

The Impact of Smart Technologies on Residential Property Management: An Applied Study in The Saudi Real Estate Sector

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2023/2024

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الاستهلال القرآني

قال تعالى: {يَرْفَعِ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا تَعْمَلُونَ خَبِيرٌ}

إهداء

الحمد لله والشكر له كما ينبغي لجلال وجهه وعظيم سلطانه عدد خلقه ورضا نفسه وزنة عرشه ومداد كلماته
على أن من علي بإنجاز هذه الدراسة، والصلاة والسلام على أفضل الخلق نبينا محمد وعلى آله وصحبه
وسلم تسليما كثيرا.

الشكر والتقدير

قال تعالى: ﴿يَا أَيُّهَا الَّذِينَ آمَنُوا كُلُوا مِن طَيِّبَاتِ مَا رَزَقْنَاكُمْ وَاشْكُرُوا لِلَّهِ إِن كُنتُمْ إِيَّاهُ تَعْبُدُونَ﴾

[سورة البقرة: 172]

والشكر أولا وأخيرا لله رب العالمين الذي وفقني الاعداد هذا البحث واخرجه في صورته المتواضعة وأصلي وأسلم على رسولنا وسيدنا محمد صلى الله عليه وسلم وعلى آله وصحبه أجمعين.

وبعد..

أشكر أستاذ ناصر المحيimid لإنشائه فكرة جامعة ميدأوشن

والشكر لكل طاقم التعليم في الجامعة على جهودهم ومثابرتهم لتقديم كافة الأمور لخدمتنا للمضي في دراستنا.

ونشكر الدكتور د.احمد زيادة و د.احمد راجح على قبولها الاشراف على مشروع تخرجي ولهما كافة الشكر والامتنان.

ملخص

هدفت الدراسة للتعرف أثر التقنيات الذكية على إدارة العقارات السكنية: دراسة تطبيقية في القطاع العقاري السعودي، حيث اعتمدت الباحثة في دراستهم على المنهج الوصفي التحليلي، وقد تم تطبيق البحث على عينة مكونة من كافة موظفي في القطاع العقاري السعودي، وكان عدد أفراد العينة مكون من (90) فرداً، تم اختيارهم بطريقة عشوائية، وقد كانت الاستبانة هي أداة جمع البيانات من عينة الدراسة .

وقد توصلت الدراسة لمجموعة من النتائج كان من أهمها هناك كفاءة عالية للأنظمة التكنولوجية الذكية في إدارة العقارات السكنية في المملكة العربية السعودية، كما بينت النتائج على . هناك نماذج واستراتيجيات تمويل مجدية لدعم رواد الأعمال العقاريين في تبني التقنيات الذكية، هناك تحديات محددة تواجه رواد الأعمال العقاريين في تطبيق الأنظمة الذكية في المملكة العربية السعودية.

وبناء على هذه النتائج قدم الباحث عدة توصيات أهمها ضرورة رفع الوعي بفوائد التكنولوجيا الذكية في إدارة العقارات السكنية وتوفير برامج تعليمية للمستثمرين وأصحاب الأعمال لزيادة قبولهم وتبنيهم لهذه التقنيات، كما يجب على الحكومة والجهات ذات الصلة وضع سياسات وأطر مناسبة لتشجيع استخدام التكنولوجيا الذكية في القطاع العقاري بما في ذلك توفير التسهيلات والحوافز المالية.

Abstract

The study aimed to identify the impact of smart technologies on the management of residential real estate: an applied study in the Saudi real estate sector, where the researcher relied in their study on the descriptive analytical approach, and the research was applied to a sample consisting of all employees in the Saudi real estate sector, and the number of sample members consisted of (90) individuals, they were randomly selected, and the questionnaire was the data collection tool from the study sample.

The study yielded several results, the most important of which indicated a negative impact of the risks associated with a decrease in interest rates and financing offers from banks on real estate investments in the Kingdom of Saudi Arabia. Furthermore, the results revealed a statistically significant positive relationship between the decrease in demand for real estate investments and the interest rate. Additionally, a statistically significant positive relationship was found between the volume of real estate investments and changes in the interest rate and financing offers from the bank.

Based on these results, the researcher made several recommendations, the most important of which is the need to raise awareness of the benefits of smart technology in residential real estate management and provide educational programs for investors and business owners to increase their acceptance and adoption of these technologies. The government and relevant authorities should also develop appropriate policies and frameworks to encourage the use of smart technology in the real estate sector, including providing financial facilities and incentives.

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Chapter One: General Framework

1. Introduction

Residential real estate management has become a task burdened with many paths and arduous work within the framework of developing modern systems in the real estate world. With technological advancement, real estate management has branched out within different technical programs' framework (Dobrain, 2011). Nowadays, modern residential real estate companies are well equipped with property management software, where most of the tasks are performed by property managers with the help of modern technological techniques.

Indeed, smart technologies have revolutionized various sectors, and residential real estate management is no exception. The integration of Internet of Things (IoT) devices, artificial intelligence (AI), and other advanced technologies has changed the way real estate is managed, providing unprecedented levels of convenience, efficiency, and security for both property managers and residents as well as real estate entrepreneurs.

Adoption of smart home technologies has grown significantly, driven by increasing demand for automation and improved living experiences. According to a report by Statista, the global smart home market is expected to reach \$135.3 billion by 2025, with a compound annual growth rate (CAGR) of 25% from 2019 to 2025 (Statista, 2021). This increase is fueled by developments in the Internet of Things, which enables devices to communicate and work together seamlessly, creating an interconnected ecosystem within residential properties.

In the Kingdom of Saudi Arabia, many modern technologies have emerged in the field of real estate, as one of the primary benefits of smart technologies in property management is enhancing operational efficiency. IoT devices, such as smart thermostats, lighting systems, and water leak detectors, allow property managers to monitor and control various aspects of a property remotely. This remote management capability not only reduces the need for field visits, but also allows for proactive maintenance, preventing potential problems before they escalate into costly repairs (Deloitte, 2018). For example, smart HVAC systems can be programmed to optimize energy use based on occupancy patterns, resulting in significant cost savings and reduced environmental impact.

In addition to operational efficiency, smart technologies also enhance security and safety within residential properties. Smart locks, security cameras, and alarm systems provide real-time monitoring and alerts, allowing property managers and residents to quickly respond to any security breaches or emergencies. These technologies can be integrated with mobile applications, allowing remote access and control, adding layer of convenience and peace of mind (Halvitigala & Gordon, 2014). Furthermore, AI-powered analytics can detect unusual activities or patterns, providing predictive insights that can further enhance security measures. Therefore, it is important to realize the impact of these modern and intelligent systems on the field of real estate management, as this paper aims to study the potential impact within the framework of real estate project management in the Kingdom of Saudi Arabia.

2. Research Problem

Integrating smart technologies into residential real estate management within the Saudi sector is a vital matter at present, especially within the framework of Vision 2030. This is for many reasons, the most important of which is improving security and raising the level of operational efficiency and management experiences. However, one of the concerns related to these smart systems is data privacy, as the increased connectivity and data sharing inherent in smart systems increases the risks of cyber-attacks and reveal vulnerabilities that can be exploited by malicious actors. Ensuring strong cybersecurity measures and complying with strict data protection regulations is essential to protecting sensitive information (McKinsey & Company, 2020).

In addition, the financial implications of implementing smart technologies are a major constraint. The initial investment required for these technologies can be significant, presenting a financial challenge for property owners, managers, and those behind these large projects. This is especially true for older buildings, which may require extensive and expensive upgrades to support new systems. Assessing the financial viability of such investments, especially given the economic conditions and market dynamics that are unique to Saudi Arabia, is crucial. (Al-Otaibi & Alzamil, 2019)

Rapid urbanization and the ambitious development plans outlined in Saudi Arabia's Vision 2030 underscore the need to understand the potential and pitfalls of smart

technologies in residential real estate management, especially within the scope of real estate entrepreneurship (Al-Otaibi & Alzamil, 2019). The integration of Internet of Things (IoT) devices, artificial intelligence (AI), and other advanced technologies can play a pivotal role in achieving the vision's goals, however, the practical challenges of implementation must be carefully considered.

Therefore, the main research problem lies in the following question: What are the main challenges and opportunities associated with integrating smart technologies into residential property management and real estate entrepreneurship in Saudi Arabia, and how can they be addressed to ensure effective, safe and financially feasible implementation in line with Vision 2030?

3. Research Significance

The importance of this research lies in many areas, as the research contributes to providing new insights related to the use of smart systems in the field of real estate entrepreneurship and the implementation of these systems in line with the vision of the Kingdom of Saudi Arabia 2030. Therefore, this research contributes to improving the field of real estate business management through implementing paths Smart technologies and thus achieving sustainable development goals. Smart systems can improve energy consumption, reduce waste, and enhance the overall environmental performance of residential properties. By promoting energy efficiency practices and integrating renewable energy sources, smart technologies can support Saudi Arabia's commitment to environmental sustainability as outlined in Vision 2030.

On the other hand, the research contributes to providing new insights related to smart systems that demonstrate the economic benefits and potential cost savings associated with smart property management. Therefore, the research can attract local and international investors. This could lead to increased funding for smart technology projects, promoting economic growth and innovation within the sector.

The research is also closely aligned with the paths of Saudi Vision 2030 based on exploring the integration of smart technologies in residential real estate management. Vision 2030 aims to diversify the Saudi economy, reduce dependence on oil, and develop key sectors such as real estate and urban development. These results can guide policies and

initiatives that promote smart urban development and contribute to achieving the overall goals of economic diversification and modernization.

4. Research Objectives

- a) To evaluate the efficiency of smart technological systems in the field of residential real estate management in the real estate sector of the Kingdom of Saudi Arabia.
- b) To identify viable financing models and strategies that can support real estate entrepreneurs in adopting smart technologies.
- c) To develop insights into the specific challenges and opportunities faced by real estate entrepreneurs in implementing smart systems in the Kingdom of Saudi Arabia
- d) To measure the impact of smart technologies on operational efficiency and resident satisfaction in residential properties managed by real estate entrepreneurs in the Kingdom of Saudi Arabia.

5. Research Questions

- a) How efficient are smart technological systems in the field of residential real estate management in the real estate sector of the Kingdom of Saudi Arabia?
- b) Are there viable financing models and strategies that can support real estate entrepreneurs in adopting smart technologies?
- c) What are the most prominent challenges and specific opportunities that real estate entrepreneurs face in implementing smart systems in the Kingdom of Saudi Arabia?
- d) To what extent do smart technologies impact operational efficiency and resident satisfaction in residential properties managed by real estate entrepreneurs in the Kingdom of Saudi Arabia?

6. Research Variables and Model

Independent Variable (IV): Smart Technology Integration

Dependent Variables (DV's): Residential Property Management

- a) Operational Efficiency & Management Costs

- b) Property Value & Marketability
- c) Real-time Problem-Solving Capabilities

d)

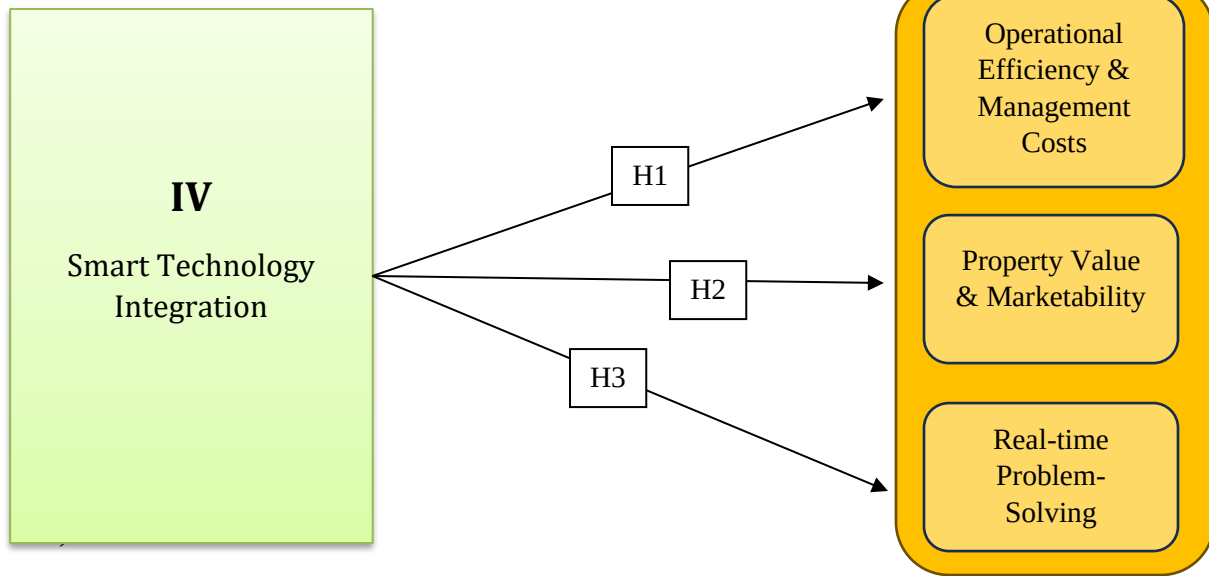


Figure 1: Research Model (By the researcher)

7. Research hypotheses

Hypothesis 1 (H1): Smart technology integration increases operational efficiency and reduces management costs within the Saudi real estate sector.

Hypothesis 2 (H2): H5: Adoption of smart technologies positively impacts property value and marketability.

Hypothesis 3 (H3): Continuous monitoring and feedback mechanisms facilitated by smart technologies enhance real-time problem-solving capabilities.

8. Literature Review

In a previous study by Siniak et al. (2020), the real estate industry is undergoing a profound digital transformation driven by the emergence of PropTech. This transformation encompasses a broad spectrum of advanced technologies such as home matching tools, drones, virtual reality, building information modeling (BIM), AI, IoT, blockchain, smart contracts, crowdfunding, fintech innovations, smart cities, smart homes, and the shared economy. The study identifies key trends and concerns associated with this shift, including the enhancement of operational efficiency and customer experience through PropTech applications, improved market transparency, potential competitive advantages for regions and companies, and implications for labor markets and education. It underscores PropTech's potential to reshape market dynamics, foster transparency, support territorial growth strategies, and influence market structures across different institutional contexts.

Also, Ullah et al., (2018) emphasize the necessity for the real estate sector to embrace disruptive technologies to transition from traditional practices to smart real estate (SRE). The study comprehensively reviews the adoption and impact of nine disruptive technologies, collectively termed the Big9, which include drones, Internet of Things (IoT), cloud computing, Software as a Service (SaaS), big data, 3D scanning, wearable technologies, virtual and augmented realities (VR and AR), and artificial intelligence (AI) and robotics. Through analysis of 213 published articles, the research evaluates how these technologies enhance consumer decision-making by providing crucial information that mitigates potential regrets. The study also examines dissemination mechanisms such as smartphone apps, websites, and social media platforms, highlighting their role in promoting SRE principles of sustainability, innovative technology, and user-centric design. Key stakeholders, including consumers, agents, government authorities, and complementary industries, are identified along with their specific needs and interactions. The findings propose extensions to the traditional Technology Adoption Model (TAM), linking the adoption of Big9 technologies to stakeholder needs and emphasizing opportunities for enhancing consumer satisfaction while minimizing regrets through informed decision-making.

In their study, Al-Otaibi & Alzamil (2019) investigate the impact of property management on maintaining the value of residential properties in Saudi Arabia. The

research compares two property management models: one managed by a professional property management system and another managed solely by the owner. Through a field questionnaire distributed among 125 real estate management institutions and offices in Riyadh, the study finds compelling results. Properties managed by professional systems experience a mere 10% decrease in value over a five-year period, whereas owner-managed properties see a significant depreciation of over 50% in the same timeframe. These findings underscore the critical role of effective property management in enhancing the quality and sustaining the market value of residential products. The paper recommends collaborative efforts between governmental and private sectors to establish a Real Estate Data Center (REDC). This center would classify residential properties based on management criteria, quality standards, and economic considerations, aiming to further strengthen the real estate market infrastructure in Saudi Arabia.

Also, Residential property values are influenced by several critical factors, as highlighted in the literature. Muyingo (2017) identifies factors such as the absence of strategic planning, inadequate funding, maintenance deficiencies, and ineffective marketing strategies as contributors to potential decreases in property value within the real estate market. Spatial location emerges as a pivotal determinant, with properties near central areas typically commanding higher prices compared to those situated on the outskirts of cities.

Research by Hui, Lau, and Khan (2011) underscores the positive impact of effective property management systems on property prices, suggesting potential increases ranging from 2.84% to 4.92%. Conversely, Heller (1998) discusses challenges related to shared property ownership, noting issues like mismanagement and neglect of common areas such as elevators and parking lots, which can lead to a decline in property values over time—a concept termed the "tragedy of the commons." Furthermore, the principle of supply and demand in the housing market directly influences property values, with scarcity often driving up prices due to increased demand for limited housing units

9. Methodology and methods

9.1 Research Design

According to Kothari (2004), the research design serves as the underlying framework that guides the execution of research, encompassing the methodology for data collection, measurement, and analysis. As per the findings of Saunders, Lewis, and Thornhill (2009). The explanatory research design is utilized to investigate a particular situation or problem to elucidate the relationships between variables. As such, this research design is deemed more suitable for the present study .

The researcher will develop a set of questionnaires utilizing the Likert scale as a means of gathering primary data. According to De Vaus' (2013) research, a questionnaire is a printed format designed to collect data via written responses from a selected employee sample. The researchers utilized a self-design questionnaire to elicit responses from participants, which were then rated on a Likert-type scale ranging from 1 to 5. The survey was self-administered, thereby ensuring anonymity and reducing the likelihood of bias as the questions were standardized and consistently presented.

9.2 Research Tools

The questionnaire for this research study will be created by the online survey builder, Google Form. The questionnaire will be distributed to the target sample via the Internet. The survey will be open for participants to participate in the survey during a certain period of time from January 2023 to February 10, 2022, which is a sufficient period of time to collect the required data and the number of participants.

9.3 Research Community

Real estate sector professionals, including developers, property managers, investors, and residents in Saudi Arabia.
data analysis

9.4 Data Analysis

The research will use the statistical program SPSS23 to analyze the data obtained through the questionnaire using the following methods: Alpha coefficient: to measure

the reliability of the questionnaire, frequencies, percentages, mean, standard deviation and relative weight to describe the Pearson correlation. For the study sample. Coefficient: Determine the level of internal homogeneity of the study instrument and identify the relationships between the study variables. Regression coefficient: to know the effect of the independent variable on the dependent variable.

9.5 Ethical considerations

- a) Data, results, methods, procedures, and publication status are reported truthfully, and data are not produced, falsified, or distorted in any way.
- b) Any patents, copyrights or other forms of intellectual property, including the use of various data, methods, results or research in general, are carefully referenced, with full indication of the author or authors and the year of publication and publication. a house.
- c) Participation in questionnaires related to the research topic is maintained, as data on participants is kept and not published at the end of the study.

10. Limitations

- a) Spatial constraints: The difference in the adoption of smart technology between urban and rural areas in the Kingdom of Saudi Arabia may be a real limitation in the context of the difference in the application of smart systems.
- b) Spatial boundaries: Some previous research and studies in the same field may not be applied due to differences in time and arrangement.
- c) Substantive limitations: Variation in stakeholder experience and understanding of smart technologies that impact data reliability.

Chapter Two: Applied Framework

3.1 Preface

In the previous parts, the study dealt with the theoretical framework, and in this part, we deal with a description of the study methodology, the individuals of the study community and its sample, as well as the study tool used and methods of preparation, and its validity and stability, as this part includes a description of the procedures that you have in codifying and applying the study tools, and finally the statistical treatments that relied on them in analyzing the study.

3.2 Study methodology

In order to achieve the objectives of the study, the researcher used the descriptive analytical approach, which is defined as a method of research that deals with existing events, phenomena and practices available for study and measurement as they are without interfering in their course and we can interact with them, so we describe and analyze them, and this study aims to know the impact of smart technologies on the management of residential real estate: an applied study in the Saudi real estate sector.

2.3 Study population

The study population consists of all employees of the management of the Tabuk Electricity Company.

3.4 Study sample

The study sample consists of employees of the real estate sector in Saudi Arabia and for the purpose of applying this study, the sample was randomly selected from various salaries in order to circulate the sample and represent the study population to a large extent, as the number of employees who were surveyed reached (90) employees in order to achieve the objectives of the current study.

Table 3-1 Results of the first axis: Study sample according to study variables

First Theme: Sample Variables			
Ratio	Repetition	Category	Variable
87.6%	92	male	Participant gender

12.4%	13	Female	
100%	105	Total	
31.4%	33	Less than 30 years	lifetime
43.8%	46	From 30 to 39 years	
20%	21	From 40 to 49 years old	
4.8%	5	50 and more	
100%	105	Total	
31.4%	33	diploma	Education level
56.2%	59	Bachelor	
12.4%	13	Master and above	
100%	105	Total	
21.9%	23	Less than 5 years	Years of Experience
34.3%	36	5 to 9 years	
27.6%	29	From 10 to 19 years old	
16.2%	17	20 years and above	
100%	105	Total	

It is clear from the previous table that the majority of the study sample members were males (87.6%) compared to the number of females (**12.4%**), with regard to age, most of the sample members were under 30 years old (31.4%) compared to those aged 30 to 39 years (49.1%), those aged 40 to 49 years were equal and amounted to (20%), and those aged 50 and over were (4.3%)) As for the educational level, the number of

samples for those who have a diploma is (31.4%) compared to those who have a bachelor's degree, it amounted to (56.2%) and comes in last place people who hold a master's degree by (12.4%), while for years of experience, it was the highest percentage of those who have experience from 5 to 9 years, where their percentage reached (34.3%) compared to those who have experience less than 5 years, this paragraph got (21.9%) and those with 20 years of experience or more (16.2%) and those with 5-9 years of experience (27.6%) come in last place.

3.5 Study tools

This study aims to analyze the impact of smart technologies on the management of residential real estate in the real estate sector in Saudi Arabia, the researcher designed a questionnaire consisting of (24) items divided into four axes. The following table shows the number of paragraphs for each theme:

Table 3-2 Distribution of the paragraphs of the study tool on its axes

axes		Number of paragraphs
1.	First Theme: Study Sample Data	4
2.	The second theme: The efficiency of smart technological systems in managing residential real estate in Saudi Arabia	5
3.	Third Theme: Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies	5
4.	Fourth Theme : Specific challenges for real estate entrepreneurs in applying smart systems in Saudi Arabia	5
5.	Fifth Theme: The impact of smart technologies on the operational efficiency and satisfaction of residents in residential real estate	5
Total		24

The raw data contained in the form were converted into digital symbols in the coding manual, according to the rules and levels of units of measurement developed to measure the characteristics of the variables included in the study according to the

Likert quintuple scale, and the answers to each paragraph according to the Likert quintuple scale were as follows:

Table 3-3 Classification of the Likert Pentameter

classification	Strongly disagree	Disagree	neutral	I agree	Strongly agree
Grade	1	2	3	4	5
Arithmetic mean	1 – 1.80	1.80-2.60	2.61 – 3.40	3.41 – 4.20	4.21 - 5

3.6 Authenticity of the study instrument

It means that the answers obtained from the participants in the questionnaire, survey or study are truthful, reliable and reflect the truth accurately, with the aim of obtaining the truthfulness of the questionnaire and ensuring that the results obtained accurately reflect the truth and help in making the correct and appropriate decisions, and the researcher has tested the validity of the questionnaire in three ways:

1- Authenticity of the content

The researcher selected the questionnaire questions from previous refereed studies and modified them according to the requirements of the study, and the questions were presented to the academic supervisor of the research and some academics of other departments and they were approved, and thus the questionnaire came out in its final form - see Appendices No. (1).

2- Believe the scale

Second: Structural Honesty

It refers to the extent to which the resolution is able to measure the concept or phenomenon that it aims to measure accurately and correctly. Constructivist honesty is

achieved by designing questions and criteria in a way that ensures their ability to accurately measure the concept and by conducting honesty tests to ensure the validity of the results. Structural honesty is important to ensure the reliability of the questionnaire and the validity of the analyses based on it, by measuring the extent to which all axes of the study correlate to the total degree of the paragraphs of the questionnaire.

Table 3-8: Study axes and correlation coefficient for each axis with the total score

axes		Correlation coefficient	Number of paragraphs
1	The second theme: The efficiency of smart technological systems in managing residential real estate in Saudi Arabia	841**	5
2	Third Theme: Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies	833**	5
3	Fourth Theme : Specific challenges for real estate entrepreneurs in applying smart systems in Saudi Arabia	258**	5
4	Fifth Theme: The impact of smart technologies on the operational efficiency and satisfaction of residents in residential real estate	0.975**	5

It is clear from the previous table that the correlation coefficients show that the probability values of the axes were less than the significance level ($0.05 > \alpha$) meaning that the correlation coefficients were statistically significant, and this proves the structural validity of the resolution

Resolution stability:

Indicate the ability of the questionnaire to give consistent and repeated results when performed multiple times on the same group of individuals or variables. The stability of the resolution is achieved through stability tests through the Cronbach alpha coefficient and this analysis is used in order to test the credibility and stability of the axes used in the questionnaire to study the impact of smart technologies on residential

real estate management: An applied study in the Saudi real estate sector where The researcher used the Cronbach alpha coefficient, to verify the quality and stability of the measures used in the study through the statistical analysis system " SPSS ", where the value of the alpha Cronbach coefficient between (1.0), which shows the degree of internal correlation between the answers of the sample elements, when its value is zero, it indicates that there is no correlation between the answers, but if its value is one, it indicates that the answers are completely related to each other, The acceptable value of the Cronbach alpha coefficient is 0.6 (60%) or more, and in the following table shows the value of the stability coefficient for each of the questionnaire axes:

Table 3-9: Cronbach alpha coefficient to measure the stability of the study axes

Axles		Number of paragraphs	Coefficient of stability
1	The second theme: The efficiency of smart technological systems in managing residential real estate in Saudi Arabia	5	0.975
2	Third Theme: Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies	5	0.970
3	Fourth Theme : Specific challenges for real estate entrepreneurs in applying smart systems in Saudi Arabia	5	0.965
4	Fifth Theme: The impact of smart technologies on the operational efficiency and satisfaction of residents in residential real estate	5	0.986
Total stability of the resolution		20	0.915

It is clear from the results shown in the previous table that the value of the Cronbach alpha coefficient The axes of the study tool ranged between (0.975) and (0.965), where we find that the Cronbach's alpha coefficient for the study model as a whole amounted to (0.915), which is a very high stability coefficient, and this indicates that all the

questionnaire phrases are important and that deleting any phrase will negatively affect the stability of the scale, and thus it is possible to rely on the entire set of phrases without deleting any of them to reach good results to study the impact of techniques Smart on Residential Real Estate Management: An Applied Study in the Saudi Real Estate Sector.

3.7 Study Procedures

Here, the questionnaire lists method was relied upon to collect the primary data necessary to conduct and complete the study in addition to reviewing the secondary data as well as conducting personal interviews as shown as follows:

A- Questionnaire lists:

The questionnaire form is a highly appropriate tool in investigating opinions and points of view on an issue or issue, and the questionnaire form was used as the main tool to obtain raw data from the study population, and the questionnaire form was designed in light of the research objectives.

B- Analytical Study:

The data was unloaded from the questionnaire form, filtered and tabbed to facilitate the analysis process, in order to extract results and indicators from it on the subject of the research using appropriate statistical means consistent with the basic assumptions of the study.

C- Statistical programs used

The researcher used SPSS version 24 to calculate honesty, stability and descriptive statistics and study the study questions for the study model.

3.8 Methods of statistical study

- Mean and std deviation scores for each item of the questionnaire;
- Alpha-Cronbach coefficient test calculates the stability coefficient of the study instrument.
- Pearson correlation coefficient to ensure the truthfulness of consistency and internality of the study instrument.

3.9 Arithmetic mean, standard deviation and relative importance

The second axis: The efficiency of smart technological systems in managing residential real estate in Saudi Arabia:

The arithmetic mean, standard deviation and relative importance of the study model were found as follows:-

Table 3-10: Arithmetic mean, standard deviation and relative importance of the axis of the efficiency of smart technological systems in managing residential real estate in Saudi Arabia:

M	The efficiency of smart technological systems in managing residential properties in Saudi Arabia	Average	Standard deviation	Relative weight	General direction	Rank
1	Smart technologies improve residential property management processes by automating tasks and improving operational efficiency.	3.21	1.47	64.2%	neutral	3
2	Smart technology systems enable remote control of residential building systems such as lighting, heating and air conditioning, improving the tenant experience.	3.34	1.48	66.8%	neutral	1
3	Digital property management platforms help organize and follow up residential properties with	3.10	1.41	62%	neutral	4

	high efficiency through advanced tools for tenant management, maintenance, and collection.					
4	Smart technologies contribute to improving transparency and communication between residential property owners and tenants.	3.30	1.29	66%	neutral	2
5	Big data and predictive analysis enable residential property management strategies to be guided based on market trends.	2.90	1.49	58%	neutral	5
Total		3.12	1.29	62.4%	neutral	

The previous table shows the average responses of the study sample members on the paragraphs of the second axis, the efficiency of smart technological systems in managing residential real estate in Saudi Arabia and arranging them according to the arithmetic averages of the highest response and the least responsive from the point of view of the study sample members. The responses of the study sample to the paragraphs of the second axis, which numbered (5) paragraphs, came with a degree of "neutral" response, with arithmetic averages ranging between (2.90,3.34) and standard deviations between (1.29, 1.49), and the highest average and in **first place** was paragraph (2), which states that "smart technological systems enable remote control of residential building systems such as lighting, heating and air conditioning, improving the tenant experience" with an arithmetic mean of (3.34), relative weight (66.8%) and standard deviation (1.48) with a "neutral" response score.

Finally, **paragraph** (5) states that "big data and predictive analysis enable residential property management strategies to be guided based on market trends" with an arithmetic mean of (2.90), relative weight (58%) and standard deviation (1.49) with a "neutral" response score.

In general, it is found that the arithmetic average of all paragraphs amounted to (3.12) with a relative weight of (62.4%), which indicates that the efficiency of smart technological systems in managing residential real estate in Saudi Arabia is high, from the point of view of the study sample.

Third Theme: Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies:

Table 3-11: Arithmetic mean, standard deviation and relative importance of the axis of feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies:

M	Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies	Average	Standard deviation	Relative weight	General direction	Rank
1	Providing government incentives and soft financing for real estate entrepreneurs to encourage them to adopt smart technologies in managing their residential properties.	3.26	1.39	65.2%	neutral	2
2	Establishing investment funds specialized in real estate technology "Probtech" to provide the necessary funding for entrepreneurs.	3.10	1.31	62%	neutral	4
3	Developing training and awareness programs for real estate entrepreneurs to enhance their understanding of the benefits of smart technologies and how to apply them.	2.99	1.39	59.8%	neutral	5
4	Create partnerships between real estate entrepreneurs and technology companies to develop solutions tailored to the needs of the real estate sector.	3.21	1.36	64.2%	neutral	3
5	Providing tax and regulatory incentives to real estate companies that adopt smart technologies in managing their residential properties.	3.41	1.32	68.2%	I agree	1
Total		3.14	1.2	62.8%	neutral	

The previous table shows the average responses of the study sample members on the paragraphs of the third axis - feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies, and arranging them according to

the arithmetic averages of the highest response to the least responsive from the point of view of the study sample members. The responses of the study sample members to the third axis paragraphs of (5) paragraphs came with a degree of response "strongly agree" with arithmetic averages ranging between (2.99,3.41) and standard deviations between (1.31,1.43), and the highest average and in **first place** is paragraph (5), which states "Providing tax and regulatory incentives to real estate companies that adopt smart technologies in managing their residential properties." with an arithmetic mean of (3.41), relative weight (68.2%) and standard deviation (1.32) with a "OK" response score.

It is followed in **last place** by paragraph (3), which states "Developing training and awareness programs for real estate entrepreneurs to enhance their understanding of the benefits of smart technologies and how to apply them." with an arithmetic mean of (2.99), relative weight (59.8%) and standard deviation (1.39) with a "neutral" response score.

In general, it is found that the arithmetic average of all paragraphs reached (3.14) with a relative weight of (62.8%), which indicates the existence of feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies, from the point of view of the study sample members.

Fourth Theme: Specific challenges for real estate entrepreneurs in applying smart systems in Saudi Arabia:

Table 3-12: Arithmetic mean, standard deviation and relative importance of the specific challenges of real estate entrepreneurs in the application of smart systems in Saudi Arabia

M	Specific challenges for real estate entrepreneurs in implementing smart systems in Saudi Arabia	Average	Standard deviation	Relative weight	General direction	Rank
1	The high initial costs of applying smart technologies in residential property management.	3.38	1.31	67.6%	neutral	5

2	Lack of competencies and skills necessary to implement and manage smart technological systems.	3.68	1.39	73.6%	I agree	2
3	Some tenants' concerns about privacy and security when using smart technologies.	3.71	1.37	74.2%	I agree	1
4	Regulatory and legislative challenges associated with the application of smart technologies in the real estate sector.	3.66	1.27	73.2%	I agree	3
5	The difficulty of integrating smart technological systems and the existing infrastructure of residential real estate.	3.65	1.28	73%	I agree	4
Total		3.57	1.12	71.4%	I agree	

The previous table shows the average responses of the study sample on the paragraphs of the fourth axis - the specific challenges of real estate entrepreneurs in applying smart systems in Saudi Arabia, and their order according to the arithmetic averages of the highest response to the least responsive from the point of view of the study sample members. The responses of the study sample members to the paragraphs of the fourth axis, which numbered (5) paragraphs, came with a "OK" response with arithmetic averages ranging between (3.38,3.71.) and standard deviations between (1.27, 1.39), the highest average and in **the first place** is paragraph No. (3), which states "the concerns of some tenants about privacy and security when using smart technologies" with an arithmetic mean of (3.71), relative weight (74.2%) and standard deviation (1.37) with a "OK" response score.

Finally, **paragraph (1)** is in last place, which states "the high initial costs of applying smart technologies in residential real estate management" with an arithmetic mean of (3.38), a relative weight (67.6%) and a standard deviation of (1.31) with a "OK" response score.

In general, it is found that the arithmetic average of all paragraphs reached (3.57) with a relative weight of (71.4%), which indicates that there are specific challenges for real estate entrepreneurs in applying smart systems in the Kingdom of Saudi Arabic from the point of view of the study sample.

Fifth Theme: The impact of smart technologies on operational efficiency and satisfaction of residents in residential properties:

Table 3-8: Arithmetic mean, standard deviation and relative importance of the impact of smart technologies on operational efficiency and satisfaction of residents in residential real estate:

M	The impact of smart technologies on the operational efficiency and satisfaction of residents in residential properties	Average	Standard deviation	Relative weight	General direction	Rank
1	Smart technologies improve operational efficiency by automating tasks and improving maintenance and management processes.	3.64	1.07	72.8%	I agree	5
2	Smart technology systems enable remote control of energy consumption, reducing operational costs.	3.67	1.25	73.4%	I agree	4
3	Smart technologies enhance the tenant experience by providing advanced services and improving comfort and security.	4.36	0.848	87.2%	Strongly agree	1
4	Big data and predictive analysis guide residential property management decisions to better meet tenants' needs.	4.33	0.739	86.6%	Strongly agree	2
5	The application of smart technologies increases residents' satisfaction and loyalty towards residential properties managed by real estate entrepreneurs.	4.31	0.857	86.2%	Strongly agree	3
Total		4.02	.6000	80.4%	I agree	

The previous table shows the average responses of the study sample members on the paragraphs of the fifth axis: The impact of smart technologies on operational efficiency and residents' satisfaction in residential real estate and their ranking according to the arithmetic averages of the highest response to the least responsive from the point of view of the study sample members. The responses of the study sample on the paragraphs of the first axis , which numbered (5) paragraphs,

came with a degree of response "OK", with arithmetic averages ranging between (4.36, 3.64) and standard deviations between (1.25, 0.739), the highest average and in **first place** is paragraph (3), which states: "Smart technologies enhance the tenant experience by providing advanced services and improving the level of comfort and security. " with an arithmetic mean of (4.36), relative weight (87.2%) and standard deviation (0.848) with a response score of "strongly agree".

In **last** place is paragraph (1), which states , " Smart technologies improve operational efficiency by automating tasks and improving maintenance and management processes." with an arithmetic mean of (3.64), relative weight (72.8%) and standard deviation (1.07) with a response score of "OK".

In general, it is found that the arithmetic average of all paragraphs reached (4.02) with a relative weight of (80.4%), which indicates thatthere is a positive impact of theuse of smart technologies on the operational efficiency and satisfaction of residents in residential properties.

Chapter Three: Conclusions and Recommendations

1- Results

- There is high efficiency of smart technological systems in residential property management in Saudi Arabia.
- There are feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies.
- There are specific challenges for real estate entrepreneurs in implementing smart systems in Saudi Arabia.
- The use of smart technologies has a positive impact on the operational efficiency and satisfaction of residents in residential properties.

2. Recommendations

1. It is crucial to raise awareness about the benefits of smart technology in residential property management and provide educational programs for investors and business owners to increase their acceptance and adoption of these technologies.
2. The government and relevant entities should establish suitable policies and frameworks to encourage the use of smart technology in the real estate sector, including providing facilitations and financial incentives.
3. Appropriate and innovative financing options should be provided to support real estate entrepreneurs in adopting smart technologies, such as low-interest loans or special financing programs.
4. Tailored technological solutions should be developed for the Saudi real estate market to meet its unique needs and overcome the specific challenges faced by entrepreneurs.

1. References

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Supplements

(1) Research Project Questionnaire

Section I of the questionnaire: Preliminary information

Sex			
☐ Male	☐ Female		
Lifetime			
☐ less than 30 years	☐ 30-39	☐ 40-49	☐ 50 and more
Education level			
☐ Diploma	☐ Bachelor	☐ Master and above	
Years of Experience			
☐ Less than 5 years	☐ 5-9	☐ 10-19	☐ 20 and more
Function			
☐ Director	☐ Deputy Director	Administrative Officer	

The second section deals with the four axes:

Tick ✓() in front of the option that's right for you:

Ferry		Strongly agree	I agree	neutral	Disagree	Strongly disagree
The first axis: the efficiency of smart technological systems in managing residential real estate in Saudi Arabia:						
1	Smart technologies improve residential property management processes by automating tasks and improving operational efficiency.					
2	Smart technology systems enable remote control of residential building systems such as lighting, heating and air conditioning, improving the tenant experience.					
3	Digital property management platforms help organize and follow up residential properties with high efficiency through advanced tools for tenant management, maintenance, and collection.					

4	Smart technologies contribute to improving transparency and communication between residential property owners and tenants.					
5	Big data and predictive analysis enable residential property management strategies to be guided based on market trends.					
The second theme: Feasible financing models and strategies to support real estate entrepreneurs in adopting smart technologies:						
1	Providing government incentives and soft financing for real estate entrepreneurs to encourage them to adopt smart technologies in managing their residential properties.					
2	Establishing investment funds specialized in real estate technology "Probtech" to provide the necessary funding for entrepreneurs.					
3	Developing training and awareness programs for real estate entrepreneurs to enhance their understanding of the benefits of smart technologies and how to apply them.					
4	Create partnerships between real estate entrepreneurs and technology companies to develop solutions tailored to the needs of the real estate sector.					
5	Providing tax and regulatory incentives to real estate companies that adopt smart technologies in managing their residential properties.					
Third Theme: Specific challenges for real estate entrepreneurs in applying smart systems in Saudi Arabia:						
1	The high initial costs of applying smart technologies in residential property management.					
2	Lack of competencies and skills necessary to implement and manage smart technological systems.					

3	Some tenants' concerns about privacy and security when using smart technologies.					
4	Regulatory and legislative challenges associated with the application of smart technologies in the real estate sector.					
5	The difficulty of integrating smart technological systems and the existing infrastructure of residential real estate.					
The second axis: The impact of smart technologies on the operational efficiency and satisfaction of residents in residential properties:						
1.	Smart technologies improve operational efficiency by automating tasks and improving maintenance and management processes.					
2.	Smart technology systems enable remote control of energy consumption, reducing operational costs.					
3.	Smart technologies enhance the tenant experience by providing advanced services and improving comfort and security.					
4.	Big data and predictive analysis guide residential property management decisions to better meet tenants' needs.					
5.	The application of smart technologies increases residents' satisfaction and loyalty towards residential properties managed by real estate entrepreneurs.					