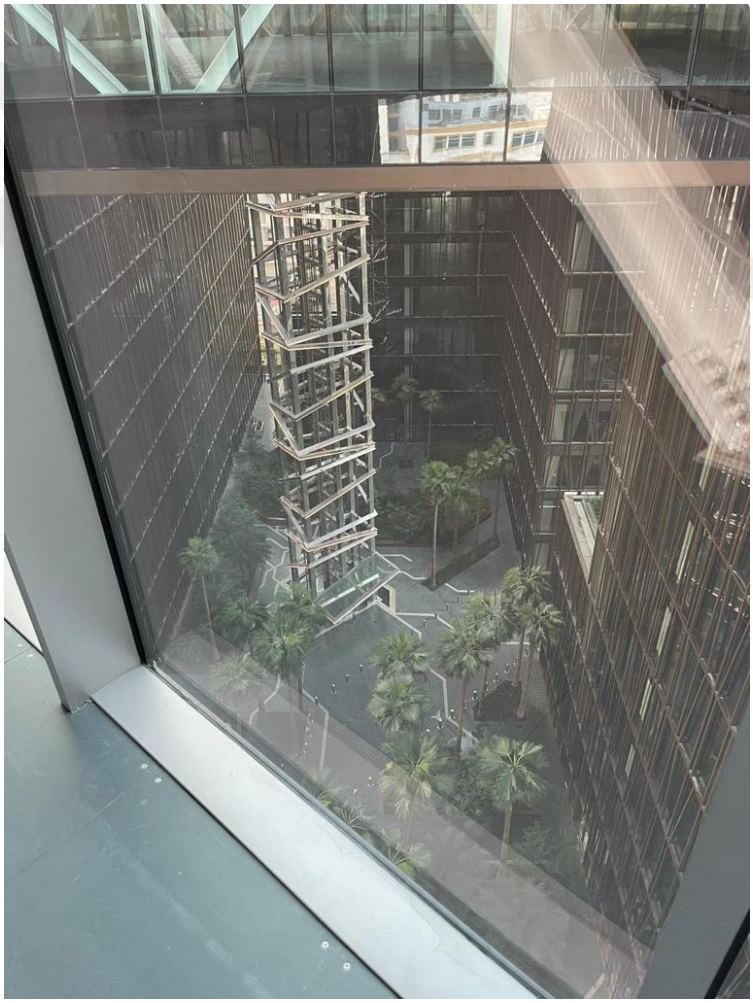

Figure 11 : The AKIG HERMAS PROJECT the landscape inside view from top

(Figure 10) it shows the green landscape of the building from the inside, as the building contains a large courtyard in the middle of the building that contains many trees. In (Figure 11), this is how it looks to the courtyard from the high floors because all the facades overlooking the courtyard have a beautiful view of the high trees.

Figure 12 : The AKIG HERMAS PROJECT the landscape from the roof

Figure 13 : The AKIG HERMAS PROJECT the landscape from the roof

In) Figure 12 and 13), they represent the roof, but from two different angles of the building, as is clear in the pictures. We can see the green areas from a high height. The roof also became a gathering area for the building's residents because of the view and the green areas that you can see from a high floor, which brings comfort and tranquility to the person.

2- The building is one of the buildings of the Musheireb city, which is located in the heart of Doha. The city of Msheireb is considered one of the smart and green cities. All buildings in the city are green, and there is also a way for buildings to converge from each other to create cool spaces in the middle. It was chosen from this smart city the AL WADI HOTEL BUILDING because it is one of the Green high-rise buildings in Msheireb.

Figure 14 : THE MUSHEIREB CITY PROJECT from top view

(Figure 14) shows the entire city of Msheireb, which is located in Doha, which is a smart and sustainable city has many green buildings.

Figure 15 : AL WADI HOTEL from the main entrance

(Figure 15) shows the building chosen for the study. Al Wadi Hotel and from the picture we see the green landscape opposite the hotel and around it from trees, as well as the presence of water bodies in Al Baraha, which is opposite the hotel, as most of the views will be on this Baraha, which contains a desert landscape that fits the surrounding environment of the building

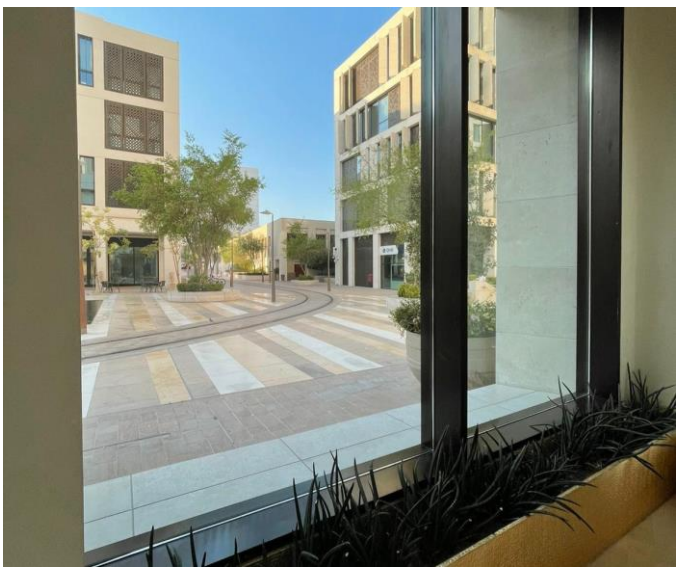

Figure 16 : AL WADI HOTEL from inside

The building focused on making most of the scenes overlooking the trees as much as possible. In (Figure16(, we can see the desert trees suitable for the environment from the interior view overlooking the hotel's green hotel to give an aesthetic appearance to the outside view

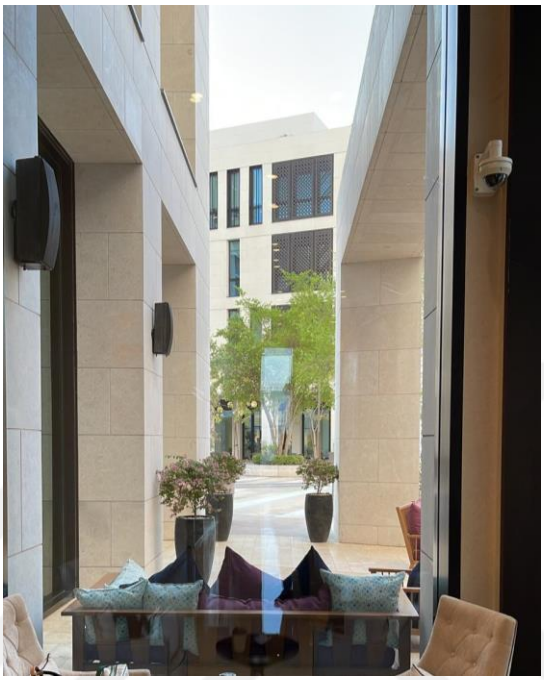

Figure 17: AL WADI HOTEL from inside

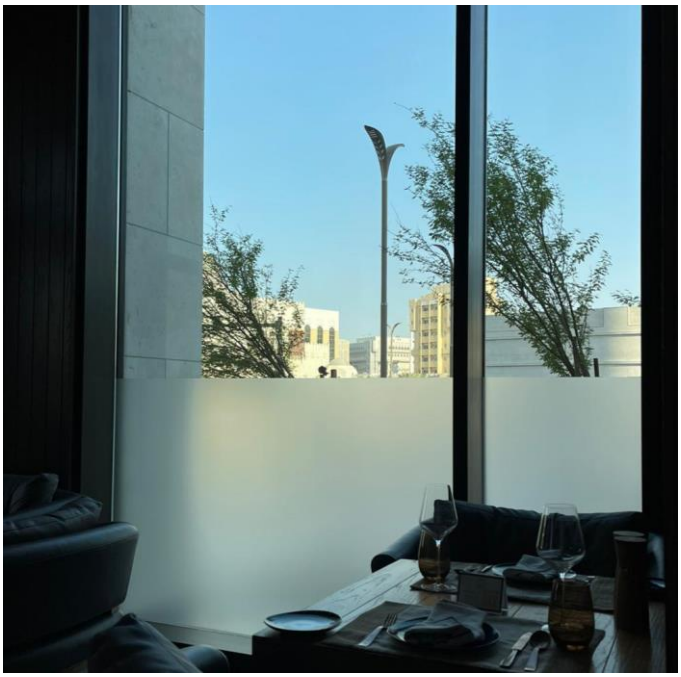

Figure 18: AL WADI HOTEL from inside and high floor

As we returned to Msheireb, the smart city located in the heart of Doha, even in the smallest areas of the landscape, the view has a green character and this is what distinguishes the city of Msheireb as we see in (Figure 17)from a narrow place, but the view is green, and as it is also clear in(Figure 18), although the image is taken from a height Until we still see trees overlooking, the city of Msheireb as a whole enjoys the proximity of buildings to each other to the fact that it is not devoid of trees, and what distinguishes it with desert afforestation is taken from the environment, which is considered a dry desert environment, but most of the trees enjoy their ability to live for a long time without continuous irrigation because they are trees that live in a dry environment.

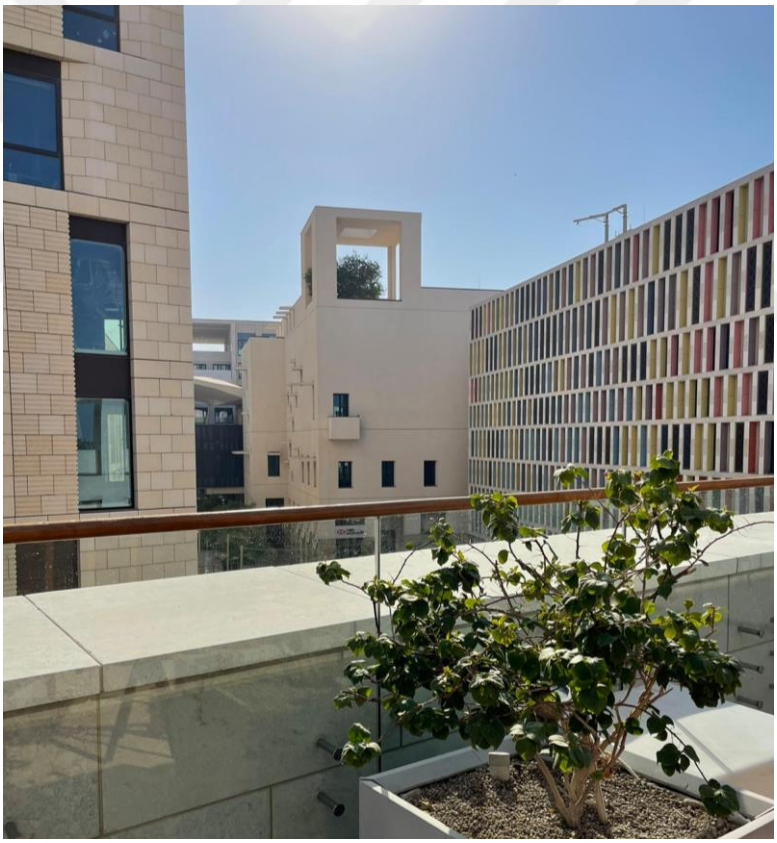

Figure 19: AL WADI HOTEL from the roof

Figure 20: AL WADI HOTEL from the roof

Figure 21: AL WADI HOTEL from high balcony

In(Figure 19)and) Figure 20), what distinguishes these images is the roofs of the building, which makes you see the green areas of the neighboring building as well, and this point is because the buildings in the smart city are close to each other because the idea in the city of Msheireb is to integrate modernity with the heritage of the old Qatari buildings because they are close, so that the nearby roofs are green, giving you the impression of comfort, especially in a close city. In)

Figure 21), we see a balcony for a restaurant from the hotel building overlooking Al-Baraha and enjoying desert landscaping that suits this space, since it is a restaurant.

3.3 THE STRUCTURES OF QUESTIONNAIRE AND SAMPLE CHARACTERISTICS

3.3.1 Introduction

In the previous chapter, the research explained and discussed the quantitative descriptive method and research procedures used in this study to collect and analyze data. Accordingly, the current chapter seeks to analyze data collected from questionnaires applied to a sample of 270 residents, visitors and workers in two landscaped green high-rise buildings in Doha in order to obtain a comprehensive and comprehensive picture. An influential conclusion regarding the landscaping effectiveness of green high-rise buildings during the occupancy period in terms of functional, technical and social performance.

3.3.2 Sample Socio-demographic Characteristics

After distributing the questionnaires to the study sample who were randomly selected and filled by them, a descriptive statistical analysis was conducted by SPSS to determine the social and demographic characteristics of the sample members of the 270 respondents, as well as to determine the personal differences between them and whether they affect the nature of the answers provided by them or not (Dobronte, 2013). Table 3.2 illustrates the characteristics of the study participants.

Table 3. 2: Descriptive Statistics of Respondents

Variable	Categories	Frequency	Percentages
Gender	Male	140	51.85%
	Female	130	48.15%
Age	20-30 years	65	24.07%
	31-40 years	140	51.85%
	41-50 years	55	20.37%
	More than 50 years	10	3.70%
Qualifications	Diploma	90	33.33%
	Bachelor's degree	165	61.11%
	Master's degree	15	5.56%
Position	Occupant (resident)	120	44.44%
	Construction worker	74	27.41%
	Architect	59	21.85%
	Visitor	17	6.30%
Years of experience	Less than 1 year	75	27.78%
	1-5 years	130	48.15%
	6-10 years	37	13.70%
	More than 10 years	28	10.37%
Actual hours of work	Full-time	160	59.26%
	Part-time	86	31.85%
	Casual	24	8.89%
Overall		**270**	**100%**

The descriptive statistics of the socio-demographic data of the study sample show that study participants were roughly equally divided between males (51.85%) and females (48.15%). This ratio indicates that it takes into account the point of view of both females

and males, but perhaps the slight increase in the number of male participants is that men do more jobs and businesses than males in traditional Qatari society.

Moreover, it can be seen from Table 3.2 that the most participated age category in the survey of this study was 31-40 years old with a percentage of (51.85%) followed by (24.07%) participants of 20-30 years old and (20.37%) of occupants, visitors and workers participated in current study are in the age of 41-50 years old, however, the age category more than 50 years old represents the least category with (3.7%) participants included in this study. This means that this sample includes a group of people of different age groups, from the advanced age group who have experience in the concept of sustainability and green buildings in the architecture and construction sector, and from an ambitious age group that does not exceed fifty years, and they have a desire to achieve the future in the construction sector, where they have an interest in green buildings and the use of building applications to achieve sustainability that reduce the negative effects of the building on the human and environment health, and to achieve the efficiency of resource use during the life cycle of the building, and consequently the responses of this study will be logical and close to the truth.

It is notable that the whole members of the sample were highly educated and the largest percentage of participants are holders of a bachelor's degree (61.11%), while (33.3%) of the sample are have diploma degree and finally only (5.56%) of participants hold a master’s degree. This can also be explained by the fact that there is interest from all categories of people with all their scientific qualifications in green buildings that achieve sustainability standards and their contribution to improving functional, technical and social functions, which gives the study the characteristic of comprehensiveness and general in collected viewpoints.

There is diversity and difference in the job title of the individuals participating in the survey, nevertheless the vast majority of it are occupants (residents) in these high-rise buildings, where they accounted for (44.44%) of the sample followed by construction workers at (27.41%), followed by (21.85%) architects and only (6.30%) are visitors. So, in general, all the job groups participated in this study, which would give its results the character of honesty and generality. Lastly, regarding years of experience, Table 3.2 shows that the vast majority of participants are individuals who have 1-5 years of

experience (48.15%), followed by individuals who have less than 1 year of experience (27.78%), then (13.7%) with experience of (6-10) years, down to the lowest category, who are those with less more than 10 years of experience by (10.37%). As for the actual working hours of individuals, the sample varied between full-time work (59.26%) and part-time work (31.85%) or informal work hours (8.89%). This indicates that the study sample consists of individuals with different experiences, which gives the impression that they possess extensive knowledge in the field of study and that their answers will be logical and exemplary and characterized by high accuracy, and that they spend a varying period in their homes in green high-rise buildings between long and intermittent periods, which enables them to Judging the effect of landscape on the functional, technical and social performance of buildings .

3.4 FINDINGS OF THE DESCRIPTIVE DATA ANALYSIS

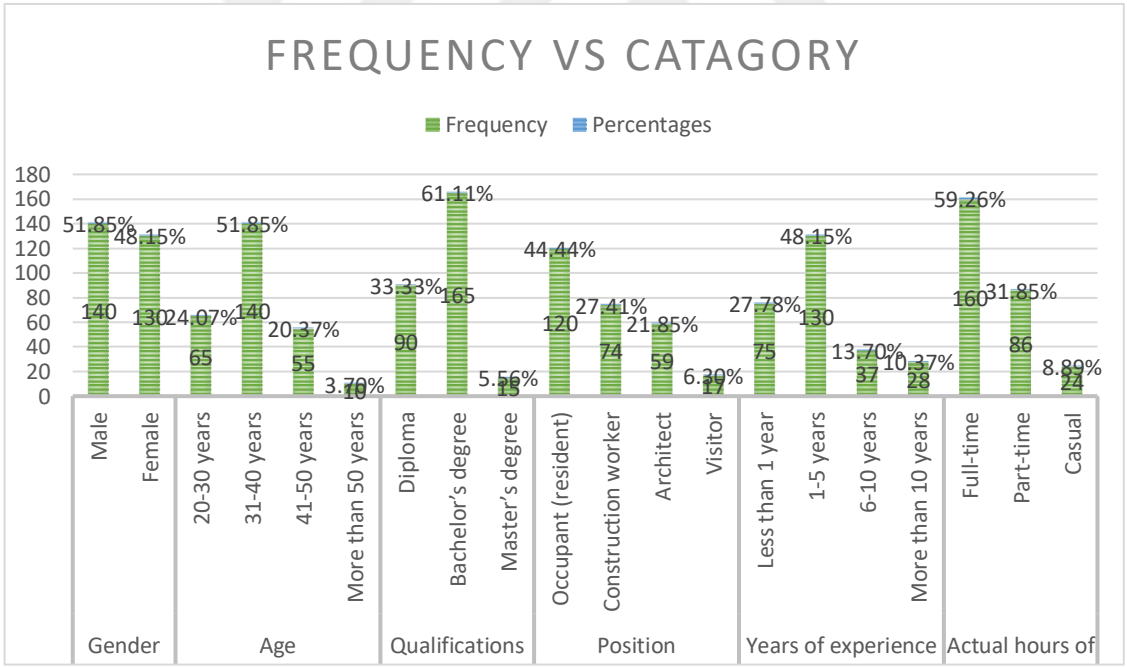

Figure 22: Frequency vs Catagory

In order to descriptively identify the landscaping effectiveness of high-rise green buildings in the post-occupancy period in terms of functional, technical and social performance, the descriptive statistics were calculated for the answers and rank them (means and standard deviations) obtained using the

five-point Likert scale via SPSS, where means (1-1.8) were considered very low, (1.8 to 2.6) low, from (2.6-3.4) was considered moderate, from (3.4-4.2) was considered high and from (4.2-5.0) was considered very high.

3.4.1 The effects of landscapes on functional performance of high-rise buildings in Doha

In this section, the descriptive analysis focuses on investigating the landscaping effectiveness of high-rise green buildings in the post-occupancy period in terms of functional performance from the perceptions of residents, architect, visitors and construction workers in those buildings. Therefore, in order to assess the effect of the landscape on the functional performance of high-rise buildings in Doha, a descriptive summary of the participants to the variable elements (means and standard deviations) was calculated as shown in the following table 3.3:

Table 3. 3: Descriptive summary for the impact of landscapes on functional performance of high-rise buildings in Doha

No.	Statement	Mean	Std. Deviation	Rank	Level
1	Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building.	4.08	0.88	3	High
2	Landscapes of high-rise buildings affects adequacy and quality of artificial lighting levels in all spaces	3.96	0.99	15	High
3	Landscapes of high-rise green buildings affects the health, and productivity level of its occupants	3.98	0.87	13	High
4	Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants	3.93	0.96	17	High
5	Landscapes of high-rise buildings can affect feeling of safety and creates positive motivation.	4.04	0.83	7	High

6	Landscapes of high-rise buildings and natural ventilation system through windows and other openings increase the functional performance of building	3.99	0.96	12	High
7	Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property	4.07	0.89	4	High
8	landscape of high-rise buildings reduces problems that hamper efficiency and production in workplaces and living environments	4.00	0.93	10	High
9	The landscape of high-rise green buildings achieves optimum audio performance and a safe and sound environment.	4.05	0.83	6	High
10	The landscape of high-rise green buildings achieves natural lighting and visual comfort	4.06	0.88	5	High
11	Landscape of high-rise green buildings provide the infrastructure necessary to carry out activities according to the type of activities performed inside the building	3.95	0.93	16	High
12	A landscape of high-rise green buildings helps improve ventilation	4.03	0.87	8	High
13	Landscape of high-rise green buildings provide thermal comfort.	4.10	0.86	1	High
14	A landscape of high-rise green buildings provides access to essential facilities.	4.09	0.86	2	High
15	Strategic landscape design helps provide screening for privacy and buffer in high-rise green buildings.	3.99	0.92	11	High
16	landscape could reduce the usage supplementary of cooling agent like air-conditioner in high-rise green buildings	4.02	0.94	9	High
17	Landscape of high-rise green buildings helps to conserve energy and water.	3.97	0.95	14	High
Overall		4.02	0.89	**High**	

It can be seen from Table 3.3 that the computational means that measure the effect of landscapes on functional performance of high-rise buildings in Doha are high and ranging

from (3.93-4.10). It can be noticed that item (13), which states that: " Landscape of high-rise green buildings provide thermal comfort", represents the highest agreed mean statement (4.10) and was followed by item (14) secondly in which it stated that: "A landscape of high-rise green buildings provides access to essential facilities" with a mean (4.09), thirdly item (1) in which it stated that: "Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building" with a mean (4.08), fourthly item (7) which stated that: "Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property" with a mean (4.07) and finally with the least mean value, item (4) which stated that: "Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants" with a mean (3.93).

The general average for this section was (4.02), which indicates that most of the sample members strongly agree with most of the items in this part of the questionnaire, which indicates their strong support and approval of the effectiveness of green high-rise buildings in the post-occupancy period in terms of functionality, as they agreed that landscapes help in reducing glare and temperature for people inside the building, contributes to reducing levels of artificial lighting in all spaces, increases health, well-being and productivity for occupants, improves task performance and occupant productivity, and can affect the sense of safety and create a positive motivation.

These results are in agreement with the studies of Harmon and Truby (2019) as well as Begec and Hamidabad (2015), where they pointed out the importance of the landscape and the great role in improving the functionality of the buildings in terms of enriching the appearance and value of the property, improving lighting, temperatures, ventilation and visual comfort in it, and other matters that raise its operational efficiency and accessibility, and spatial capacity for activities, adequacy of facilities, communication, response to additional change, efficiency of communication and circulation, which improves the efficiency of life and well-being of the occupants.

3.4.3 The effects of landscapes on technical performance of high-rise buildings in Doha

In this part of the study, the descriptive data analysis focuses on investigating the landscape effectiveness of green high-rise buildings in the post-occupancy period in terms of artistic performance from the perceptions of residents, architecture students, visitors, and construction workers in those buildings. Therefore, in order to evaluate the effects of landscapes on technical performance of high-rise buildings in Doha, the descriptive summary (means and standard deviation) of the responses to the variable items was calculated as shown in the following table 3.4:

Table 3. 4: Descriptive summary for the impact of landscapes on technical performance of high-rise buildings in Doha

No.	Statement	Mean	Std. Deviation	Rank	Level
1	The focus on landscape design and operation of high-rise green buildings plays a large and important role in reducing global warming.	4.08	0.83	3	High
2	The focus on landscape design and operation of high-rise green buildings impacts the health of individuals and communities.	3.98	0.95	14	High
3	Strategic landscape design of high-rise green buildings may help improve a building's energy efficiency, reduce costs and need for additional systems.	3.95	1.00	17	High
4	Landscape design is an ideal and important part of the broader design process, allowing for significant interaction between building orientation, building design and proposed landscape development.	3.93	0.96	18	High
5	Landscaping provides many important green services for the building including water efficiency	3.98	0.87	13	High
6	landscape of high-rise green buildings in dealing with sanitary facilities helps achieve the sustainable water recycling of buildings and individual	4.07	0.88	4	High

7	Building defects are identified, design and construction standards are formulated, and performance measures are supported, and building lifecycle costs are reduced through errors of identifying design.	3.97	0.99	15	High
8	Landscape helps to continuously improve the quality and performance of facilities.	3.99	0.87	11	High
9	Building performance evaluation helps to ascertain if organizations are managing existing building stock responsibly.	3.92	0.96	19	High
10	Adequacy of opening design (doors and windows) is good	4.04	0.83	7	High
11	Overall quality of building layout is good	3.99	0.96	12	High
12	There is adequacy of horizontal circulation routes in the building	4.05	0.89	6	High
13	There are adequacy vertical circulation routes within the building	4.00	0.93	10	High
14	Noise control can be provided through walls, floors, windows, and doors that provide adequate reduction of sound from adjacent activities	4.04	0.83	8	High
15	The application of landscape is pertinent, effective, and successful in determining the users' satisfaction level and providing recommendations for improving building performance.	4.06	0.88	5	High
16	landscape plays a vital role in the strategic planning of building management	3.96	0.93	16	High
17	Landscape of high-rise green buildings help to reduce the negative impact on the natural environment, reduce the consumption of non-renewable resources, and reduce the use of environmentally harmful materials.	4.04	0.87	9	High
18	A landscape of high-rise green buildings helps manage materials, resources and waste management.	4.10	0.86	1	High
19	Landscape of high-rise green buildings may improve the storm water management.	4.09	0.86	2	High
overall		**4.01**	**0.88**	**High**	

It can be noticed from Table 3.4 above that the arithmetic means that measure the impact of landscapes on technical performance of high-rise buildings in Doha are high and ranging from (3.92-4.10). It can be noticed that item (18), which states that: "A landscape of high-rise green buildings helps manage materials, resources and waste management", represents the highest agreed mean statement (4.10) and was followed by item (19) secondly in which it stated that: "Landscape of high-rise green buildings may improve the storm water management" with a mean (4.09), thirdly item (1) in which it stated that: "The focus on landscape design and operation of high-rise green buildings plays a large and important role in reducing global warming" with a mean (4.08), fourthly item (6) which stated that: "landscape of high-rise green buildings in dealing with sanitary facilities helps achieve the sustainable water recycling of buildings and individual" with a mean (4.07) and finally with the least mean value, item (9) which stated that: "Building performance evaluation helps to ascertain if organizations are managing existing building stock responsibly" with a mean (3.92).

The overall mean for this section was (4.01) which shows that there is a high agreement on the effectiveness of the landscape of green high-rise buildings in the post-occupancy period in terms of technical performance, as they agreed that landscapes contribute to improving the energy efficiency of the building, reducing costs and the need for additional systems, improving the efficiency of water use and sanitation in the building, managing natural resources, managing rainwater and waste, and other matters related to achieving safety, security and health for its occupants. The high-rise building with the presence of the landscape contributes to improving the level of occupant’s satisfaction and providing recommendations to improve the performance of the building technically.

Consequently, these results are in agreement with (Hussain et al., 2014; Jasim, 2020; Begec & Hamidabad, 2015) studies, where they indicated the importance of landscapes and their great role in improving the technical performance of buildings in terms of reducing the negative impact on the natural environment, reducing the consumption of non-renewable resources, reducing the use of environmentally harmful materials, and in terms of water management, lighting, ventilation and other technical matters that extends the life of the building, reduces energy drain, and increases its structural efficiency.

3.4.3 The effects of landscapes on social performance of high-rise buildings in Doha

In this part, the descriptive analysis of the collected data focuses on investigating the landscaping effectiveness of high-rise green buildings in the post-occupancy period in terms of social performance from the perceptions of residents, architectural students, visitors and construction workers in those buildings. So, in order to evaluate the effects of landscapes on social performance of high-rise buildings in Doha, descriptive summary (means & standard deviation) of the participants to the variable items were calculated as shown in the following Table 3.5:

Table 3. 5: Descriptive summary for the impact of landscapes on social performance of high-rise buildings in Doha

No.	Statement	Mean	Std. Deviation	Rank	Level
1	The landscape of high-rise green buildings really brings convenience to the workers inside the building	3.99	0.92	11	High
2	Landscapes affect people's feelings, so they become more positive and motivated	4.03	0.94	6	High
3	Landscaping provides many important green services for the building, as it may provide recreational opportunities for individuals.	3.97	0.94	13	High
4	Strategic landscape design can help prevent widespread heat gain in buildings and produce a healthy, natural environment for the surroundings.	4.07	0.83	2	High
5	Landscape may increase the value of your property by adding a real green component to the building.	3.98	0.95	12	High
6	landscape added to the high-rise green buildings and the surrounding site are visually persuasive to me in representing the green icon of the building	3.95	1.00	15	High
7	Functional divisions, spaces, and environmental conditions of the landscape of	3.92	0.98	16	High

	high-rise green buildings affect the behavior of people within the building				
8	Landscape of high-rise green buildings helps create a connection between the occupants' activities and the physical environment within the building.	4.01	0.92	9	High
9	landscape affects the size and number of persons that share it upon a building′s occupant	4.05	0.88	4	High
10	Spatial attributes, the sequence, location, relationships, shape, size, and detail of spaces affect occupant behavior	4.03	0.96	7	High
11	The layout of space, furniture, and storage and the convenient circulation and accessibility to various usable spaces within a building affect occupant behavior	4.06	0.85	3	High
12	The exposure of individuals to sunlight and natural air in buildings designed as green or environmentally friendly buildings, increases their productivity and maintains their health	3.96	0.99	14	High
13	Office workers could be more productive, and students' academic achievement would go up if the buildings they were in were environmentally friendly and sustainable	4.08	0.87	1	High
14	Strategic landscape design can help produce a natural and healthy atmosphere for employees and thus increase their productivity.	4.00	0.93	10	High
15	Strategic landscape design of high-rise green buildings may help provide privacy for employees	4.04	0.88	5	High
16	landscape helps control the behavior of building users by emphasizing the positive interactions between the user and the building	3.91	0.95	18	High
17	Landscape of high-rise green buildings can be used as natural retreats for the building users.	3.93	1.00	17	High
18	Green roofs indirectly help mitigate air pollution problems in the building and thus improving the health of people inside.	4.02	0.94	8	High
Overall		**4.00**	**0.91**	**High**	

It can be noticed from Table 3.5 above that the arithmetic means that measure the impact of landscapes on social performance of high-rise buildings in Doha are high and ranging from (3.91-4.08). It can be noticed that item (13), which states that: "Office workers could be more productive, and students' academic achievement would go up if the buildings they were in were environmentally friendly and sustainable", represents the highest agreed mean statement (4.08) and was followed by item (4) secondly in which it stated that: "Strategic landscape design can help prevent widespread heat gain in buildings and produce a healthy, natural environment for the surroundings" with a mean (4.07), thirdly item (11) in which it stated that: "The layout of space, furniture, and storage and the convenient circulation and accessibility to various usable spaces within a building affect occupant behavior" with a mean (4.06), fourthly item (9) which stated that: "landscape affects the size and number of persons that share it upon a building′s occupant" with a mean (4.05), fifthly item (15) which stated that: "Strategic landscape design of high-rise green buildings may help provide privacy for employees" with a mean (4.04) and finally with the least mean value, item (16) which stated that: "landscape helps control the behavior of building users by emphasizing the positive interactions between the user and the building" with a mean (3.91).

The overall mean for this section was (4.00) which indicates that most of the study sample members strongly agree with the items of this part of the study and indicates that there is great agreement on the effectiveness of the landscape of green high-rise buildings in the post-occupancy period in terms of social performance, as they agreed on them contributes to providing comfort to its residents. They agreed that the landscapes contribute to providing them with visual and psychological comfort, so they become more positive and stimulating. For example, green spaces and gardens contribute to providing recreational opportunities for individuals, which is reflected in the activity and vitality of individuals and improves their social behaviour, communication and interaction with each other.

These results are consistent with what was indicated by (Moor & Erysheva, 2018; Alzubaidi, 2013) studies, where they emphasized the importance of landscaping and its great role in improving the social performance of buildings in terms of creating a link between occupants' activities and the physical environment, and this includes the level of occupant's comfort and how functional divisions, spaces and environmental conditions affect their behaviour inside the building. They indicated that the presence of the

landscape contributes to creating a connection between the activities of the residents and the physical environment inside the building, and increases the interaction of residents with each other in many aspects and events.

3.4.4 Comparison between the responses of Occupant (resident) and Construction worker:

In this section, the descriptive analysis focuses on investigating the landscaping effectiveness of high-rise green buildings in the post-occupancy period in terms of functional performance from the perceptions of residents, architect, visitors and construction workers in those buildings. I separated the answers related to the construction workers, whose number consisted of (74) answers, and separated the residents, whose number is (120), noting that the remaining two parts were the architects with (59), the visitors with only (17). In this section I chose the residents and construction workers to make a simple comparison in their answers. Calculating a descriptive summary of the variable elements (means and standard deviations) separately for the answers of workers and residents in the building only in the functional question part of the first section of the questionnaire for each of them and comparing the difference in the means between the two tables.

Table 3. 6: Descriptive summary for the impact of landscapes on functional performance of high-rise buildings in Doha responses of Occupant (resident) only

No.	Statement	Mean	Std. Deviation	Rank	Level
1	Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building.	3.92	0.26	1	high
2	Landscapes of high-rise buildings affects adequacy and quality of artificial lighting levels in all spaces	3.83	0.37	8	high
3	Landscapes of high-rise green buildings affects the health, and productivity level of its occupants	3.75	0.43	16	high

4	Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants	3.76	0.42	15	high
5	Landscapes of high-rise buildings can affect feeling of safety and creates positive motivation.	3.82	0.38	9	high
6	Landscapes of high-rise buildings and natural ventilation system through windows and other openings increase the functional performance of building	3.85	0.35	7	high
7	Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property	3.89	0.31	5	high
8	landscape of high-rise buildings reduces problems that hamper efficiency and production in workplaces and living environments	3.82	0.38	10	high
9	The landscape of high-rise green buildings achieves optimum audio performance and a safe and sound environment.	3.78	0.41	14	high
10	The landscape of high-rise green buildings achieves natural lighting and visual comfort	3.90	0.28	4	high
11	Landscape of high-rise green buildings provide the infrastructure necessary to carry out activities according to the type of activities performed inside the building	3.75	0.43	17	high
12	A landscape of high-rise green buildings helps improve ventilation	3.82	0.38	12	high
13	Landscape of high-rise green buildings provide thermal comfort.	3.90	0.28	3	high
14	A landscape of high-rise green buildings provides access to essential facilities.	3.91	0.27	2	high

15	Strategic landscape design helps provide screening for privacy and buffer in high-rise green buildings.	3.82	0.38	11	high
16	landscape could reduce the usage supplementary of cooling agent like air-conditioner in high-rise green buildings	3.86	0.34	6	high
17	Landscape of high-rise green buildings helps to conserve energy and water.	3.80	0.40	13	high
Overall		3.8387	0. .32287	high	

In this table, the answers consist mainly of **Job position = Occupant (resident)** only, whose number consists of 120 answers. This table has been separated for comparison with other answers related to **Job position = Construction worker**, and also to the first questionnaire section functional performance in green high-rise buildings, it can be seen from **Table 3. 6** that the computational means that measure the effect of landscapes on functional performance of high-rise buildings in Doha are high and ranging from (3.75-3.92). It can be noticed that item (1) which stated that: "Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building" with a mean (3.92) and was followed by item (14) secondly in which it stated that: "A landscape of high-rise green buildings provides access to essential facilities" with a mean (3.91), thirdly item (13), which states that: " Landscape of high-rise green buildings provide thermal comfort", represents the highest agreed mean statement (3.90) , fourthly item (10) which stated that: "The landscape of high-rise green buildings achieves natural lighting and visual comfort" with a mean (3.90) and finally with the least mean value, item (11) which stated that: "Landscape of high-rise green buildings provide the infrastructure necessary to carry out activities according to the type of activities performed inside the building" with a mean (3.75).

Table 3. 7: Descriptive summary for the impact of landscapes on functional performance of high-rise buildings in Doha responses of Construction worker only

No.	Statement	Mean	Std. Deviation	Rank	Level
1	Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building.	3.91	0.27	8	High
2	Landscapes of high-rise buildings affects adequacy and quality of artificial lighting levels in all spaces	3.86	0.34	14	High
3	Landscapes of high-rise green buildings affects the health, and productivity level of its occupants	3.86	0.34	15	High
4	Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants	3.78	0.41	17	High
5	Landscapes of high-rise buildings can affect feeling of safety and creates positive motivation.	3.89	0.31	9	High
6	Landscapes of high-rise buildings and natural ventilation system through windows and other openings increase the functional performance of building	3.83	0.37	16	High
7	Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property	3.98	0.11	4	High
8	landscape of high-rise buildings reduces problems that hamper efficiency and production in workplaces and living environments	3.89	0.31	10	High
9	The landscape of high-rise green buildings achieves optimum audio performance and a safe and sound environment.	4.00	0.00	3	High
10	The landscape of high-rise green buildings achieves natural lighting and visual comfort	3.87	0.32	12	High

11	Landscape of high-rise green buildings provide the infrastructure necessary to carry out activities according to the type of activities performed inside the building	3.93	0.25	7	High
12	A landscape of high-rise green buildings helps improve ventilation	3.97	0.16	5	High
13	Landscape of high-rise green buildings provide thermal comfort.	4.00	0.00	1	High
14	A landscape of high-rise green buildings provides access to essential facilities.	4.00	0.00	2	High
15	Strategic landscape design helps provide screening for privacy and buffer in high-rise green buildings.	3.87	0.32	13	High
16	landscape could reduce the usage supplementary of cooling agent like air-conditioner in high-rise green buildings	3.95	0.19	6	High
17	Landscape of high-rise green buildings helps to conserve energy and water.	3.89	0.31	11	High
Overall		3.9149	0.20908	**High**	

In this table, the answers consist mainly of **Job position = Construction worker** only, whose number consists of 74 answers. This table has been separated for comparison with other answers related to **Job position = Occupant (resident)**, and also to the first questionnaire section functional performance in green high-rise buildings, it can be seen from **Table 3.7** that the computational means that measure the effect of landscapes on functional performance of high-rise buildings in Doha are high and ranging from (3.78-4.00). It can be noticed that item (13) which stated that: "Landscape of high-rise green buildings provide thermal comfort" with a mean (4.00) and with the same mean followed by item (14) which it stated that: "A landscape of high-rise green buildings provides access to essential facilities" with a mean (4.00), also with the same mean followed by item (9), which states that: " The landscape of high-rise green buildings achieves optimum audio performance and a safe and sound environment." represents the highest agreed

mean statement (4.00) , fourthly item (7) which stated that: "Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property" with a mean (3.98) and finally with the least mean value, item (4) which stated that: "Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants" with a mean (3.78).

When comparing the two tables, we can see that there is a difference in the Rank between the types of questions, as in Table 3.5 of the Occupant (resident), the item which number one is the owner of the highest Mean, as in Table 3.6 of the Construction worker responses item No. 13 is the owner of the highest Mean There may be some convergence in some of the answers. Still, most of the two tables are different, and the differences in the responses are always due to the understanding of the question, as workers have different understandings of the landscape. For the inhabitants, their understanding is often more superficial.

also, we can notice that the answers in Table 3.6 for Construction workers have the highest three equal responses on Mean No (. 13, 14. and 9) with a rate of (4.00), all of them are higher even than the Mean responses in the second table 3.5. overall, all levels are high in the two tables.

3.5 HYPOTHESES TESTING

This part of the study is concerned with testing the hypotheses that related to the effect of the landscape of high-rise green buildings on their functional, artistic and social performance. Consequently, multiple linear regression analysis and Pearson's correlation were used in order to test the presence of relationships (hypotheses) between the independent variable (IV) (landscape of tall green buildings) and dependent variables (DVs) (functional, technical, and social performance) and the significance of those relationships.

3.5.1 The Effect of landscapes of high-rise green buildings on functional performance

1- The correlation between landscapes of high-rise green buildings (IV) and functional performance of the building (DV), indicated as the first hypothesis on

the functional part: *H1: The functional, technical and social performance of high-rise green buildings can be evaluated by using landscape indicators with post-occupancy evaluation techniques.*

was tested by simple linear regression analysis and Pearson correlation, where Table 3.8 represents the resulted model for this correlation and regression test:

Table 3. 8: Linear regression's model summary for the first hypothesis in functional part:

(R)	(R^2)	Adjusted (R^2)	F	DF		α	β	T	Sig
0.988	0.977	0.976	62783.090	Regression	1	0.00	1.002	250.57	0.00
				Residual	298				
				Total	299				

The model summary and overall fit statistics from Table 3.8 indicate that there is a statistically significant positive effect of landscapes on the functional performance of high-rise buildings in Doha, where the Pearson correlation coefficient R (0.988) is at ($\alpha \leq 0.05$). The coefficient of determination R^2 amounted to (0.977), this means that (97.7%) of the positive changes in the functional performance of the high-rise green building are because of the landscapes. Furthermore, the degree of influence (β) of the landscape effect on the functionality of the high-rise buildings in Doha is (1.002). This means that increasing the level and presence of the landscape by one step improves functionality by (1.002). The significance of this effect is the calculated value (F), which amounted to (62783.090) and is significant at the level ($\alpha < 0.05$) (sig. = 0.000), and then the first hypothesis was accepted. This result is consistent with the study (Davis, 2007; Golasz-Szolomicka & Szolomicki, 2019; Moor & Erysheva, 2018) who showed that there is a positive impact of the landscape on the artistic performance of high-rise buildings in Doha, where they emphasized that the landscape, which represents a man-made ecosystem for the external and internal environment of the building, includes; The green roof, sky garden, podium gardens and green spaces integrate with the natural ecosystem in buildings and urban infrastructure contributes to improving the form of buildings. They emphasized that landscapes contribute to improving functional performance of buildings that deals with the level of functionality and efficiency of features, and includes

accessibility, and the spatial capacity of activities, adequacy of facilities, communications, response to additional change, efficiency of communication and circulation of air, temperature and lightning.

3.5.2 The Effect of landscapes of high-rise green buildings on technical performance

The correlation between landscapes of high-rise green buildings (IV) and technical performance of the building (DV), indicated as the first hypothesis in technical part of this study was tested by simple linear regression analysis and Pearson correlation, thus table 3.9 is the summary of the resulting model for this regression and correlation test:

Table 3. 9: Linear regression's model summary for the hypothesis in technical part

(R)	(R^2)	Adjusted (R^2)	F	DF		α	β	T	Sig
0.996	0.992	0.992	38565.202	Regression	1	0.00	1.005	196.38	0.00
				Residual	298				
				Total	299				

From the above Table 3.9, the linear regression's model summary indicates that there is a statistically significant positive impact of landscapes on technical performance of high-rise buildings in Doha, where the coefficient of Pearson correlation R (0.996) at ($\alpha \leq 0.05$). The coefficient of determination R^2 amounted to (0.992), this means that (99.2%) of the positive changes in the technical performance of the high-rise green building are because of the landscapes. Furthermore, the degree of impact (β) for the impact of landscapes on technical performance of high-rise buildings in Doha is (1.005).

This means that increasing the level and presence of the landscape one step improves artistic performance by (1.005). The significance of this effect was the calculated value (F), which amounted to (38565.202), which is significant at the level ($\alpha < 0.05$) (sig. = 0.000), and from here the second hypothesis was accepted. This result is consistent with a study (Hussain et al., 2014; Jasim, 2020; Begec & Hamidabad, 2015) that showed that there is a positive effect of landscaping on the artistic performance of high-rise buildings in Doha, emphasizing that green building landscaping provides many benefits to many

stakeholders in the construction industry, including building occupants and the community at large.

Sharma (2018) added that these landscape features also contribute to improving the building's surviving features, such as fire safety, sanitation, structure, security, ventilation, and health. Green landscape buildings typically comprise abundant natural lighting, better air quality, noise control, and availability of views that benefit most of building occupants, making these buildings a great place to live or work. The aim of those landscapes focuses on protecting the existing ecological balance, improving environments by recycling water and reducing energy waste and ensuring the building's durability.

3.5.3 The Effect of landscapes of high-rise green buildings on social performance

The correlation between landscapes of high-rise green buildings (IV) and functional performance of the building (DV), indicated as the first hypothesis of this study on social performance: was tested through Pearson correlation and simple linear regression analysis, where Table 3.9 represents the resulted model summary for this regression and correlation test

Table 3. 10: Linear regression's model summary for the hypothesis on social performance part

(R)	(R^2)	Adjusted (R^2)	F	DF		α	β	T	Sig
0.903	0.816	0.814	36148.605	Regression	1	0.00	0.995	190.13	0.00
				Residual	298				
				Total	299				

From the above Table 3.10, the model summary and overall fit statistics indicates that there is a statistically significant positive impact of landscapes on social performance of high-rise buildings in Doha, where the coefficient of Pearson correlation R (0.903) at ($\alpha \leq 0.05$). The coefficient of determination R^2 amounted to (0.816), this means that (81.6%) of the positive changes in the social performance of the high-rise green building are

because of the landscapes. Moreover, the degree of impact (β) for the impact of landscapes on social performance of high-rise buildings in Doha is (0.995). This means that a one-step increase in the level and existence of landscapes improves the social performance by (0.995). The significance of this effect is the value of the calculated (F) which reached (36148.605) and is significant at the level of ($\alpha < 0.05$) (sig. =0.000), hence the third hypothesis was accepted. This result is consistent with the study of (Moor & Erysheva, 2018; Alzubaidi, 2013) who showed that there is a positive impact of landscapes on the social performance of high-rise buildings in Doha, as they emphasized that landscapes in green buildings contribute to providing psychological and visual comfort to its residents, so they become more positive and stimulating, and that the presence of landscapes contributes to creating a social connection between the residents and the physical environment inside the building, and increases the interaction of residents with each other in many activities.

CHAPTER 4: CONCLUSION & RECOMMENDATIONS

This chapter summarizes the research and provides conclusions based on the research's findings as well as recommendations that would be contributed to the future researchers.

4.1 CONCLUSION

In conclusion, this study highlights post-occupation evaluation of the landscape of green high-rise green buildings in Doha, details of green wall or vertical landscape design as well as roof garden design and how both green systems can contribute to the well-being of the environment, humans as well as wildlife. Apart from integrating the scope of green design in the building with a number of environmental and performance benefits such as aesthetic improvement, reduction of carbon footprint, protection of building facades as well as temperature regulation, the application of this green system is very important in order to balance the structural and natural development and thus increase the level of sustainability especially in urban, metropolitan and urban areas. Green buildings and green roofs improve the general health of the population, as they give people oxygen and absorb what is expelled from carbon dioxide, and therefore they play the role of improving air quality and thus maintaining population health. It plays an important role in achieving the non-material needs of the user through his practice of different types of activities and sports such as running and walking, which achieve his physical balance. Green areas play on achieving security, as reports and scientific research confirm the link between the crime rate in a region and the extent of environmental deterioration for this region, and on the contrary, when the region is supported by plant elements. Green spaces improve and soften harsh climatic conditions, as their use within urban spaces increases the thermal balance of the urban mass and helps reduce and mitigate high temperatures in the summer and prevents them from dropping sharply in winter as a result of radiation. It reduces the emission of carbon dioxide and thus controls climate changes at the level

of the percentage of harmful gases. It also affects fresh water sources in quantity and quality through the balance they do and the production of oxygen that dissolves in water, and therefore it is considered one of the necessities of life on Earth.

POE offers a valuable methodology for analyzing building performance in general, and especially for green tall building landscapes, and analysis of the results confirms that POE implementation is appropriate, effective and successful in determining the level of user satisfaction and making recommendations for improving building performance. This approach has great potential for building performance analysis, because it uses a planned approach to achieve the best quality in building services, in which building user behavior, insights, and opinions are integrated. POE also plays a vital role in building management strategic planning and can be placed in a public sector context. POE can reduce the appearance of defective problems, because the process allows for a strategic assessment of the current performance of the building. Building design should also take into account the variables, features and parameters that will determine the effective performance of the buildings consistent with the high satisfaction and comfort of the building users.

The following is a reminder of the most important results that were reached in this study after completing the analysis of the questionnaire conducted by the researcher.

1. Landscaping helps reduce glare and temperature for people inside the building, contributes to reducing levels of artificial lighting in all spaces, increases health, well-being and productivity for occupants, improves task performance and occupant's productivity, and can affect a sense of safety and create positive motivation.
2. The importance of landscaping and the great role in improving the functionality of buildings in terms of enriching the appearance and value of the property, improving lighting, temperatures, ventilation and visual comfort in it, and other matters that raise its operational efficiency, accessibility, spatial ability for activities, and adequacy of facilities and communication, responding to additional change, efficient communication and circulation, which improves the efficiency of life and the well-being of occupants.
3. landscaping contributes to improving the energy efficiency of the building and reducing costs and the need for additional systems, improving the efficiency of water use and sanitation in the building, managing natural resources,

managing rainwater and waste, and other matters related to achieving safety, security and health for its occupants.

4. The high-rise building with the presence of landscaping contributes to improving the level of occupant satisfaction and providing recommendations to improve the performance of the building from a technical point of view. This indicates the importance of landscaping and its great role in improving the technical performance of buildings in terms of reducing the negative impact on the natural environment, reducing the consumption of non-renewable resources, and reducing from the use of environmentally harmful materials, and in terms of water management, lighting, ventilation and other technical matters that extend the life of a building, reduce energy drain, and increase its structural efficiency.
5. The landscape of green high-rise buildings contributes to providing comfort to its residents in the post-occupation period in terms of social performance. And that the landscape contributes to providing visual and psychological comfort for them so that they become more positive and stimulating. For example, green spaces and parks contribute to providing recreational opportunities for individuals, which is reflected in the activity and vitality of individuals and improves their social behavior, communication and interaction with each other.
6. The presence of the landscape contributes to creating a connection between the activities of the residents and the physical environment inside the building, and increases the interaction of residents with each other in many aspects and events.
7. There is a positive impact of landscaping on the artistic performance of high-rise buildings in Doha, as it affirmed that landscaping that represents a man-made ecosystem for the building's external and internal environment, includes; The green rooftop, sky garden, podium gardens and green spaces integrate with the natural ecosystem in the buildings and urban infrastructure contribute to improving the look of the buildings.
8. That landscaping contributes to improving the functionality of buildings that deals with the level of functionality and efficiency of features, and includes

accessibility, spatial capacity for activities, adequacy of facilities, communications, responsiveness to additional change, and efficient communication and circulation of air, temperature and lightning.

9. That there is a positive effect of landscaping on the technical performance of high-rise buildings in Doha, and the results confirm that landscaping provides green buildings with many benefits for many stakeholders in the construction industry, including building occupants and the community at large.
10. There is a positive impact of landscapes on the social performance of high-rise buildings in Doha, as the results confirmed that landscapes in green buildings contribute to providing psychological and visual comfort to its residents, so that they become more positive and stimulating, and that the presence of landscapes contributes to creating a social connection between residents and the physical environment inside the building. , and increase the interaction of residents with each other in many activities.

4.2 RECOMMENDATIONS

Based on the previous results, there are a set of recommendations in this study that can be summarized as follows:

1. Most of the indicators, their characteristics and items related to building performance (DQ, IEQ and QBSS) have a significant correlation with the levels of satisfaction of building users. Hence, it is recommended to use a POE approach to improve the performance of green buildings and the landscape of green high-rise green buildings in Doha.
2. LEED® certified buildings for new buildings may be best suited for Qatar as they provide a proven, achievable, non-market-based avenue to rapidly improve new buildings.
3. It is also necessary to upgrade the existing building stock to adapt to similar standards to achieve the overall reductions. For new architectures, a mandatory top-down approach would be the most effective approach to ensuring full compliance. Finally, adherence to the World Green Building Council's commitment to best practices is advised.

1. The strategic landscape design and development is similar to the root of Islamic environmental practices that emphasize the relationship between the environment and man. Hence, the implementation of this type of development must be continuous to ensure a better and safer life for the present society and also for the future generation.

4.3 FUTURE RESEARCH

The concept of green high-rise green buildings is developing as a holistic approach to deal with the various problems caused by the construction industry. Green building is subject to continuous development of new technologies, integrated management of the construction process, consistent standards of certification systems, and appropriate policy adjustment, all of which have a significant impact on the development of green high-rise green buildings. Green building rating systems are developed and applied by most countries around the world as a guideline for achieving sustainable building construction goals.

This study is a small step in assessing the performance of landscape of green high-rise green buildings. The implementation of such Post-occupation evaluation of the landscape of green high-rise green buildings in Doha, despite its great significance in itself, its results will be limited to the region unless this is accompanied by a reconsideration of the current planning and institutional framework and the implementation of the system of combining the current legislation and laws and development projects in the current areas And the development of new areas in parallel with local incentives for community participation, to achieve balanced development within the framework of broader urban plans. To this end, prospective studies are needed from time to time for the following:

- Future research in this field can go further by measuring lighting, air pollutants, indoor temperature and the like, in order to more accurately assess the indoor environment of buildings.
- Furthermore, future research could also include technical and economic aspects of a building's performance, such as energy use and maintenance costs. This would give a broader view of how the building is performing, and complement POE data from tenants' reports of their experiences.

- A review of methodologies for the application of landscape of green high-rise green buildings in densely populated areas
- Axes of effective popular participation in the maintenance and development of the urban fabric of the region and the intangible environment of the population.
- Analysis of complementary legislation and laws to support the experience of green roofs
- An intellectual approach to evaluating the roles of the stakeholders in the implementation of landscape of green high-rise green buildings towards their generalization at the urban level
- Designing community participation approaches to implement the landscape of green high-rise green buildings towards ensuring the urban upgrading of the area.

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APPENDIX 1: QUESTIONNAIRE

POST-OCCUPANCY EVALUATION of LANDSCAPES OF HIGH-RISE GREEN BUILDINGS (Doha as a Case study)

Green building is one of the applications of sustainability in buildings; it refers to the use of construction applications that reduce the negative effects of the building on the environment and human health. Landscaping within high-rise buildings became more and more common due to the large increase in population density in many countries of the world. This affected the architectural style of buildings in them with the orientation to high-rise buildings and the emergence of environmental challenges. It is a man-made ecosystem of the external and internal environment of a building, and includes; green roof, sky garden, podium parks and greenery that integrate with the natural ecosystem in buildings and urban infrastructure. The landscape in high rise building improves the shape of the buildings, and it also contributes to improving the air quality inside the building.

1- As an occupant of a high-rise green building with landscaping in the city of Doha, we want to ask you to answer all paragraphs of this questionnaire carefully and objectively, please express your honest opinions, and there is no need to reveal your name or address.

2-As a worker in a high-rise building, in Qatar as a construction worker, employee or architect, we would like to ask you to answer all of this questionnaire objectively and express your honest opinions. There is no need to write your name or address.

Please kindly return it to the researcher as soon as possible. The information in this questionnaire will be treated with strict confidentiality and it will be used for scientific research purposes only and will depend on the accuracy of the study results.

Thanks in advance for your precious time and cooperation in this research, ***Best Regards,***

Section A: General Information

Kindly chose the answer that suits you from the followings:

1. Name (optional): …….
2. Age: ……
3. Gender: □Male □ Female
4. Qualification: □Diploma □Bachelor □Master
5. Responders: □ Architectural Eng □ visitor □ Construction worker □Residents of the place
6. Job position: □ Branch Manager □Deputy Director
   □ Head of Facilities department □ facilities Staff
7. Experience: □less than 1 □ 1-5 □6-10 □more than 10 years
8. Actual hours of work: Full-time □ Part-time □ Casual □

Section B: Questionnaire axes

Post-occupation evaluation of the landscape of high-rise green buildings in Doha

The following are several statements to understand the effectiveness of landscaping in high-rise green building with post-occupancy evaluation methods. Please put a tick mark (√) beside the answer that represent your point of view.

1. **Measuring the effects of landscapes on functional performance of high-rise buildings in Doha**

Functional performance deals address the functionality and level of competency of features in buildings and facilities. Functional elements include accessibility, adequacy of necessary facilities, and spatial capacity for activities. Other elements include facilities, communication, response to change over time, and efficiency of communication and deliberation. These elements are directly related to the activities within the building. It must be compatible with the specific needs of passengers

The effects of landscapes on functional performance of high-rise buildings.						
No.	Areas of measure	Strongly agree	agree	Neutral	disagree	Strongly disagree
1	Landscaping of high-rise green buildings helps reduce glare and temperature for people inside the building.					
2	Landscapes of high-rise buildings affects adequacy and quality of artificial lighting levels in all spaces					
3	Landscapes of high-rise green buildings affects the health, and productivity level of its occupants					
4	Landscapes of high-rise green buildings affects the performance of tasks and productivity of building occupants					
5	Landscapes of high-rise buildings can affect feeling of safety and creates positive motivation.					
6	Landscapes of high-rise buildings and natural ventilation system from windows and other openings increase the functional performance of building					
7	Strategic landscape design of high-rise green buildings can help enrich the appearance and value of the property					
8	landscape of high-rise buildings reduces problems that hamper efficiency and production in workplaces and living environments					
9	The landscape of high-rise green buildings achieves optimum audio performance and a safe and sound environment.					
10	The landscape of high-rise green buildings achieves natural lighting and visual comfort					

11	Landscape of high-rise green buildings provide the infrastructure necessary to carry out activities according to the type of activities performed inside the building					
12	A landscape of high-rise green buildings helps improve ventilation (same with Q8)					
13	Landscape of high-rise green buildings provide thermal comfort.					
14	A landscape of high-rise green buildings provides access to essential facilities.					
15	Strategic landscape design helps provide screening for privacy and buffer in high-rise green buildings.					
16	landscape could reduce the usage supplementary of cooling agent like air-conditioner in high-rise green buildings					
17	Landscape of high-rise green buildings helps to conserve energy and water.					

2. Measuring the effects of landscapes on technical performance of high-rise buildings in Doha

Technical Performance Elements Technical performance elements deal with survival attributes, such as fire safety and security (security: degree of resistance or protection from damage; fire safety: resistance of major structural elements of a building from fire, flame spread, fire extinguishing and containment, smoke generation, ease of egress in case of fire, toxicity of combustible materials), ventilation and health, structure and sanitation. From an environmental perspective, Technical Performance addresses Indoor Environmental Quality (IEQ) issues, which directly affect the comfort, health and productivity of occupants. IEQ elements include thermal comfort (natural ventilation system and HVAC), visual comfort (quantity and quality of illumination, lighting, shade control, glare and adequate lighting), indoor air quality, and acoustic comfort (acoustic

comfort primarily relates to creating conditions in a building that facilitate clear verbal communication between its inhabitants).

The effects of technical-on-technical performance of high-rise buildings.						
No.	Areas of measure	Strongly agree	agree	Neutral	disagree	Strongly disagree
1	The focus on landscape design and operation of high-rise green buildings plays a large and important role in reducing global warming.					
2	The focus on landscape design and operation of high-rise green buildings impacts the health of individuals and communities.					
3	Strategic landscape design of high-rise green buildings may help improve a building's energy efficiency, reduce costs and need for additional systems.					
4	Landscape design is an ideal part of the broader design process, allowing interaction between building orientation, building design and proposed landscape development.					
5	Landscaping provides many important green services for the building comprising water efficiency					
6	landscape of high-rise green buildings in dealing with sanitary facilities helps achieve the sustainable water recycling of buildings and individual					
7	Building defects are identified, design and construction standards are formulated, and performance measures are supported for asset and facility management, and building					

	lifecycle costs are reduced through errors of identifying design.					
8	Landscape helps to continuously improve the quality and performance of facilities.					
9	Building performance appraisal helps ascertain whether organizations are managing their existing building inventory well and responsibly.					
10	Adequacy of opening design (doors and windows) is good					
11	Overall quality of building layout is good					
12	There is adequacy of horizontal circulation routes in the building					
13	There are adequacy vertical circulation routes within the building					
14	Noise can be controlled through windows, floors doors, and walls that provide clear sound reduction from outside activities					
15	The landscape application is relevant and successful in making recommendations and determining the level of user satisfaction to improve the performance of the building.					
16	Landscaping plays an important and obvious role in the strategic planning of building management.					
17	Landscape of high-rise green buildings help to reduce the negative impact on the natural environment, reduce the consumption of non-renewable resources, and reduce the use of environmentally harmful materials.					
18	A landscape of high-rise green buildings helps manage materials, resources and waste management.					

19	Landscape of high-rise green buildings may improve the storm water management.					

3. Measuring the effects of landscapes on social performance of high-rise buildings in Doha

The elements of social performance create a relation between the activities of the occupants and the physical environment. Typical social performance issues comprise the effect of area size and the number of people sharing it on the building occupant, and the effect of functional distance between spaces on frequency of use. Furthermore, occupant comfort is also influenced by the configuration of circulation routes on social interaction, and features that influence the building's image and outlook.

The effects of landscapes on social performance of high-rise buildings.						
No.	Areas of measure	Strongly agree	agree	Neutral	disagree	Strongly disagree
1	The landscape of high-rise green buildings really brings convenience to the workers inside the building.					
2	Landscapes affect people's feelings, so they become more positive and motivated.					
3	Landscaping provides many important green services for the building, as it may provide recreational opportunities for individuals.					
4	Strategic landscape design can help prevent widespread heat gain in buildings and produce a healthy, natural environment for the surroundings.					
5	Landscaping may increase the value of your property by adding a truly green component to the building.					
6	landscape added to the high-rise green buildings and the surrounding site are					

	visually persuasive to me in representing the green icon of the building					
7	Functional divisions, spaces, and environmental conditions of the landscape of high-rise green buildings affect the behavior of people within the building					
8	Landscape of high-rise green buildings helps to create a connection between the activities of the occupants and the physical environment within the building.					
9	Landscape affects the size and number of people who share it with the occupant					
10	Location, sequence, Spatial features, relationships, details of spaces, size and shape influence the behavior of the occupant.					
11	The layout of the convenient handling, furniture, storage, space and accessibility of the various usable spaces in the building influence the behavior of occupants.					
12	The exposure of individuals to sunlight and natural air in buildings designed as green or environmentally friendly buildings, increases their productivity and maintains their health					
13	Office workers could be more productive, and students' academic achievement would go up if the buildings they were in were environmentally friendly and sustainable					
14	Strategic landscape design can help produce a natural and healthy atmosphere for employees and thus increase their productivity.					
15	Strategic landscape design of high-rise green buildings may help provide privacy for employees					

16	landscape helps control the behavior of building users by emphasizing the positive interactions between the user and the building					
17	Landscape of high-rise green buildings can be used as natural retreats for the building users.					
18	Green roofs indirectly help mitigate air pollution problems in the building and thus improving the health of people inside.					

Thanks for your cooperation,