INTERNAL AND EXTERNAL DRIVERS TOWARDS INTENTION AND ACTUAL GREEN BUILDING ADOPTION IN SAUDI ARABIA

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INTERNAL AND EXTERNAL DRIVERS TOWARDS INTENTION AND ACTUAL GREEN BUILDING ADOPTION IN SAUDI ARABIA

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LIST OF ABBREVIATIONS

AEC	Architecture, Engineering, and Construction
AVE	Average Variance Extracted
BIM	Building Information Modelling
CMV	Common Method Variance
CMB	Common Method Bias
CR	Composite Reliability
DV	Dependent Variable
GBRS	Green Building Rating Systems
GBC	Gulf Building Codes
GCCSO	Gulf Cooperation Council Standardization Organization
GDP	Gross Domestic Product
HTMT	Heterotrait-Monotrait ratio
IT	Information Technology
IV	Independent Variable
KSA	Kingdom of Saudi Arabia
LEED	Leadership in Energy and Environmental Design
PLS–SEM	Partial Least Squares–Structural Equation Modeling
SBC	Saudi Building Code
SCA	Saudi Contractors Authority
SCOPUS	Elsevier's Abstract and Citation Database
SD	Standard Deviation
SEM	Structural Equation Modeling
SgBC	Saudi Green Building Code

TOE	Technology–Organization–Environment
USGBC	US Green Building Council
UNEP	United Nations Environment Program
VIF	Variance Inflation Factor

LIST OF APPENDICES

PEMACU DALAMAN DAN LUARAN TERHADAP NIAT DAN ADOPSI SEBENAR BANGUNAN HIJAU DI ARAB SAUDI

ABSTRAK

Sistem penarafan bangunan hijau (GBRS) dianggap sebagai cara terbaik untuk menilai kelestarian dan prestasi alam sekitar projek bangunan. Walau bagaimanapun, terdapat bukti terhad yang memfokuskan pada penyelidikan pendorong dalaman dan luaran yang mungkin mempengaruhi niat untuk mengadopsi dan pengadopsian sebenar GBRS. Oleh itu, kajian ini mengisi jurang yang ada dengan menjalankan kajian empirikal yang mengkaji pendorong dalaman dan luaran yang mempengaruhi niat untuk mengadopsi dan pengadopsian sebenar GBRS. Kajian ini mengintegrasikan kerangka teknologi, organisasi, dan alam sekitar (TOE) dan teori institusi untuk mengkaji pendorong dalaman, termasuk pengetahuan dan maklumat, kos dan risiko, serta sumber manusia, serta pendorong luaran seperti permintaan pasaran dan sokongan kerajaan yang mempengaruhi niat pengurusan atasan syarikat binaan untuk mengadopsi GBRS, yang seterusnya menghasilkan pengadopsian sebenar GBRS. Teori-teori ini relevan kerana mereka menyediakan pendekatan terstruktur untuk menganalisis pengadopsian dan pembangunan teknologi dan amalan lestari dalam konteks bangunan hijau. Kajian ini menggunakan teknik pensampelan kecergasan dengan pensampelan rawak mudah untuk memilih responden. Satu kajian telah dijalankan dengan menggunakan kaedah borang Google dalam talian untuk mengumpul 521 respons yang sah dan boleh dipercayai. Pemodelan persamaan struktur menggunakan perisian Smart PLS versi 3 telah digunakan untuk menguji dan mengesahkan hipotesis kajian. Penemuan menunjukkan bahawa kos dan risiko, sumber manusia, permintaan pasaran, dan sokongan kerajaan mempunyai pengaruh

langsung dan signifikan terhadap niat pengurusan atasan untuk mengadopsi GBRS. Sementara itu, niat untuk mengadopsi GBRS mempunyai pengaruh langsung dan positif yang signifikan terhadap pengadopsian sebenar GBRS. Selanjutnya, penemuan menunjukkan bahawa kos dan risiko, sumber manusia, permintaan pasaran, dan sokongan kerajaan mempunyai kesan tidak langsung dan signifikan terhadap pengadopsian sebenar GBRS melalui niat. Kajian ini memperluas pengetahuan para sarjana yang sedia ada mengenai pengadopsian GBRS di Arab Saudi dan negara-negara membangun yang lain. Ia menyediakan implikasi yang berguna untuk pembuat polisi untuk meningkatkan pengadopsian GBRS di kalangan syarikat binaan. Selain itu, kajian ini memberikan petunjuk kepada pembuat polisi untuk merancang polisi dan strategi lestari yang menggalakkan pengadopsian GBRS. Kajian masa depan boleh memperluas model kajian dengan menambah variabel lain untuk memahami kesannya terhadap pengadopsian GBRS. Kajian seperti itu boleh menghasilkan maklumat berguna untuk pembuat polisi mengenai faktor lain yang boleh mempengaruhi niat pengurusan atasan syarikat binaan untuk mengadopsi GBRS.

INTERNAL AND EXTERNAL DRIVERS TOWARDS INTENTION AND ACTUAL GREEN BUILDING ADOPTION IN SAUDI ARABIA

ABSTRACT

The green building rating systems (GBRS) are considered to be the best means of assessing the sustainability and environmental performance of building projects. However, there is limited evidence that focuses on investigating internal and external drivers that may influence the intention to adopt and actual adoption of GBRS. Therefore, this study fills the existing gap by conducting an empirical study that examines the internal and external drivers that influence the intention to adopt and actual adoption of GBRS. This study integrated the technology, organizational, and environmental framework (TOE) and institutional theory to examine the internal drivers, including knowledge and information, cost and risk, and human resources, as well as external drivers such as market demand and government support influencing construction companies' top management intention to adopt GBRS, which in turn result in the actual adoption of GBRS. These theories were relevant as they provided structured approaches to analyze the adoption and development of sustainable technologies and practices in the context of green buildings. The study employed convenience sampling techniques with simple random sampling to select the respondents. A survey was conducted by using the online Google form method to collect 521 valid and reliable responses. Structural equation modeling using Smart PLS version 3 software was employed to test and confirm the study's hypotheses. The findings show that cost and risk, human resources, market demand, and government support have a direct and significant influence on top management's intention to adopt GBRS. Meanwhile, the intention to adopt GBRS has a direct and positive significant

influence actual adoption of GBRS. Furthermore, the findings indicate that cost and risk, human resources, market demand, and government support have an indirect and significant effect on the actual adoption of GBRS through intention. The study expands the existing scholars' knowledge on the adoption of GBRS in Saudi Arabia and other developing countries. It provides useful implications for policy makers to increase the adoption of GBRS among construction companies. In addition, this study provides indications to policy makers to design sustainable policies and strategies that encourage the the adoption of GBRS. Future studies can extend the model of the study by adding other variables to understand its effects on the adoption of GBRS. Such studies can produce useful information for policymakers on other factors that can influence top management of construction companies' intention to adopt GBRS.

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter offers a comprehensive overview of the research. In particular, it discusses the background of the construction industry, including Saudi Arabia. It also discusses issues about internal and external drivers that have an impact on the intention to adopt green building rating systems (GBRS). The role of intention in influencing the adoption of actual GBRS is also studied. The chapter also listed the research problem, the research questions, and the research objectives. This chapter also contains significance, the scope of the study, the establishment of the definition of the main variables, and the structure of the chapter.

1.2 Background of Study

The construction industry, due to its provision of infrastructure for the efficient operation of society, plays a vital and indispensable role in the operation of diverse sectors. Moreover, the industry's interdependence with other sectors in terms of supply and demand further enhances its importance (Sui Pheng et al., 2019; Tunji-Olayeni et al., 2023). The construction industry, in terms of its global reach and influence, plays a vital role in the overall economy and exerts a substantial effect on the trajectory of economic growth. The construction industry's progress provides benefits by creating buildings that enhance safety and improve work-life spaces, thus fostering community development (Remizov et al., 2021). In Saudi Arabia, the construction industry is the second-largest non-oil sector. It significantly contributes to the country's GDP growth and is seen as a lucrative investment sector. The chairman of the Saudi Contractors

Authority mentioned that the sector contributes about 6% to the Kingdom's GDP, totaling SR255 billion ($68 billion) (Arab News, 2023, 17-09).

The construction sector has a positive impact but faces sustainability challenges due to non-environmentally friendly materials use, pollution, and ecological deterioration (Tunji-Olayeni et al., 2023). Construction operations have been identified as a significant cause of environmental pollution, posing a major concern. The UNEP highlights that the construction sector uses 40% of global energy, 25% of Earth's water, and 40% of natural resources, half of which are non-renewable (Uddin et al., 2020). The industrial sector is responsible for 40% of the global consumption of natural stone, gravel, and sand, along with 30% of the total release of greenhouse gases (Karunathilake et al., 2018; Uddin et al., 2020). It accounts for 25% of newly harvested wood annually (Akintayo et al., 2020). Moreover, the sector utilizes significant amounts of natural resources (Tunji-Olayeni et al., 2019) and plays a role in global warming and shifts in emerging economies. Furthermore, it impacts public health, safety, and natural ecosystems (Darko & Chan, 2018; Noor et al., 2023). Construction activities produce substantial amounts of dust, noise, solid waste, smoke, and wastewater, which harm human health and contribute to climate change (Chan et al., 2017; Darko & Chan, 2018; Shen et al., 2017).

The construction industry needs to adopt a sustainable approach to address global environmental and societal issues effectively. This is attributed to the substantial impact that the construction sector wields in worsening these problems (Marchi et al., 2021; Mohammed et al., 2023). Public concern about adverse effects has increased, resulting in a focus on using green materials in construction (Debrah et al., 2020). The construction industry is currently experiencing the combined effects of these negative impacts and the growing global consciousness, resulting in heightened

pressure to uphold and enhance the overall quality of life (Wen et al., 2020). Therefore, the sector must adopt sustainable strategies that can generate favourable results in terms of the environment, society, and economy (Tunji-Olayeni et al., 2020).

The increasing influence of the construction industry on energy consumption and carbon emissions in Saudi Arabia necessitates the significant energy consumption of residential buildings (Mohammed et al., 2023). Buildings in Saudi Arabia contribute to over 70% of total electricity consumption across all sectors. Additionally, it is noteworthy that the residential building sector, in isolation, consumes precisely one-half of the electricity utilized in Saudi Arabia (Al-Homoud & Krarti, 2021). This can be attributed to the dynamic advancement of economic sectors, the enhancement of the current capacities, as well as the creation of novel ventures. However, it cannot be denied that the construction process leads to substantial environmental losses and damage. The country shows potential in improving and enforcing energy efficiency requirements for energy-intensive devices and systems but faces limitations.

Given the increasing impact of the construction sector on energy usage and carbon emissions, Saudi Arabia must adopt environmentally sustainable and energy-efficient construction methods. The importance of sustainability and green building in Saudi Arabia's VISION 2030 is emphasized to align with international standards through the adoption of GBRS by the government (Mastini et al., 2021). The need to reduce environmental impact and improve the sustainability of green buildings is driven by climate change and fossil fuel depletion on a global scale (Al-Surf et al., 2021). It is also imperative to promote the concept of green building adoption. Only prominent developers are demonstrating proactive efforts, whereas the smaller and medium-sized counterparts adopt a more uncertain stance. Consequently, companies

continue to encounter significant difficulties in adopting green building as a customary procedure.

Green building refers to environmentally sustainable structures designed to minimize their impact on the environment. These buildings aim to reduce energy consumption, utilize eco-friendly materials, and promote resource efficiency (Hossain, 2019). Additionally, green buildings focus on energy efficiency, aiming to lower energy consumption during both construction and operation and analyzing the economic and social aspects of sustainable development (Cole et al., 2021). Green buildings aim to incorporate green practices by adapting human activities to nature, reducing negative impacts, and addressing pollution and health risks linked to current buildings (Domingo & Batty, 2020). Green building practices advocate for strategies like reducing construction's environmental impact by using recycled materials and minimizing the building's size to preserve land in recent times (Al Amri et al., 2023). Green building practices aim to reduce the environmental impact of buildings and promote sustainable construction (Tunji-Olayeni et al., 2023). These practices are significant for the economy, environmental protection, health, and comfort. As a result, governments globally express interest in green building for improving indoor air quality, ensuring safety, and quality assurance, and promoting renewable energy resources.

Green building technology (GBT) is a set of advanced technologies used to create buildings with minimal environmental impact (Darko & Chan, 2018). Green building is an efficient approach to enhance the implementation of green building technologies that can contribute to reducing pollution, increasing ecosystem recovery, and conserving natural resources for future generations (Nsafon et al., 2020; Papoyan et al., 2021). The construction industry recognizes the importance of integrating green

building practices and GBT for sustainable development (Alattyih et al., 2020; Darko & Chan, 2018; Tran et al., 2020). Together, GBTs can lower operational expenses, create energy-efficient and green structures, and improve the health of occupants (Remizov et al., 2021).

GBRSs are commonly market-oriented standards that evaluate the degree of sustainability of buildings through a comprehensive assessment based on multiple criteria (Marchi et al., 2021; Sartori et al., 2021). The utilization of GBRS is increasing, providing reliable assessment of built environments, and gaining importance (Al Kady et al., 2023). The ultimate purpose of GBRS is to provide guidance and evaluation for the entirety of a project's life cycle, thereby minimizing any negative influence on the environment (Li et al., 2023; Marchi et al., 2021). There exists a plethora of GBRS that are currently accessible on a global scale (Li et al., 2023). These systems differ in terms of their procedures for implementation and the criteria used for evaluation. Prominent examples of such systems include BREEAM, CASBEE, and Green Globes, as well as the Green Star and Leadership in Energy and Environmental Design (LEED) certifications, all of which enjoy widespread adoption worldwide (Marchi et al., 2021; Remizov et al., 2021).

In Saudi, GBRS are developed, but implementation plans need reinforcement. Furthermore, stakeholders' strategies in the Saudi Arabian construction market have shown a promising level of awareness and desire to employ both locally and internationally renowned grading systems, such as Mostadam and LEED (Al-Surf et al., 2021). With their objective of influencing the construction market to adopt more environmentally friendly practices, the Saudi government has incorporated the Green Building Code (SBC-1001), Mostadam, and other international GBRS like LEED.

Accordingly, there is significant potential for enhancement, particularly through the implementation of sustainable building systems.

Recently, Nasser Al-Hajri, Editor-in-Chief of Magwel magazine (2023, May), affirmed that Saudi construction companies should adopt technologies and rating systems in their construction strategies, which will save $700 to $1.2 trillion in the next ten years. The submission from Al-Hajri gave a clear picture of the importance of adopting GBRS, especially coming from an expert in this field, to raise awareness that this issue is current and demands pragmatic solutions. This led to the concept of adoption of GBRSs, which has been steadily increasing worldwide, including in Saudi Arabia (Alyami, 2019; Remizov et al., 2021). That being said, for GBRS to be adopted and widely accepted, a deeper understanding of the underlying drivers influencing its progress must be developed.

The adoption of GBRSs is crucial for implementing global sustainable development within the construction sector. However, there is a scarcity of studies that have explicitly investigated the drivers influencing GBRS. Previous research has mainly focused on the significance of drivers, and strategies for facilitating the integration of green building technology (GBT) (Amuda-Yusuf et al., 2020; Chan et al., 2018; Darko, et al., 2018; Mohamed et al., 2023). To date, numerous studies have examined the factors of GBT including attitude and perceived behavioral control (Tunji-Olayeni et al., 2023), operating cost (Tjenggoro & Prasetyo, 2018), technology availability (Alawneh et al., 2018; Khoshbakht et al., 2018), energy efficiency (Mohamed, 2019), green technologies (Shan & Hwang, 2018), training and knowledge (Shan & Hwang, 2018), higher rental value (Leskinen et al., 2020), green resources (Hussain et al., 2019), new resources (Mosly, 2018), and natural resources (Gupta,

2017), innovativeness capability (Sweis et al., 2019), and governmental support (Al Surf et al., 2021; Jain et al., 2020).

Based on previous studies exploring GBT, various internal and external influencing drivers have been identified. Some of the internal drivers are found to be related to aspects are knowledge and information about green building, cost, and risk (Darko et al., 2018; Mohammed et al., 2023). Additionally, higher costs and risks are often at the forefront, as the initial costs for green building can be higher than traditional methods (Saleh et al., 2020; Noor et al., 2023; Tunji-Olayeni et al., 2023). Human resources are also regarded as a significant influence that inspires the adoption of GBRS. In general, both employees' and owners' skills and competencies can positively impact green construction practices (Darko et al., 2018; Sweis et al., 2019). The competency aspect of human resources about green building and systems has generated interest among companies to adopt GBRS (Berawi et al., 2020).

The external drivers, on the other hand, are demonstrated through government support in the form of legal regulations, workshops and training, and appropriate incentive policies (e.g., grants or loans) (Amuda-Yusuf et al., 2020; Chan et al., 2018; Hwang et al., 2017). Furthermore, market demand for green buildings can also motivate companies to adopt GBT (Darko & Chan, 2018). As a result, the influences of factors on GBT have been reported at different levels, including the individual, technology, organization, and environment (e.g., governmental support). These studies highlight the need for further research on the drivers for the adoption of sustainable development within the construction sector. These influencing drivers as reported in the previous studies also reflect technology–organization–environment (TOE) models

consisting of technological, organizational, and environmental (Tornatzky& Fleischer, 1990).

TOE framework is applied as a valid, robust, and precise model as its well-defined drivers (including internal and external) clarify how to formulate technology adoption decisions (Nguyen et al., 2022). TOE is applied to construct the influencing factors of adopting green information technology (IT) has significantly expanded and extended to include green building (Chong & Olesen, 2017; Chin et al., 2019; Li et al., 2022). Institutional theory provides insights into individual and organizational behaviours. However, empirical evidence is lacking regarding the influence of institutional pressure on adopting sustainable construction practices in green building contexts (Tunji-Olayeni et al., 2023). The environmental precursors that affect green IT initiatives are also of interest to the three aspects of the institutional theory (Chong & Olesen, 2017). Environmental factors encompass government support and market demand that affect the green adoption behavior of construction enterprises (Li et al., 2022; Mohammed et al., 2023). However, since little is known about the underlying factors that may potentially lead to the intention to adopt GBRS, it is therefore important to specify and explore how these factors contribute.

Consequently, by identifying the internal and external influencing drivers, which is the aim of this study, relevant stakeholders like the government, the top management of construction companies, and developers may be able to determine the possible areas of support, as well as issued to be considered, to help adopt GBRS. For these reasons, there is a call for more exploration into the intentions of Saudi construction companies' top management to adopt GBRS, particularly focusing on their perspectives regarding the drivers influencing the actual implementation. The

specific objective was to explore the mediating role of intention on the relationship between internal and external drivers and the actual adoption of GBRS.

1.2.1 Green Buildings in Saudi Arabia

Saudi Arabia is an emerging nation that makes a substantial contribution to the field of construction. As urbanization and population growth continue, constructing new houses and industries negatively impacts society and the environment. These challenges have been highlighted in previous literature and hinder the industry's ability to thrive in a clean, green, and sustainable environment. Urbanization is experiencing a rapid acceleration, and projections indicate that approximately two-thirds of the global populace will reside in urban areas by the year 2050 (Sharma, 2018). Furthermore, a significant number of current construction endeavors fail to adequately deliver customer satisfaction, as the execution of these projects is frequently hindered by delays and excessive expenditures (Raouf & Al-Ghamdi, 2018)

Further Saudi Arabia is expected that its population will increase, the building demand will also increase, and they have started to build new residential and commercial buildings, which can directly affect the building business in both positive and negative ways (Gondal et al. 2017). An approximate value of $1.3 trillion in significant initiatives is expected, including government megaprojects, industrial projects, and maintenance capital expenditures, with a peak annual spending exceeding $175 billion from 2025 to 2028. The projected yearly contract allocation is threefold the previous average, escalating from $50 billion to $150 billion (McKinsey & Company, 2023).

Increasing frequent development in urban areas has a mixed influence on the environment and the construction sector, leading to problems with air pollution, home

emissions, high water demand, high energy use, and solid waste generation (Arocena & Sutz, 2021; Mohanty, 2020). Al Surf et al. (2014) mentioned that rapid urbanization in developing countries is putting pressure on infrastructure and depleting natural resources to meet increasing demands. The urbanization rate in Saudi Arabia has experienced a significant rise, climbing from 21% in 1950 to 83% in 2015 (Al-Alola et al., 2021). In addition, Saudi citizens construct 300,000 to 400,000 new houses each year, with a 5 percent increase (Fiaz et al., 2018).

For the last decades, researchers and academicians have targeted green buildings specifically in Middle east countries (Saleh et al., 2020) because Golf countries are mostly dependent on the oils sector (Nurunnabi, 2020). In the 1970s, high oil prices benefited the economy of Saudi Arabia, maintaining its position as a leader in the oil sector. The country is now aiming to excel in green energy, including green hydrogen, wind energy, and solar energy (CNBC interview of Prince Turki Al Faisal). To meet these aspirations, strong government support in the form of incentives, regulations, and educational programs is crucial for catalyzing the widespread adoption of GBRS. This governmental role is not merely facilitative but is, in fact, pivotal for the holistic attainment of both the VISION 2030 objectives and the United Nations' Sustainable Development Goals.

Saudi Arabia heavily relies on the exportation of oil, thus leading to a significant concern regarding the emissions of greenhouse gases within the nation (Al Surf et al., 2021). The abundance of economical petroleum discourages the utilization of public transportation and the implementation of alternative energy projects. Both endeavors entail substantial costs (Mohammed et al., 2023). Saudi Arabia is currently undergoing a period of swift urbanization, as it strives to establish itself as a socially oriented emerging market economy. Saudi Arabia has actively promoted the

development of a low-carbon society by implementing a variety of local, regional, and global initiatives (Rajaee et al., 2019). In addition, people found an important opportunity in the nation, especially in cities like Riyadh, due to rising oil prices. This resulted in migration towards urban areas and subsequent population growth (Blaisi, 2019; Umar, 2020).

Saudi Arabia, as one of the world's leading economies, recognizes the importance of embracing sustainable construction practices and promoting the adoption of green buildings. However, despite the potential advantages, the rate of green building adoption in the Saudi Arabian construction sector remains relatively low. “However, better late than never” is what Prince Mohammad Bin Salman the Crown Prince and Prime Minister of Saudi Arabia said according to Arab News in 2021 (Full Transcript, 2021). In 2021, Arab News reported that Prince Mohammad Bin Salman stated, "Better late than never," when discussing the problems faced by King Faisal's government in the 1970s about the construction industry in Saudi Arabia. The Prince, Bin Salman highlighted the lack of adoption of international rating systems and explained that the private sector must apply the same standards as those used at ROSHN if they hope to have successful developments. The Prince also argued that had the government started construction companies with international rating systems in the 1970s, Saudi Arabia would have had some of the biggest real estate companies in the world. Unfortunately, opposition from officials and ministers hindered the advancement of private sector opportunities. This led to issues such as poor building quality, inadequate architecture, lack of employee expertise, low quality of life, water resource problems, traffic congestion, air pollution, and insufficient greenery (Arab News, 2021).

Green buildings have a notable impact on the advancement of sustainable urban development in Saudi Arabia (Alattyih et al., 2022). The country has launched initiatives and programs by promoting green buildings as one of the national plans to become a global leader in the sustainable building sector (Balabel et al., 2021). Green buildings are crucial for Saudi Arabia's economic development, environmental issues, and climate change challenges due to the Kingdom's heavy reliance on oil for 87% of its economy (Al-Yami & Sanni-Anibire, 2019; Al Surf et al., 2021).

The Saudi Arabian government is currently strategizing to transition away from its reliance on oil towards an alternative industry. It is crucial to reduce the harmful impacts of regulatory infrastructure growth on the environment, such as worsening air pollution and releasing greenhouse gases from homes. This also includes increasing the need for water resources, boosting energy use, producing large quantities of solid waste, and affecting the general quality of life (Alkhathlan et al., 2020; Banafea & Ibnrubbian, 2018). However, the construction companies' owners are facing a lot of challenges and barriers to shifting from regular construction to green construction. Thereby, Prince Mohammed Bin Salman also highlighted the point during his speech and said that: "The construction company that does not meet the international requirements rating system will go out of the market".

1.2.2 Green Buildings and Saudi VISION 2030

In April 2016, the Government of Saudi Arabia inaugurated VISION 2030, a strategic framework demarcated into three core pillars: A Lively Society, A Successful Economy, and An Aspiring Nation. These pillars were constructed in alignment with the nation's unique contextual challenges and opportunities. Saudi Arabia's VISION 2030 strategy serves as an exemplar, explicitly promoting the adoption of green

construction methods and techniques that align with internationally recognized standards. The shift towards sustainable construction thus becomes not just a market response but a strategic imperative for addressing both environmental and economic challenges synergistically (Al-Surf et al., 2021).

In this context, governmental intervention becomes instrumental. Through its VISION 2030 strategic framework, the Saudi Arabian government explicitly aims to enhance the quality of life by promoting green building practices compliant with international standards. The emphasis on resource-efficient structures, particularly those that optimize water and energy consumption, aligns with consumer demand and broader socio-environmental objectives (Mastini et al., 2021). The infrastructure and development sector are pivotal in the Saudi Arabian government's economic reformation agenda (Alqahtany, 2020). Before the outbreak of the COVID-19 pandemic, this sector was recognized as highly extensive in the Gulf Cooperation Council, with investments exceeding $825 billion in upcoming projects that are still awaiting financing. Data reveals a notable escalation in contract awards, rising from $11.2 billion in 2016 to $14.6 billion in 2018 (Alawadi et al., 2018).

Explicitly within the ambit of VISION 2030, the Saudi government emphasizes the need to adopt GBRS, converging with international standards (Mastini et al., 2021). This is a strategic initiative that has significant implications for environmental sustainability. Employing such systems not only aligns with international best practices but also serves to ameliorate air quality, thereby enhancing public health and economic efficiency. Such advancements are congruent with VISION 2030's objective to create a "safe, clean, healthy, happy, smart, green, and friendly quality of life environment" (Al-Surf, et al., 2021).

The Saudi Government introduced VISION 2030 in April 2016, organized into three pivotal pillars: A Lively Society, A Successful Economy, and An Aspiring Nation. These pillars were strategically devised to address Saudi Arabia's unique challenges and leverage its opportunities. The focus is supported by Saudi Vision 2030, outlining projects and directives to promote growth in green building (Abubakar & Dano, 2020; Al-Surf, et al., 2021). The first pillar, A Lively Society, aims to foster healthy lifestyles and enhance quality of life. This is a pressing concern, as per the World Health Organization (WHO), which has categorized Saudi Arabia's air quality as subpar, leading to many public health issues (Alsubaie & Berekaa, 2020). The second pillar, A Successful Economy, signifies a shift from an oil-centric economy towards a diversified one that incorporates renewable energy sources. The transition is crucial due to the impact of air pollution and climate change, worsened by the country's use of fossil fuels, harming the quality of life and productivity (Abas et al., 2017). The third pillar, An Aspiring Nation, is subdivided into efficient governance and responsible citizenship. This underpins the implementation of the overarching vision.

Within the scope of VISION 2030, the Saudi government specifically endorses adopting internationally recognized GBRS (Mastini et al., 2021). This endorsement is not merely symbolic but carries considerable implications for achieving environmental sustainability. The implementation of green building technologies is aligned with international best practices and contributes substantively to improving air quality, thereby enhancing public health and economic productivity. This strategic direction is in harmony with VISION 2030's mission to offer a "safe, clean, healthy, happy, smart, green, and friendly quality of life environment" (Al-Surf, et al., 2021). Moreover, VISION 2030 explicitly facilitates the transition from traditional construction

methodologies to those that meet international green building standards (Mastini et al., 2021). The adherence to such standards is designed to create cleaner, greener, and more sociable environments, which is integral to improving the quality of life—a principal objective of VISION 2030 (Al-Surf, et al., 2021).

In conclusion, the Saudi government actively promotes green building standards to achieve VISION 2030 goals, addressing environmental and economic vulnerabilities. A robust governmental framework is essential to actualize these environmental and societal ambitions. This entails providing fiscal incentives, enforcing rigorous regulations, and implementing educational outreach programs aimed at galvanizing the large-scale adoption of accredited GBRS.

1.3 Problem Statement

There is still limited adoption of green buildings despite their significant environmental benefits and available rating systems (Akcay, 2023; Maqsoom et al., 2023). Barriers to green building adoption in developing countries include higher construction costs, lack of knowledge, absence of authorized rating systems, unavailability of materials, and insufficient market demand (Anzagira et al., 2019; Khan et al., 2019; Remizov et al., 2021). Factors hindering green building development encompass financial, governmental, organizational, technical, and socio-cultural aspects, To address these challenges, strategies such as introducing new regulations, offering incentives, fostering collaboration, and sharing success stories are crucial. Government policies globally aim to encourage stakeholders in the construction sector to embrace green practices. Innovative tools and techniques are essential to enhance the adoption of green buildings and rating systems in developing nations (Anzagira et al., 2019; Khan et al., 2019; Remizov et al., 2021).

The adoption of GBRS among construction companies in Saudi Arabia remains low, hindering the evaluation of green buildings. Despite the significant number of construction companies in Saudi Arabia, only 1240 projects out of 14,000 are certified by organizations such as Green Building Council (USGBC) or Leadership in Energy and Environmental Design (LEED) by 2022 (USGBC, 2023). Obtaining certifications from internationally recognized organizations like the US USGBC or LEED is crucial for evaluating green buildings due to their widespread acceptance as international standards. The low certification rate adoption of green buildings could indeed be a contributing factor to the low implementation of sustainable building practices in the country. This is because sustainable building certification systems play a crucial role in promoting and standardizing environmentally friendly construction practices. The certification process ensures that buildings meet specific sustainability criteria, encouraging developers to adhere to green building principles. Therefore, the low certification rate adoption may indicate a lack of emphasis on sustainable practices in the construction industry, hindering the widespread implementation of green building initiatives in Saudi Arabia (Yi & Yun, 2022).

This highlights the current gap in the adoption of green building practices and the need for increased efforts to promote sustainability in the construction sector in Saudi Arabia. Many Saudi construction companies perceive implementing green building practices as requiring substantial investments, leading to reluctance to adopt GBRS (Mohamed et al., 2023; Shamseldin, 2023). Saudi Arabia is still behind in implementing green buildings compared to other Asian and African countries such as China, Japan, Malaysia, the United Arab Emirates, and Singapore. The justification for this argument is that there are barriers to adopting GBRS in Saudi Arabia, such as

higher green construction costs, lack of knowledge, inadequate market demand, and lack of written and clear building code (Mohamed et al., 2023).

Recently, Prince Mohammad Bin Salman, Crown Prince and Prime Minister of Saudi Arabia highlighted the lack of adoption of international rating systems and explained that construction companies' strategies must apply the same standards as those used at ROSHN if they hope to have successful developments. The presentation by Prince Bin Salman described an issue raised by the Prime Minister of Saudi Arabia, emphasizing its current relevance and need for practical solutions (Arab News, 2021).

Many construction projects struggle to meet customer expectations because of problems with going over schedule and budget limits ((Raouf & Al-Ghamdi, 2019). The lack of GBRS implementation remains a major concern in Saudi Arabia. Experts predict widespread consequences on ecosystems, resource depletion, global warming, and eco-friendly building practices (Al Amri et al., 2023; Mohamed et al., 2023). The failure to embrace such systems adversely impacts public health, contributes to emissions, escalates energy and water consumption, and diminishes overall quality of life. This study will provide an evaluation and comparison of the drivers to implement GBRS practices in green buildings in Saudi Arabia. It will also identify and assess the internal and external drivers for the intention to adopt GBRS in building projects in Saudi Arabia. Hence, the findings of this study will serve as a roadmap for policymakers in Saudi Arabia to overcome the barriers and promote the widespread implementation of GBRS practices, leading to improved public health, reduced emissions, and more efficient energy and water consumption.

Additionally, the GBRS adoption in Saudi Arabia is not mature, primarily due to a lack of support from the government and a need for increased awareness and

knowledge of these technologies (Al Amri et al., 2023; Mohamed et al., 2023). Furthermore, construction companies should identify the skills of human resources in managing the business (Alattyih et al., 2020; Azeem et al., 2017). This lack of success persists despite the government's diligent endeavors to promote sustainable development in the nation through Vision 2030. Nonetheless, the implementation of fresh governmental policies and regulations that provide benefits to industries to foster the integration of green construction methods into their plans (Al Amri et al., 2023) is still a major issue as there is no clear evidence on how government support facilitates the adoption of GBRS. It is reported that the high cost and risks associated with green building technologies have a significant effect on the barriers to implementing green buildings within the construction sector (Al-Surf et al., 2021). Mohamed et al. (2023) and Alattyih et al. (2020) identified that high costs and risks related to green building are behind the slow adoption of rating system tools in the Saudi context.

The low adoption of GBRS in Saudi Arabia can be attributed to various barriers, including market demand and perceived high prices among customers who are aware of green buildings (Al-Surf et al., 2021; Mohamed et al., 2023). The studies have explicitly shown that the lack of awareness and understanding of the benefits of green buildings may lead to limited market demand, hindering the widespread adoption of such sustainable practices in the construction sector. Additionally, the high cost associated with green buildings may deter potential customers from investing in such projects, further limiting GBRS adoption.

Additionally, studies have shown that the lack of adequate government support in the diffusion of GBRS adoption is considered to be a major barrier in motivating Saudi constructing comeliness to adopt GBRS in their projects (Al-Surf, 2021; Mohamed et al., 2023). Most of the country’s government institutions are not well

prepared to introduce new regulations, provide incentives to industries, and create a collaborative culture among stakeholders to promote awareness and knowledge sharing. Therefore, a need to strengthen government support could be essential in speeding up the provision and adoption of GBRS adoption.

Existing studies have been conducted to identify and explain the challenges and barriers to implementing green construction technology in the Saudi context (Abubakar & Dano, 2020; Alattyih et al., 2019; Alsulaili et al., 2020; Alyami, 2019). However, there is no evidence for empirical green studies that focus on investigating drivers that may influence the adoption of GBRS among Saudi construction companies. This lack of research hinders the adoption of GBRS, which in turn limits the mitigation of environmental impacts from construction activities and the improvement of quality of life as outlined in the Saudi Vision 2030. Al Surf et al. (2021) highlighted the importance of green building rating systems like LEED and Mostadam in Saudi Arabia's construction industry. These systems play a crucial role in promoting sustainable practices and influencing stakeholders to integrate green elements into residential projects. The research emphasizes the significance of stakeholders' awareness and willingness to adopt these rating systems for sustainable development. Understanding stakeholders' perspectives on LEED and Mostadam can provide valuable insights for future research on enhancing sustainability in residential construction projects in Saudi Arabia. Therefore, there is a need for a specific empirical study that could provide insights to scholars, practitioners, and policymakers on the drivers of GBRS adoption in Saudi Arabia.

Previous literature has primarily focused on the challenges and barriers to GBRS adoption, but this study shifts the focus to the drivers that can facilitate successful adoption (Al Kady et al., 2023; Remizov et al., 2021; Awadh, 2017). The

current study focuses on the drivers of GBRS adoption in the construction industry in Saudi Arabia. Al Surf et al. (2021) emphasize the importance of internal and external drivers, which include providing information and knowledge about green building, human resource skills, and governmental support (Al Surf et al., 2021). By understanding and addressing these drivers, construction companies can better prepare themselves for the adoption of GBRS and contribute to the achievement of sustainable development goals in Saudi Arabia

This study, in fact beyond the recent study by Noor et al. (2023), who called to explore additional determinants or factors that may influence the intention to adopt GBT. This study contributes to understanding the drivers behind the intention to adopt GBRS and fills the gap in empirical research in this area. This study focuses on major drivers for intention to adopt GBRS, such as knowledge and information, cost & risk, human resources, government support, and market demand, and examines the influence intention on actual adoption of GBRS in construction companies. These drivers can inspire top management and contribute to changing their work strategies to the actual adoption of such systems.

Studies such as Darko, Chan, et al. (2018) investigated the quantitative impacts of barriers, strategies, and drivers on the adoption of GBTs in construction projects. According to the authors, there exists an insufficient amount of information regarding the quantitative effects of drivers on the adoption of GBTs within the construction sector. The Darko and Chan research team points out that the adoption of GBTs in developing countries needs better research and investigation. The authors emphasize the importance of studying critical drivers for GBT adoption and their correlations in future research. This research expands on the work of Darko and Chan by scrutinizing

how internal and external drivers influence the intentions of top management in construction companies to adopt GBRS in Saudi Arabia.

Saleh et al. (2020) investigate the correlation between different variables and the intention to embrace green sustainable construction approaches in Qatar. The research primarily concentrated on engineering consultants and contractors in Qatar, thereby ignoring the involvement of other prominent decision-makers such as owners, stockholders, and chief executive officers of construction companies. Subsequent investigations ought to take into account the incorporation of these stakeholders to furnish a more all-encompassing comprehension of the implementation of green construction techniques.

Given the significance of GBRS adoption in the present era and the lack of studies carried out in Saudi Arabia to assess the impact of these drivers on GBRS adoption, it warrants a new study that serves as the novelty of this study. Moreover, the existence of a mediation effect of intention will provide further enrichment into the current green building literature as well as invite more studies in the future in developed nations. In reality, this particular study focuses on top management strategies that follow the guidelines during the construction process, giving new insights into both green building and GBRS literature in the context of Saudi Arabia.

1.4 Research Objectives

The main aim of this study is to develop a model that can be used to facilitate the actual adoption of GBRS among top management of construction companies in Saudi Arabia. In particular, the model is expected to demonstrate the relationships between the internal (i.e., knowledge and information, cost and risk, and human resources) and external drivers (i.e., government support and market demand) and

intention to adopt, which in turn result in the actual adoption of GBRS. The specific objective is to explain the role of intention as a mediator, which serves to mediate the connection between the internal and external drivers and the actual adoption of GBRS among top management of construction companies in Saudi Arabia. To achieve the desired outcomes of this investigation, the subsequent research goals have been established;

RO 1: To examine whether the internal drivers such as knowledge and information, cost and risk, and human resources have a significant influence on the intention to adopt GBRS.

RO 2: To examine whether the external drivers such as market demand and government support have a significant influence on the intention to adopt GBRS.

RO 3: To examine whether the intention to adopt GBRS influences the actual adoption of GBRS.

RO 4: To determine if there is a mediating effect of the intention to adopt GBRS on the relationship between the internal such as knowledge and information, cost and risk, and external drivers such as market demand and government support, and the actual adoption of GBRS among construction companies' top management.

1.5 Research Questions

This research addresses the following questions, and the questions are as follows:

RQ 1: Do the internal drivers such as knowledge and information, cost and risk, and human resources influence the intention to adopt GBRS specifically?

RQ 2: Do the external drivers such as market demand and government support influence the intention to adopt GBRS specifically?

RQ 3: Does the intention to adopt GBRS influence the actual adoption of GBRS?

RQ 4: Is there a mediating effect of the intention to adopt GBRS on the relationship between the internal such as knowledge and information, cost and risk, and external drivers such as market demand and government support, and the actual adoption of GBRS construction companies' top management?

1.6 Significance of the Study

The present research aims to provide theoretical and practical insights into green building technologies and rating systems adoption, with a specific focus on the Saudi Arabian context.

1.6.1 Theoretical Implication

The study makes important theoretical contributions to the GBRS literature. The study further examines the empirical validity of the integrated utilization of the TOE framework and institutional theory to investigate the effect of the internal and external drivers on the top management's intention to adopt GBRS. Nevertheless, empirical studies that examine the influence of these driver constructs on intention to adopt GBRS that in turn tend to affect actual adoption are less common in the green building context. The findings offer empirical evidence on the influence of internal

drivers (cost and risk, and human resources), and external drivers (government support and market demand) on top management's intention to adopt the GBRS which in turn influences the actual adoption of GBRS, thus enriching the existing literature. This study also provides the existing literature on GBRS within the context of the construction industry in Saudi Arabia, a non-Western nation —the context has not yet received much attention from scholars. Consequently, these empirical results will be more valuable for the theory building of GBRS adoption.

By incorporating the internal and external drivers, this study extends the previous studies and provides a unique integration model to GBRS adoption literature because both internal drivers (which are reflected by knowledge and information, cost and risk, and human resources constructs) and external drivers (drivers which are reflected by market demand and government support), are examined under one conceptual framework previous studies have discovered (e.g., Amuda-Yusuf et al., 2020; Darko et al., 2017a; Darko, Chan, et al., 2018; Noor et al., 2023; Saleh et al., 2020).

In particular, since GBRS adoption is in the infant stage in most developing countries, particularly in Saudi Arabia (Al-Surf et al., 2021), there are limited empirical studies on the adoption of GBRS mostly in this area. Studying individual drivers predicting or hindering the adoption of green buildings may lose significance when analyzed together, requiring a more comprehensive approach to assess the actual adoption of GBRS. To fill this gap, this study empirically examines the effect of internal and external drivers on the intention to adopt the GBRS.

In this way, the current study integrates the mediating role of intention on the relationship between both internal factors (including cost and risk, knowledge and