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Editorial for JARER Vol. 8 Issue 1, 2023

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Editorial

Welcome to Volume 8 (2023) Issue 1 edition of the Journal of African Real Estate Research (JARER). The Journal remains an exciting platform for the dissemination of scholarships and the different types of applied research in the real estate sector in Africa, and it has continued to grow in leaps and bounds. As reported in the last issue, JARER has been listed in the Directory of Open Access Journal (DOAJ) since January 2023 and has been recognised as meeting acceptable quality in the three categories (real estate finance, real estate & urban economics and built environment) of the 2021 American Real Estate Society's (ARES) Real Estate Journal list. The list can be found at https://www.aresnet.org/page/journal-list. We want to appreciate the efforts and support of the Journal editorial board members, anonymous reviewers, and other stakeholders, without which these achievements would not be possible. Also, the support we continue to receive from the African Real Estate Society board members, the Library services at the University of Cape Town and the Urban Real Estate Research Unit at the university is appreciated. Our gratitude also goes to the Journal Manager, Ms. Lesedi Kgaka, for her diligent efforts in moving the Journal forward.

As usual, the current issue contains thought-provoking and informative topics and is a must-read by everyone who cares to have an understanding of African real estate research and related cities. The first paper, focusing on Lagos, Nigeria, examined the benefits and challenges in the adoption of modern technologies for real estate marketing. The work found that real estate practitioners in Nigeria were yet to fully tap into the unfolding benefits of modern technologies due to a low level of enlightenment and a lack of property data. The paper concluded with the need for practitioners to be enlightened, educated, and trained on the use of various modern technologies for real estate marketing.

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The second paper, which is an examination of the factors influencing the adoption of automating systems in high-rise buildings in Lagos, Nigeria. The paper found the need to protect buildings against failure as the most significant factor influencing the adoption of automation in the management of facilities in high-rise buildings. The authors concluded that the use of automation in facilities management of high-rise buildings presents facility managers with innovative ways of ensuring the functionality of the built environment.

The roles played by various actors in household mobility and the eventual reoccurrence of slums in the city of Kampala, Uganda, amidst the slum upgrading initiatives formed the focus of the third paper. The paper, which adopted a case study approach, found that the influence of slum upgrading actors in the low-income household mobility and reoccurrence of the Namuwongo slum was exhibited through three thematic areas. These are the tracking of the residential mobility tendencies, fit-for-purposes of the upgrading programs and actors' collaboration in the process. The paper's conclusion emphasised the need for actors' collaboration and participation of low-income slum-dwelling households to enable adequate fit-for-purposes of the in-situ upgrading initiatives.

Given that access to housing is one of the challenges international students face in universities worldwide, the fourth paper examined housing satisfaction among international students studying at Hong Kong's universities. Using the snowball sampling technique, data was collected from seventy-four international students of six nationalities studying at four universities in Hong Kong. This study highlighted some far-reaching implications for Hong Kong universities, including the need to revisit the issue of accommodation and support provided to international students and an increase in the student housing stock to assist international students.

The fifth paper examines Blockchain technology's (BCTech) potential in the real estate sector. To achieve this objective, the paper used a systematic review of the literature found in Researchgate, ScienceDirect, Semantic Scholar, IEEE Xplore, and Google Search. Examining a total of 99 publications from 2016 to 2022, the paper found that BCTech could provide platforms for tokenised ownership, smart contracts, quick transactions and cost reduction and offers secure and transparent platforms for real estate stakeholders. The study concluded that though BCTech is not yet widely used, it has a lot of potential to offer in terms of the sustainability of the real estate industry.

I am sure that the JARER will continue to grow from strength to strength in the years to come and contribute to the development of African researchers' activities and endeavours. I look forward to receiving your feedback on this and previous issues of the Journal.

Professor Abel Olaleye
Editor-in-Chief

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Benefits and Challenges to the Adoption of Modern Technologies for Real Estate Marketing in Lagos, Nigeria

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Abstract

Historically, some industries have lagged behind others in adopting technological improvements. Real estate is one of such industries. Even as technology affects the world around them, many real estate professionals continue to market or manage properties the same way they did in the past. Hence, there is a need to examine how informed they are about modern technological options that can boost their productivity and why they have not leveraged these options. This research uses selected modern technology to examine the benefits and challenges of real estate marketing in Lagos State, Nigeria. Eighty-two questionnaires were administered to the Estate Surveyors and Valuers (ESVs) in the study area, and 76 (93%) were returned and found beneficial. The data was analysed with the use of descriptive and inferential statistical tools. The findings show that a majority of the ESVs are aware of digital marketing, big data, virtual reality, artificial intelligence, drone technology and blockchain technology as a medium for marketing real estate. The study also revealed that digital marketing is the most commonly used technology for marketing real estate (e.g., email, WhatsApp and Telegram, among others).

The findings further show their perception of the benefits of adopting these technologies, such as a reduction in manual labour and efficient communication between clients and real estate agents, among others. Finally, the ESVs have not adopted most of these technologies because of resistance to adoption of modern technologies and lack of up-to-date and relevant property information. The study

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concluded that there is a need for the Nigerian Institution of Estate Surveyors and Valuers (NIESV) and the Estate Surveyors and Valuers Registration Board of Nigeria (ESVARBON) to provide opportunities for ESVs to be enlightened, educated and trained on the use of various modern technologies for real estate marketing.

Keywords**:** *technology, benefits, challenges, property marketing, Nigeria*

1. Introduction

In today's society, technology is becoming increasingly important in all industries, including real estate. Technology has profoundly impacted almost every aspect of the industry, transforming the traditional business model. This is because technology acts as a catalyst for innovation, and it can be said that business needs it for sustenance (Diah, 2019). Technology has emerged as a game-changer in the real estate sector, separating players. It is anticipated to upend the real estate industry's traditional business model, including transaction processes and the development of long-term partnerships (Dominguez, 2021).

Technology is quickly evolving and shaping the future of real estate marketing, and the significance of real estate marketing cannot be overemphasised (Forbes Real Estate Council, 2020). This is because it serves as a tool for advertising and promoting real estate services, as well as generating potential leads that could lead to even more growth. In terms of the adoption of technology, the real estate industry has a long history of being considered a laggard (Nail et al., 2019). Regardless of being one of the world's oldest industries, it is typically five years behind the technology curve, according to some researchers (Smith, 2015; Trembecka & Kwartnik-Pruc, 2018). The real estate market comprises of a network of material producers and service providers who collaborate to create a finished product, such as buildings. The process of organising and implementing strategies to produce the final product becomes much more challenging when a large number of participants are involved.

Precisely because of this large number of players, the real estate sector has always had an impact on a country's economic growth. Diah (2019) states that it accounts for two-thirds of a state's net earnings. Also, real estate is a necessary component of the production process. This is because it has the same effect on production as capital and labour; the efficient use of real estate can significantly impact a business's productivity (Glickman, 2013). Finally, one of the most significant employers of labour is the real estate industry (Chastney, 2020; Iyiola, 2020). This is because it comprises at least five sub-sectors – housing, retail, hospitality, commercial or industrial and warehousing (Saxena, 2018). It is worthy of note that despite its size, the real estate industry is remarkably adaptable.

The need to invest more in technology is essential for the real estate industry's growth and to increase customer participation in real estate transactions. The global COVID-19 pandemic is also an indicator that conventional real estate marketing strategies may no longer be effective because of several restrictions placed on people's mobility (Agara, 2021). Moreover, adopting these technologies for marketing real estate in Nigeria may also be a way for ESVs to have an edge over the charlatans (quacks) that are intruding into the practice, real estate agency in particular. Therefore, this study focuses on

bringing to light the benefits and barriers to applying modern technologies for real estate marketing in Lagos State, Nigeria.

Several research efforts exist on the impact of technology on real estate practice. For example, South Africa (Warburton, 2016), Malaysia (Mohd, 2019; Diah, 2019; Ullah et al., 2020; Ullah and Al-Turjman, 2021), the US (Saiz, 2020), the UK (Braesemann and Baum, 2020), Sweden (Kayihura, 2021) as well as in Nigeria (Mohammed and Bello, 2021; Akinwamide, 2021; Akinwamide and Hahn, 2021; Agara (2021); Akeju et al., 2021) among others.

However, as far as the authors are aware, the majority of research efforts in the Nigerian context focused on real estate digital marketing, while those on property technology (PropTech) were theoretical. No published empirical study has looked holistically at the benefits of the adoption of artificial intelligence, digital marketing, drones, blockchain, big data, virtual reality, marketing automation, and chatbots in real estate marketing, as well as the challenges associated with their adoption in Nigeria, particularly among ESVs. The study of Agara (2021), in particular, specifically suggested that further research be done to ascertain the challenges associated with the adoption of modern technologies from the perspectives of ESVs. Therefore, this research is expected to advance further the existing discourse on adopting modern technology for real estate marketing among ESVs. The focus on ESVs is because they are the only duly registered professionals in Nigeria who are certified competent and have legal approval to offer services such as agency, property management, and marketing, among others (Olapade et al., 2018; Demola-Alade, 2021). The outcome of this study is expected to fill a gap in the literature by extending the corpus of knowledge in the field of real estate marketing in Nigeria.

The paper is organised into five sections, including this introduction. The second section delves into the concept of modern marketing technologies and reviews previous research. The study's research approach is discussed in the third section, and the findings are discussed in the fourth section. The final section sums up the findings, and appropriate recommendations are made.

2. Literature Review

The real estate sector has been slow to embrace state-of-the-art technological transformation. However, the COVID-19 pandemic has been a catalyst in accelerating technology adoption (Impermanenceatwork.admin, 2021). According to Anand (2021), the increasing use of technology in real estate has influenced the operation of the sector and has transformed the face of the industry. This is because industry players are starting to understand the benefits of investing in and using modern technologies (Horiachko, 2021).

2.1 Modern Technologies for Real Estate Marketing

According to Boitnott (2020), adopting modern technology allows companies to free up valuable time and resources for future development. In the words of Kharchenko (2019), Barber (2020), Marr (2020), Chhina (2020), Laloux (2021), Olick (2021), Horiachko (2021), Saini (2022), Chaffey (2022) and Samuel (2022), some modern technologies that can be used to market real estate are identified in Table 1.

Table 1: Modern Technologies for Real Estate Marketing

Modern Marketing Technologies	Usage Details
Virtual reality	It is used to showcase properties, conduct virtual tours and virtual staging (Chhina, 2020)
Chatbot	It is a piece of software that simulates a conversation and enables an estate agent to be available 24 hours a day (Laloux, 2021)
Marketing automation	It uses software to handle repetitive marketing and social activities, e.g. email marketing and social media posting, among others (Samuel, 2022)
Digital Marketing	It involves using Instagram, Facebook and Google search - among others - as marketing channels (Chaffey, 2022)
Drones	They can create emotional storytelling around a particular property and are also useful for displaying bigger homes and properties, giving a real feel of the size of a place (Marr, 2020)
Artificial intelligence	It enables real estate agents and prospective buyers to narrow a home search (Olick, 2021)
Blockchain	It enables access to broader investor pools due to ownership fractionalisation (Horiachko, 2021; Saini, 2022)
Big data	Estate agents can use big data to predict consumer behaviour, refine their audience and target relevant buyers, analyse buyer preferences and their level of commitment to potentially close a deal (Kharchenko, 2019; Barber, 2020)

2.2 Review of Past Studies

The adoption of modern technologies in real estate has been the topic of extensive academic research (Warburton, 2016; Ullah and Sepasgozar, 2019; Akinwamide and Bello, 2019; Diah, 2019; Saiz, 2020; Low et al. (2020); Akinwamide, 2021; Ullah and Al-Turjman, 2021; Kayihura, 2021; Akinwamide and Hahn, 2021; Akeju et al., 2021). To have a strong footing for this current study, it is pertinent to look into the findings of some of the earlier studies as they relate to this current one**.** In the US, Saiz (2020) focused on three key media for spreading the use of IT in commercial real estate, i.e. the commoditisation of space, online brokerage and sales and Fintech in mortgage and equity funding, to ascertain the most important new markets and products created by the IT revolution, as well as their likely influence on critical participants in the commercial real estate arena.

Braesemann and Baum (2020) looked into whether PropTech is transforming the real estate market into a data-driven economy in the UK. The study concluded that in order for firms to reap the benefits of market digitalisation, they must first recognise the economic value of the data they generate while purchasing or managing real estate. The article by Siniak et al. (2020) examined the impact of PropTech on the real estate industry's growth. The study was divided into four sections, namely: uses of PropTech in the real estate sector, effects of PropTech on real estate market transparency, how PropTech could give an area or a company a competitive advantage, and concerns about the broader consequences of these changes on the labour market and education. It was

concluded that PropTech is advantageous for territorial competitiveness and territorial growth strategies. Moreover, real estate technology can change system dynamics and improve market transparency. Finally, PropTech can have an impact on the changing structure of the real estate market (the demand for hi-tech, new skills, and growing policy difficulties for the real estate industry) depending on the institutional structures.

In Nigeria, numerous studies have also been carried out on adopting technologies in real estate practice. Aihie (2019), for instance, examined what prompted Nigerian real estate practitioners to accept PropTech as a medium for bridging the technological divide that could hinder the industry. The author also focused on the factors militating against the growth and development of technological advancement and the reason why most firms could not afford to invest in technological development. In another study, Mohammed and Bello (2021) researched the impact of information and communication technology on real estate management and valuation to develop a more sustainable real estate practice. The authors concluded that adopting technologies has beneficial and adverse effects on real estate management and valuation firms and their personnel. Akeju et al. (2021) investigated real estate firms' awareness and use of mobile technology to provide information that will raise awareness of mobile technology and encourage its use in real estate practice.

These studies notwithstanding, there appears to be a scarcity of research into the benefits and challenges of using modern technologies in real estate marketing. The few previous studies in this area include the efforts of Akinwamide and Bello (2019), Low et al. (2020), Agara (2021), and Akinwamide (2021). For instance, Akinwamide and Bello (2019) looked into the link between digital real estate marketing performance and digital emotional intelligence in Nigeria. The outcome demonstrated a statistically significant, positive relationship between digital real estate marketing performance and digital emotional intelligence among agents. According to their findings, the most efficient digital marketing platforms in real estate marketing are social media, websites and search engines. The study concluded that real estate agents' adoption of digital emotional intelligence would boost the performance of digital real estate marketing in Nigeria.

Also, Low et al. (2020) researched the concepts and practices of sustainable digital marketing in the Malaysian property development industry. The findings revealed that property development companies were motivated by the ability to access real-time consumer information to better create and communicate value to customers through the corporate brand. Moreover, Agara (2021) looked at the prospects of marketing real estate using contemporary technology in Lagos State. The outcome revealed that the effects of technology adoption on real estate marketing were enhancement of real estate networking and easy contact with potential clients. Akinwamide (2021) conducted a follow-up study in Nigeria, focusing on the importance of digital intelligence for long-term real estate digital marketing. According to the findings, social media and email are the most popular digital marketing platforms. The majority of the firms sampled in the study also stated that digital intelligence is vital for the effective and efficient use of the best digital marketing platforms for real estate transactions. Furthermore, digital competencies such as digital security, identity, rights and safety were the well-known components of digital intelligence in digital real estate marketing.

Although these studies achieved their objectives and served as the basis of this research, most focused on digital marketing to the exclusion of other modern marketing technologies such as virtual reality, drones and artificial intelligence, among others, despite the apparent benefits of adopting new technologies for real estate marketing, there appears to be a paucity of literature on the subject. In addition, the few studies that looked at these modern technologies focused on their impact on real estate marketing without considering the challenges that may be associated with their adoption in Nigeria, particularly among ESVs. The ones that looked at the challenges were not empirical. As a result, more empirical research is needed to explore this new normal, which could improve real estate operations in the country. This is the rationale for the current study.

2.3 Adoption of Modern Technologies for Real Estate Marketing: Benefits and Challenges

Based on the outcomes of several research efforts globally, some of the benefits and challenges of marketing real estate using modern technologies are summarised in Table 2. This study is restricted to these benefits and challenges.

Table 2: Benefits and Challenges to the Adoption of Modern Technologies for Real Estate Marketing

Benefits		
S/N	**Author/Year**	**Benefits**
1	Barillas (2020); Agara (2021); Fizal (2022)	Reduction of manual labour in sales
2	Anand (2021); Agara (2021); Fizal (2022)	Enhanced communication with clients
3	Barillas (2020); Anand (2021); Agara (2021); Fizal (2022)	Seamless rendition of services
4	Anand (2021); Agara (2021); Fizal (2022)	Provides immersive virtual tours to prospects
5	Barillas (2020); Anand (2021); Agara (2021); Fizal (2022)	Enhances networking among agents
6	Kharchenko (2019); Barillas (2020); Anand (2021); Horiachko (2021); Agara (2021); Fizal (2022)	Speeds up transactions
7	Kharchenko (2019); Siniak et al. (2020); Barillas (2020); Anand (2021); Agara (2021); Fizal (2022)	Provides detailed data to prospects
8	Baker (2021); Agara (2021); Fizal (2022)	Easy and constant contact with potential clients

9	Barillas (2020); Anand (2021); Agara (2021); Horiachko (2021); Fizal (2022)	Technology can generate automated advertisements
10	Barillas (2020); Agara (2021)	Technology increases client-base
11	Barillas (2020); Agara (2021); Fizal (2022)	Generation of more leads and sales
Challenges		
S/N	**Author/Year**	**Challenges**
1	Oni (2013); Aihie (2019); Barillas (2020); Forbes Business Council (2022)	Resistance to the adoption of modern technologies
2	Olapade and Olaleye (2019); Onwuanyi (2020)	Lack of up-to-date and relevant property information
3	Babajide et al (2018); Oyetunji et al (2018); Aihie (2019); Olapede and Olaleye (2019)	Limited skilled human resources to operate modern technologies
4	Oni (2013); Babajide et al (2018); Oyetunji et al (2018); Aihie (2019); Olapede and Olaleye (2019)	Lack of financial resources
5	Olapade and Ekemode (2018); Aihie (2019); Akeju et al. (2021)	Low level of awareness of modern technologies

3. Data and Methodology

This study's target population are Estate Surveyors and Valuers (ESVs) firms within Ikeja, Lagos State. The restriction to Ikeja was to curb unnecessary generalisation of results. Moreover, Ikeja was chosen because it is one of the three primary stratifications of the Lagos property market (Akeju et al., 2021). Furthermore, this research is limited to ESVs because they are the only duly registered professionals in Nigeria who are certified competent and have legal approval to offer services such as valuation, agency, property management, and marketing, among others (Olapade et al., 2018; Demola-Alade, 2021). From the 2020 online NIESV directory of registered firms, there are 82 firms located in the study area. This study, therefore, administered questionnaires on the ESVs in these firms, i.e. one questionnaire per firm. The focus of the study is limited to the following modern technologies: virtual reality, chatbot, drones, marketing automation, digital technology, artificial intelligence, blockchain and big data. This is because they are the major modern technologies adopted for marketing real estate in most developing and developed nations of the world (Alton, 2019; Marr, 2020; Vilmate, 2020).

The researchers designed a structured questionnaire to gather data for the study. The questionnaire has four sections, i.e. sections A, B, C and D. Section A's questions focused on the level of awareness of the selected modern technologies, while section B

was on the level of adoption of the technologies among the ESVs in the study area. Section C's questions centred on the benefits of adopting the technologies, and the last section was on the challenges of adopting modern technologies for real estate marketing. The measurement scale used to draw the questionnaire is a five-point Likert-type scale. Out of the 82 questionnaires administered, 76 (93%) were returned and found useful. The data obtained from sections A and B was analysed using percentages, mean, standard deviation and Pearson Correlation. In contrast, for sections C and D, mean and Relative Importance Index (RII) were used to arrive at the results. The RII result was interpreted following the suggestion of Fernando (2014) as follows: low level (RII < 50%), medium level (50% ≤ RII < 70%) and high level (RII ≥ 70%). The results for all the sections are displayed in tables and a chart.

4. Results and Discussion

This section contains a thorough examination of the data gathered as well as a discussion of the findings. The discussion is divided into five subheadings. The first, second and third sections are about the level of awareness and adoption of modern technologies, respectively. In contrast, the focus of the fourth and fifth sections is the benefits and challenges of adopting the technologies for real estate marketing.

4.1 Level of Awareness of Modern Technologies for Marketing Real Estate

The respondents were asked to state their level of awareness of the modern technologies used in marketing real estate identified earlier from the literature. This was done to ensure that the ESVs are abreast of the selected technologies for marketing real estate that are trending around the globe, particularly in developed countries. Additionally, it will ascertain if they are in a position to proffer accurate answers with respect to the aim of the study. Figure 1 shows their responses.

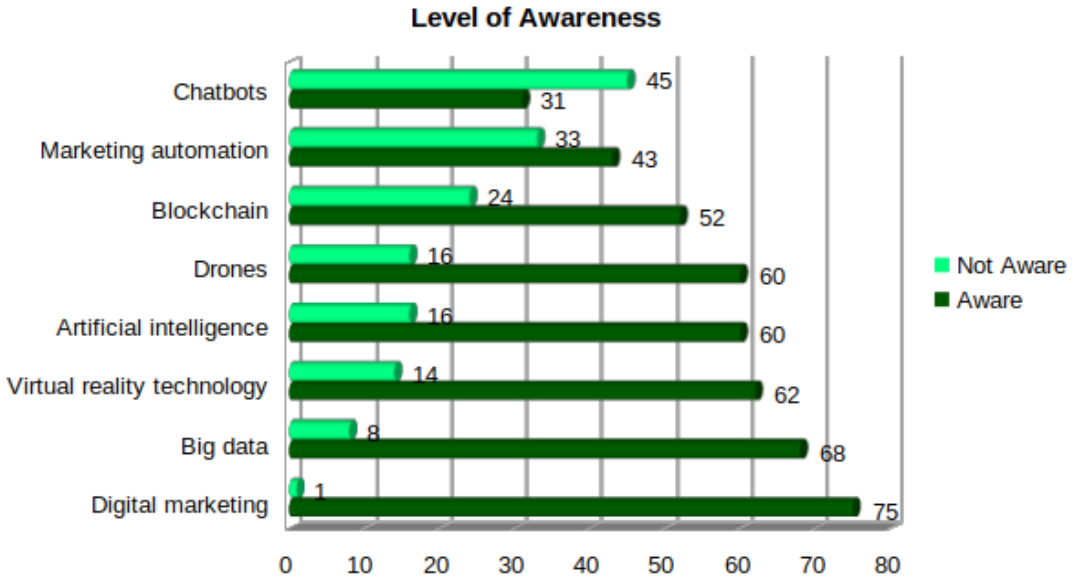

Figure 1: Level of Awareness

Figure 1 depicts the level of awareness of modern technologies in marketing real estate among the respondents. Based on their responses, 75 of them (99%) are aware of digital marketing, 68 of them (89%) are aware of big data, 62 of them (82%) are aware of virtual reality, 60 of them (79%) are aware of artificial intelligence, 60 of the respondents (79%) are aware of drone technology, 52 of the respondents (68%) are aware of blockchain, 43 (57%) are aware of marketing automation and 31 of the respondents (41%) are aware of chatbots as a real estate marketing tool. The outcome of these findings vividly shows that the majority of ESVs in the study area are conversant with modern technologies adopted for real estate marketing. The highest percentage (99%) of them are particularly familiar with digital marketing. This outcome supports the views of Akinwamide and Bello (2019), Low et al. (2020) and Akinwamide (2021).

4.2 Level of Adoption of Modern Technologies for Marketing Real Estate

The respondents were asked to state the extent of adoption of the selected modern technologies. This was intended to determine whether they were actually adopting them in marketing real estate in their firms. To achieve this, the researchers assigned 5 to "Every Time", 4 to "Almost Every Time", 3 to "Occasionally", 2 to "Almost Never" and 1 to "Never". Table 3 shows their responses.

Table 3: Level of Adoption of Modern Technologies for Marketing Real Estate

Level of Adoption	5	4	3	2	1	Mean	SD	Remark
Digital Marketing	55	21	0	0	0	4.72	4.22	Every Time
Big data	0	36	30	10	0	3.34	2.88	Occasionally
Virtual reality	0	33	33	6	4	3.25	2.82	Occasionally
Blockchain	0	30	31	6	9	3.08	2.71	Occasionally
Marketing automation	3	4	26	29	14	2.38	2.06	Almost Never
Artificial intelligence	0	0	20	45	11	2.12	1.66	Almost Never
Chatbots	0	3	14	41	18	2.03	1.63	Almost Never
Drones	0	0	7	13	56	1.36	0.94	Never
Average Mean: 22.31/8 = 2.788								

Note: SD = Standard Deviation

In order of adoption, Table 3 indicates that digital marketing is the most commonly used technology for real estate marketing in their firms (mean=4.72). They, however, confirmed that they "occasionally" use Big Data (mean=3.34), virtual reality (mean=3.25) and blockchain (mean=3.08). The table further reveals that they "almost never" adopt marketing automation (mean=2.38), artificial intelligence (mean=2.12) and chatbots (mean=2.03), while they "never" use drones (mean=1.36). This outcome implies that the majority of modern technologies are not frequently adopted in the study area for real estate marketing (with an average mean of 2.80). Evidently, only digital marketing is gaining ground among ESVs in the study area. This outcome further buttresses the works of Akinwamide and Bello (2019), Low et al. (2020) and Akinwamide (2021).

4.3 Level of Awareness and Adoption of Modern Technologies (Pearson Correlation)

The researchers used the Pearson Correlation to determine the nature of the relationship between ESVs' level of awareness and the adoption of modern technologies for real estate marketing. Table 4 illustrates the results.

Table 4: Awareness and Adoption of Modern Technologies

Awareness of Modern Technologies (X Values)	**Adoption of Modern Technologies (Y Values)**	**X and Y Combined**
Mx: 56.375 $\sum$ = 451 $\sum(x - M_x)2 = SS_x = 1381.875$	My: 2.752 $\sum$ = 22.02 $\sum(y - M_y)2 = SS_y = 7.007$	N = 8 $\sum(x - M_x)(y - M_y) = 59.022$

Key

x = x values y = y values;
M_x = Mean of x values M_y = Mean of y values;
SS_x = sum of $(x - M_x)^2$ SS_y = sum of $(y - M_y)^2$

R Calculation

$r = \sum((x - M_y)(Y - M_x)) / \sqrt{((SS_x)(SS_y))}$
$r = 59.022 / \sqrt{((1381.875)(7.007))} = 0.5998$
r = 0.5998

As displayed in the calculation, the values for r and r^2 are 0.5998 and 0.3598, respectively. The coefficient of determination (r^2) shows how much of the variance in the dependent variable (degree of adoption) can be accounted for by the independent variable (level of awareness). 36% of the variance in this case can be explained. Additionally, when r moves away from zero, the strength of the linear relationship between the two variables gets stronger. As a result, Pearson's correlation coefficient (r=0.5998) confirms that there is a moderately positive correlation between the level of awareness and the adoption of modern technologies. This suggests that as awareness levels rise, adoption rates also tend to increase. This result implies that ESVs must make an effort to keep up with the latest technologies if they want to use them to market real estate.

4.4 Benefits of Adopting Modern Technologies for Marketing Real Estate

In an attempt to ascertain the benefits of adopting modern technologies in the study area, the researchers assigned 1 to "Strongly Disagree (SD)" and 5 to "Strongly Agree (SA)". The outcome of the analysis using RII is shown in Table 5.

Table 5: Benefits of Adopting Modern Technologies for Real Estate Marketing

Benefits	SA	A	U	D	SD	RII	Rank
It reduces manual labour	39	37	0	0	0	0.903	1st
It aids and enhances efficient communication between clients and real estate agents	39	37	0	0	0	0.903	1st
Seamless rendition of services	46	24	4	2	0	0.900	3rd
Provides immersive virtual tours to prospects	45	25	5	1	0	0.900	3rd
It enhances real estate networking	47	23	3	2	1	0.897	5th
Speeds up transactions	45	20	11	0	0	0.889	6th
Technology has helped clients access detailed data, which makes them more knowledgeable on issues relating to real estate	36	35	5	0	0	0.882	7th
Easy and constant contact with potential clients	29	40	6	1	0	0.855	8th
Technology can generate automated advertisements	28	37	10	1	0	0.842	9th
Technology increases client-base	19	35	11	10	1	0.761	10th
Generation of more leads and sales	3	25	28	14	6	0.613	11th

Note: low level (RII < 50%); medium level (50% ≤ RII < 70%) and high level (RII ≥ 70%)

Based on the results from RII, it is clear that all the benefits listed are important. However, ten are the most important. They include reduction in manual labour (RII=0.903); efficient communication between clients and real estate agents (RII=0.903); real estate services are rendered seamlessly and efficiently (RII=0.900); technology enables virtual tours (RII=0.900); technology enhances real estate networking (RII=0.897); technology saves time spent on transactions (RII=0.889); access to detailed data (RII=0.882); easy and constant contact with potential clients (RII=0.855), technology can generate automated advertisements (RII=0.842) and technology increases client-base (RII=0.761). However, according to respondents, the lowest ranked benefit is the generation of more leads and sales (RII=0.613), which ranked 11th respectively. From the foregoing, it is clear that these benefits are statistically significant, considering that the RII of the lowest-ranked benefit is greater than 0.5 (50%). The implication of this result is that ESVs have a lot to gain when they adopt these modern technologies for marketing real estate. These outcomes give credence to the findings of the studies of Anand (2021), Agara (2021), and Fizal (2022).

4.5 Challenges of Adopting Modern Technologies for Real Estate Marketing

Considering the responses of the ESVs in Figure 1 and Table 5, it is evident that they are aware of modern technologies and their benefits. So, why are they not making good use of these incredible benefits? This question was posed to the ESVs, and a list of probable challenges drawn from the literature was presented to them to choose from. Their responses were analysed using a five-point Likert scale where five is "Strongly Agree (SA)", four is "Agree (A)", three is "Uncertain (U)", two is "Disagree (D)", and one is "Strongly Disagree (SD)". The result of the analysis is shown in Table 6.

Table 6: Challenges of Adopting Modern Technologies for Real Estate Marketing

Challenges	SA	A	U	D	SD	Mean	RII	Rank
Resistance to the adoption of modern technologies	52	24	0	0	0	4.68	0.936	1st
Lack of up-to-date and relevant property information	45	25	6	0	0	4.51	0.902	2nd
Limited skilled human resources to operate modern technologies	20	28	15	13	0	3.72	0.744	3rd
Lack of financial resources	0	15	30	24	7	2.70	0.540	4th
Low level of awareness of modern technologies	0	10	16	22	28	2.11	0.422	5th

Note: low level (RII < 50%); medium level (50% ≤ RII < 70%) and high level (RII ≥ 70%)

The analysis in Table 6 of the challenges to adopting modern technologies for real estate marketing shows that the major challenge is ESVs' resistance to adopting modern technologies (RII=0.936). This is closely followed by a lack of up-to-date and relevant property information (RII=0.902) and limited skilled human resources to operate modern technologies (RII=0.744). However, they are not entirely convinced by the notion that lack of financial resources (RII=0.540) and low level of awareness of the modern technologies among ESVs in the study area (RII=0.422) are significant challenges. These findings imply that ESVs' resistance to adopting modern technologies, lack of up-to-date and relevant data, and limited skilled human resources are the major impediments to using modern technologies in the study area. This outcome is not surprising, considering previous research findings (Onwuanyi, 2020; Barillas, 2020; Ashton, 2021; Forbes Business Council, 2022). Without a willingness to accept change, a constant supply of relevant data or skilled human resources, embracing modern technology in real estate practice will be a difficult task.

5. Conclusion and Recommendations

This research examined the benefits and challenges of adopting modern technologies for real estate marketing in Ikeja, Lagos State, Nigeria. From this research, four findings stand out. The first is that ESVs are aware of the selected technologies for marketing real estate, and it is noteworthy that they are very much aware of digital marketing in particular. Secondly, despite the majority of them being aware of the technologies, they hardly use them, except for digital marketing. Thirdly, there is a moderately positive correlation between the level of awareness and the adoption of modern technologies. Fourthly, the benefits of the adoption of modern technologies reveal that they will be an excellent addition to the toolkit of Nigerian real estate professionals for real estate marketing. Finally, resistance to the adoption of modern technologies and the absence of up-to-date and relevant data are significant barriers to their adoption. Based on the findings of the study, the researchers make the following recommendations:

1. NIESV and ESVARBON should provide forums where ESVs can be enlightened, educated and trained on how to use the various technologies for real estate marketing. This will help curb the issue of low levels of adoption of modern technologies.
2. Also, considering the numerous benefits of modern technology in real estate marketing, it is suggested that ESVs embrace its adoption, as this would improve the real estate industry in Nigeria, specifically real estate marketing.
3. Moreover, practical seminars and workshops can be organised at professional branch levels for Heads of Practice (ESVs) to get them abreast of the benefits of modern technologies. This is to address the issue of resistance to the adoption of modern technologies.
4. Furthermore, it is suggested that NIESV and ESVARBON should see to the establishment of a central data bank where relevant data can be drawn when needed. This is with a view to finding a lasting solution to the issue of lack of up-to-date and relevant data.
5. Finally, rather than looking to hire in-house Information Technology professionals - which may be expensive - firms may consider outsourcing by engaging consultants. This will alleviate the third barrier (lack of skilled human resources).

6. Limitations and Suggestions for Further Studies

This research was carried out by administering questionnaires, and only eight modern technologies for real estate marketing were the focus. Thus, there might be a possibility that the study's results may be different if other relevant, emerging modern technologies are included and examined in a new study. Moreover, there may be peculiar limitations associated with the questionnaire survey approach. Based on this, it is suggested that more studies be conducted by applying mixed data collection methods such as interviews and questionnaire surveys. Furthermore, this research considered just five barriers to adopting modern technologies; hence, further studies can be regarded as including more barriers. Also, this study only covered ESVs in Ikeja, Lagos State; a further study could be extended to ESVs in other geographical locations. Finally, a follow-up study may measure the influence of modern technologies on real estate marketing.

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Factors Influencing the Adoption of Automating Systems in the Facilities Management of High-Rise Buildings in Lagos, Nigeria

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Abstract

The paper examined factors influencing the adoption of automating systems in high-rise buildings in Lagos, Nigeria, to provide information that could enhance facilities management practice. The study adopted a quantitative research approach, administering 53 copies of a questionnaire to resident facilities managers of selected high-rise buildings in Lagos with a response rate of 77.4%. Simple frequency distribution, percentage (%) weighted mean score on a point-Likert scale measurement and factor analysis were used to analyse responses.

The study revealed that the need to protect buildings against failure was considered the most significant factor influencing the adoption of automation in the management of facilities in high-rise buildings. The researcher encountered bureaucratic bottlenecks, which required writing letters to the board of directors before the questionnaire could be filled; this slowed down the pace of data collection. Also, the level at which respondents treated information with secrecy affected data collection; hence, the sampling technique was limited to purposive sampling.

The use of automating systems presents facilities managers with innovative ways of ensuring the functionality of the built environment through the integration of people, place, process and technology. The study contributes to the frontier of knowledge on the adoption of automation in the facilities management of high-rise buildings.

Keywords: *automation, automating system, facilities management, high-rise buildings, resident facilities managers, Lagos, Nigeria*

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1. Introduction

The reality that buildings built decades ago are ageing and that they need more upkeep, recurrent repairs and upgrades poses serious challenges to building operators (building owners and facilities managers). Also, the nature and function of building facilities continue to evolve in the face of technological innovation and the overall digitalisation of our modern space. This evolution is constantly changing the roles of facilities managers and making building operators continuously find innovative ways of controlling and managing facilities. These roles could get more complex for facilities managers of high-rise buildings. This is because high-rise buildings are a particular type of construction based on their height, structural stability and various mechanical and electrical systems needed to make occupation conducive. Hence, facilities managers are increasingly striving for better control over resource utilisation rates of their facilities for a more economical, environment-friendly and optimised facilities management experience through the use of information technology herein referred to as facilities management automation (East, Bogen, and Rashid, 2012; Parasanazhad and Tarandi, 2012).

Facilities management automation provides the facilities manager with the tools and methods that aid control over the facilities management process, which can be said to be complex in nature. It spurs facilities management implementation and also serves as an integrating factor for people, places and facilities (Lunn and Stephenson, 2000; Madritsch and May, 2009). Studies have revealed that data repository technology such as Building Information Management (BIM), interoperability software like Industry Foundation Class (IFC), workflow systems such as Computer Aided Facilities Management (CAFM), facilities intelligence software such as Building Maintenance System (BMS) sensor mobile like Augmented Reality (AR) and field capture technology such as (drone) are the common automating systems used in facilities management practice (Wang, Wang, Yung and Jun, 2013; Coenen and Felten, 2014; Scupola, 2014; Ebbesen 2015; Lok and Baldry, 2015). Automation is not a new term in facilities management because the term "facilities management" originated from the hi-tech world, and it was adapted into the built environment by space planners and office manufacturers (Owen 1995). It has since evolved in the last four decades from pneumatic and mechanical devices into direct digital controls and later into electronic devices with microprocessors and communication capabilities (Lunn and Stephenson, 2000; Ebbesen, 2015; Golabachi and Kamat, 2016).

According to Azarh (2011), introducing and adopting new technology usually require factors which may affect the use of such technology for its successful take-off and subsequent benefits to be derived. Hewawasam *et al.* (2016) identified high initial cost, lack of knowledge and competencies, technical faults and design failures, staff attitude and resistance to change as factors affecting the adoption of automating systems in the construction industry. Hassainain *et al.* (2017) also identified inappropriate selection of facilities management personnel, inadequate training of facilities personnel and poor operation and maintenance activities as factors affecting the adoption of automation in the construction industry. Studies on automation have been broadly discussed in relation to the construction industry. Meanwhile, studies on facilities management automation (Oladokun, 2011; Aliyu, 2015; Ebbesen, 2015; Golabachi & Kamat, 2016; Ogunleye, 2017) have not explicitly addressed the use of automation in facilities management of high-rise buildings, especially i n Nigeria. Also, there is the need to show that advancement in the country'sv built environment is not a mere imitation of Western technology but a result of advancement in technological development and the needs of building operators within Nigeria. This study examined factors influencing facilities management automation in high-rise buildings in an attempt to fill the gap in the literature and also to provoke advancement in facilities management practice in Nigeria.

The major research question that this paper will address is: what factors influence the adoption of automating systems in facilities management of high-rise buildings? This intends to identify factors that are peculiar to developing countries like Nigeria and provide information that could enhance advancement in facilities management practice.

2. Literature Review

2.1 The Concept of High-Rise Buildings

The Council of Tall Buildings and Urban Habitat (2004) defined high-rise buildings as buildings that create distinct conditions in terms of design and construction when compared to other buildings in a particular region and specific period as a result of their height. The definitions of high-rise buildings have been based on height and number of floors. These definitions differ based on time, region and technological innovation. For instance, Nigeria had no high-rise buildings when the Western world decided on the vertical transformation of horizontal expansion in the 1870s (Ajayi and Awosode, 2019). Awotona (1987) defined a high-rise building as any building higher than a three-storey walk-up. Lagos State Urban and Regional Planning Development Law (LSURPD, 2005) considers any building with a minimum of five floors of high-rise buildings (Ezema and Olutayo, 2014). This is quite different from the definition of the National Fire Protection Association in the United States (NFPPA, 2016), which identified high-rise building as a building with a minimum overall height of 28 meters from the ground level to the highest floor.

High-rise buildings were first built in the United States of America in the 1870s. In contrast, tall buildings began to surface in Shangai, Hong Kong, Sao Paulo, and other important Asian and Latin American cities in the 1930s. Europe and Australia decided to go vertical in the mid-twentieth century. Meanwhile, the first high-rise building in Nigeria and West Africa (The Cocoa House) was built in 1965 with 26 floors and a height of 105 meters. The operational definition of high-rise buildings for this research is based on the standard height of the fire equipment department, which ranges between 28 and 32 meters. For the purpose of this study, any building with a minimum number of 10 floors was considered a high-rise building. This is in line with Knoke's (2006) definition of a high-rise building as a building considered with a height that is beyond the maximum reach of available fire-fighting equipment (23- 30 meters), provided the floor height is three meters. According to High-Rise Security and Fire Safety (2009), three essential inventions that gave birth to the construction of high-rise buildings are the invention of the world's first safety elevator in 1853, the replacement of the fragile combination of cast iron and wood with steel frame in 1870s and the invention of air conditioning in 1902.

It is worth noting that high-rise buildings were first built as a response to continuous industrialisation and swift population growth of the late nineteenth century, which led to a significant demand for office space. Early high-rise buildings were targeted to meet the increasing demand for office space, while the first residential high-rise building (Ritz Tower), with 41 stories and 165 meters in height, was built in 1926. The cost of developing high-rise buildings is often high when compared to low-line buildings. To ensure the long-term sustainability of investment made in these structures, there is a need to protect such investment through maintenance of the building fabrics, building systems and building services, which will make occupation conducive for users.

2.2 Concept of Facilities Management Automation

Maintenance of building fabric and its services (which is an aspect of facilities management) during the operation phase of the building contributes immensely to the sustainable performance of the building (Ding *et al*., 2009). A good maintenance culture is needed for a nation to maintain the value and amenity of its building stock; however, the consistent change in the nature and function of building systems coupled with the level of sophistication of users of high-rise buildings require that facilities managers find innovative ways to control and manage facilities. More so, facilities management requires in-depth knowledge of skills and tools for building operations, maintenance, engineering, forecasting, budgeting, health, safety and security. Information and communication technology tools, herein referred to as automation, have influenced facilities management in recent years (Thompson, 2000). Facilities management automation, which is defined as "the use of computerised system to perform or supplement facilities management functions, spurs facilities management implementation. It also serves as an integrating factor for people, place and facilities" (Lunn and Stephenson, 2000; Madritsch and May 2009). According to Wang *et al*. (2013), information technological tools used in facilities management are divided into two: data containers (e.g. FTP servers, BIM and GIS etc.) and workflow systems (e.g. CMMS, CAFM and IWMS). In comparison, Ebbesen (2015) gave a more elaborate list of the commonly used automating systems in facilities management: data repository technology, interoperability software, workflow system, facilities intelligence software, sensor mobile and field capture technology.

Lunn and Stephenson (2000), cited in Awosode (2018), stated that facilities management has evolved in four distinct generations since the initial computerised of the early 1960s through the technology push of the mid-1980s down to the current communications generations, which has been defined by communications infrastructures, mobile and the Internet and communication between programming languages, structures and interoperability. The study further stated that the extent to which automation is adopted in facilities management is hinged on several factors, which are not limited to the level of information technology, global competition, rate of churn, employee expectations, demand for information, cost of mistakes, design standards and inventory, strategic resource, change, high cost of facilities and space among others.

2.3 Empirical Studies

Ebbesen (2015) reviewed the literature on information technology in facilities management. The study considered the current state of research on the use of information technology in facilities management. The study revealed that data repository technology (BIM), interoperability software (IFC), workflow system (CAFM), facilities intelligence software (BMS), sensor mobile (augmented reality AR) and field capture technology (drone) are the standard automating systems used in facilities management practice. It further stated that BIM is the most researched technology while CAFM is the most used technology. The study is not empirical and thus based on the author's opinion rather than replicable data. Also, the study focused on facilities management practices in Europe. However, this study focused on Nigeria, where facilities management automation is relatively new and uses empirical data.

According to Azhar (2011), introducing and adopting new technology usually require factors which may affect the adoption of such technology for its successful take-off and subsequent benefits to be derived. Factors affecting facilities management automation in high-rise

buildings can be grouped into those specific to the nature and level of sophistication of high-rise buildings and those specific to different models and software adopted in facilities management automation. In contrast, others are general to the diffusion of information technology into facilities management practice. Hewawasam *et al.* (2016) identified high initial cost, lack of knowledge and competencies, technical faults and design failures, staff attitude and resistance to change as factors affecting the adoption of automating systems in the construction industry. Hassainain *et al.* (2017) also identified inappropriate selection of facilities management personnel, inadequate training of facilities personnel and poor operation and maintenance activities as factors affecting the adoption of automation in the construction industry. All these studies were carried out in developed countries. Although these factors can be ubiquitous, there is a need to identify those peculiar to developing countries like Nigeria, where this study is domiciled.

3. Methodology

To provide answers to factors influencing the adoption of facilities management automation in high-rise buildings in Lagos, the study adopted survey research where 53 high-rise commercial buildings were purposively selected out of the 95 that were identified through field survey in Ikoyi, Lagos Island and Victoria Island all in Lagos State Nigeria. These locations were selected for the study because they have the highest concentration of high-rise Lagos 159 (97.5%), whereas Lagos has the highest number of high-rise buildings (163) Aliyu *et al.* (2015). This selection was based on accessibility to the building and the willingness of respondents to provide useful information. Primary data from a questionnaire administered to facilities managers of high-rise buildings was used for the study. A total number of 53 hard copies of the questionnaire were issued, while 41 copies of the questionnaire were returned and found useful for analysis. Information collected included types of automating systems used in high-rise buildings, time of acquisition of the system, factors that influenced the choice of the systems used and the factors influencing the adoption of facilities management automation. A frequency distribution table, mean ranking of a 5-point Likert scale and factor analysis techniques were used for appropriate data analysis of the information gathered from respondents.

3.1 Data Validity Test

Table 3.1 illustrates the test of assumptions on the adequacy of the matrix and the significance of the factors influencing the adoption of automation in the management of high-rise buildings in the study area. With a determinant level of .001, the assumption is that the listed factors affect the adoption of automation in the management of high-rise buildings in the study area. More so, with a KMO of .770, greater than 0.70, this indicates that enough items were predicted by each (principal factor component). And since Bartlett's test has a significant value of .000, which is less than .05, this implies that the variables (factors affecting the adoption of automation in high-rise buildings in Nigeria are correlated highly enough to provide a reasonable basis for factor analysis).

Table 3.1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.770
Bartlett's Test of Sphericity	Approx.Chi-Square	433.488
	Df	.91

	Sig.	0.000

Table 3.2 Distribution of high-rise buildings in Lagos Metropolis

Local Government	**Frequency**
Apapa	1
Eti-Osa	106
Lagos Island	53
Lagos Mainland	2
Total	**163**
Nature of Use	**Frequency**
Commercial Office Space	98
Healthcare	1
Hospitality	8
Mixed-use	13
Residential	43
Total	**163**

Source: Author's Field Survey 2019

4. Analysis and Results

This section presents findings from the field survey, which were introduced in line with the research objective, while inferences were drawn from the data gathered.

Table 4.1 shows that 19 (46.3%) of the sampled commercial high-rise buildings had property maintenance or management department that performs the traditional role of property managers. In comparison, 17 (41.5%) had structured facilities management departments or units. This corroborates the findings of Aliyu *et al.* (2015) that public and private corporation operators consider facilities management an effective tool for managing their buildings. However, facilities management application in managing high-rise buildings in Lagos is still below average. One can infer that there is no significant relationship between ownership of high-rise buildings and the presence of facilities management departments. The Table also indicated that 21 (51.2%) of the sampled buildings had in-house facilities management departments, while 10 (24.4%) adopted outsourced facilities management strategy, and the remaining 10 (24.4%) adopted hybrid facilities management strategy. A keen look at the facilities management strategy and ownership of the buildings shows that a more significant percentage of the public buildings, 13 (76.5%,) adopted an in-house facilities management strategy against outsourcing management. This indicates that public building operators prefer employing staff treated as civil servants in the facilities management department rather than contracting their services out to experts constantly updated with developments in the facilities management industry. This could explain why most of our public buildings were in a state of disrepair (Iyagba 2005).

Table 4.1: Facilities Management Strategies Adopted in High-Rise Buildings

Facilities Management Department	**Frequency**	**Percentage (%)**
Property/Maintenance department	19	46.3

Facilities Management Department	17		41.5
None	5		12.2
Total	**41**		**100.0**
Facilities Management Strategies			
Inhouse Facilities Management	21		51.2
Outsourced Management	10		24.4
Hybrid Facilities Management	10		24.4
Total	**41**		**100.0**
Facilities Management Strategy* Ownership of Buildings	**Ownership**		**Total**
	Public	*Private*	
Inhouse Facilities Management	8	13	21
Outsourced Management	7	3	10
Hybrid Facilities Management	9	1	10
Total	**24**	**17**	**41**

Table 4.2 indicates that facilities managers were more familiar with computer-aided facilities management (CFAM), with 26(19.8%) followed by computer maintenance management system (CMMS), 23(17.6%) and building information model (BIM), 20(15.3%). Industry foundation class (IFC) and integrated workspace management system (IWMS) have the lowest frequency 8(6.1%). Computer-aided facilities management (CFAM) has been around for a while, and its ease of use makes it a more popular building information model (BIM). It is the latest technology in the built environment, and every facilities manager wants to know its usage.

Table 4.2: Types of Automating Systems that Facilities Managers are Familiar with

Automating System	Frequency	Percentage (%)
Building Automating (BAS)	19	14.5
Building Information Model (BIM)	20	15.3
Building Maintenance System (BMS)	16	12.2
Computer Aided Facilities Management (CAFM)	26	19.8
Computer Maintenance and Management System (CMMS)	23	17.6
Construction Operation Building Information Exchange (COBie)	11	8.4
Industry Foundation Class (IFC)	8	6.1

Integrated Workspace Management System (IWMS)	8	6.1
Total	**131*** **	**100.0**

*A Note: ***** This figure exceeded the number of respondents because multiple responses were allowed.*

As indicated in Table 4.3, 19 (48.7%) of facilities managers use computer-aided facilities management (CAFM) to manage their facilities. In comparison, 9 (23.10%), 7 (18.0%), 3 (7.7%) and 1 (2.5%) used computer maintenance and management systems, building automating systems, building maintenance systems and building information models, respectively. Automating systems such as Construction operation building information exchange (COBie), industry foundation class (IFC), and integrated workspace management system (IWMS) are not being used by facilities managers in the study area. Integrated workspace management (IWMS) performs similar functions to CAFM. Most facilities managers choose CAFM because it aids the capturing, usage and electronic analysis of all data that applies to the life cycle of facilities. According to (GEFMA, 2007), CAFM provides numerous key functions to meet the required standard expected by its users (building owners and facilities managers) satisfactorily, and these functions include lease administration, project management, space management, maintenance management processing and resource planning.

Hence making CAFM attractive for real estate and facilities management companies. This could be the reason most facilities managers chose CAFM over other computerised systems. This corroborates the view of Ebbesen (2015) that CAFM is the only technology being used in facilities management organisations, and implementation of BIM technology in the facilities management industry is at the initial stage. Building information model is a data repository technology that is relatively new to the Nigerian construction industry. It is used traditionally right from the design stage of construction, considering the vast amount of information needed to manage the life cycle of a building. However, 29 (76.3%) of the sampled high-rise buildings were constructed between 11 and 50 years ago. This makes it difficult for facilities managers to use BIM for facilities management, which explains why only 1 (2.5%) facilities manager adopted BIM. This could be because the building (Heritage Place Building) is relatively new and considered the only fully automated commercial high-rise building in Nigeria. The response ratio of the awareness facilities managers about different automating systems to use these systems is 3:1 (0.3). This means that other factors aside from the level of awareness of facilities managers about these systems affect the choice of computerised systems used by facilities managers.

Table 4.3: Types of Automating Systems Used by Facilities Managers

Types of Automating Systems Used by Facilities Managers	Frequency	Percentage (%)
Computer Aided Facilities Management (CAFM)	19	48.7
Computer Maintenance and Management System (CMMS)	9	23.1
Building Automating (BAS)	7	18.0
Building Maintenance System (BMS)	3	7.7
Building Information Model (BIM)	1	2.5

Construction Operation Building Information Exchange (COBie)	-	-
Industry Foundation Class (IFC)	-	-
Integrated Work Space Management System (IWMS)	-	-
Total	**39*** **	**100**

As presented in Table 4.4, a total number of 22 (53.7%) high-rise buildings are being managed using a computerised system, most of which were acquired between 5 and 9 years ago. The result indicates that computerised systems in the study area became popular in the last decade. And that automation is still in its early stages in Nigeria. More so, 6 (27.3%) of the sampled facilities managers stated that the computerised system was acquired at the construction stage of the building, and these high-rise buildings were built in the last five years. Computerised systems were installed at the operation stage of 16 (72.7%) high-rise buildings. Based on these findings, one can infer that professionals in the built environment in Nigeria are gradually catching up with the happenings in the global built environment in the last decade.

Table 4.4: Acquisition of Automating System

Time of Acquisition of Computerised System		
Years	**Frequency**	**Percentage (%)**
1-2	1	4.5
3-4	9	41.0
5-6	8	36.4
7-8	3	13.6
9-10	1	4.5

Table 4.5 shows factors influencing the adoption of automating systems in the facilities management of high-rise buildings in the study area. Protection against failure with relative importance index RII of 4.27 is considered the most critical factor influencing the use of computerised systems in managing facilities in high-rise buildings. The reason for this could be partly due to the assertion that high-rise buildings are considered as a particular type of building because of their height and the need for facilities within the building to make them conducive for occupation. The failure of any mechanical system for an extended period could pose a serious threat to the occupiers/users. More so, investment in high-rise buildings requires a tremendous amount of capital. The increasing cost of property, fixed assets and maintenance has led to the use of different techniques to identify and allocate space together with furniture, equipment and power. However, automating tools is said to help maximise the use of existing and expensive facilities such as the HVAC or lift system to prolong their economic life. Hence, the high cost of facilities is ranked 2nd with a RII of 4.24. Iyabga (2005) stated that Nigeria has a poor maintenance culture, which has made many high-rise buildings to be economically obsolete. This is not unconnected to the use of paper boxes in carrying out facilities management activities. To improve facilities management activities, facilities managers have identified using automated tools to enhance facilities management activities, prolonging the economic life of high-rise buildings. In lieu of this,

poor operation and maintenance activities ranked 3rd with a RII of 4.05 among factors that influence the adoption of automation in managing facilities in high-rise buildings. In contrast, the initial installation and implementation cost ranked 4th with a RII of 4.02.

Lunn and Stephenson (2000) stated that the perceived cost of installing and managing automating tools dissuades many organisations from adopting them to manage their facilities. Also, high implementation cost, as indicated in the work of Czmocha and Pokala (2014), poses a serious challenge in the form of enormous hardware and software prices. This is reflected in the result shown in Table 4.6. Another factor that influences the adoption of facilities management automation is the availability of an information system capable of embracing various data types throughout the life cycle of the building. This is more peculiar to developing countries in general and Nigeria in particular because there is a lack of sound data recording and filing systems. This explains the reason for the availability of information, with RII of 3.98 Ranked 6th. Furthermore, the built industry has been perceived to be rigid in its approach to new technology, which is why the fear of some matured facilities management staff of replacing human personnel with automated systems adapted to changes ranked 7th with RII of 3.95.

In line with the adaptation to changes by the facilities management department, the ineptitude of decision makers with a RII of 3.85 ranked 8th and inadequate enlightenment on the part of the decision-makers as to the importance of automation has led to the lack of support in the adoption of automating tools in facilities management. Management strategies and staff strength ranked 9th with a RII of 3.83. The need to reduce maintenance costs ranked 11th with a RII of 3.81. Enormous investment is committed to high-rise buildings, and studies have shown that a large portion of it is committed to their maintenance to make them physically stable and economically viable. The majority of facilities managers believe that the use of automating tools will reduce maintenance costs in the long run, especially for organisations that have considerable assets. Interoperability, organisation age, faulty designs and lack of graphical interface all have a relative importance index lesser than 3.0. This shows that their influence is less significant in the adoption of automation in facilities management of high-rise buildings. A comparison between the Nigeria Reinsurance Company building, established in 1949 and had no trace of automation, and the First Bank of Nigeria building, established in 1894, with a considerable level of automation. One can infer that the age of the organisation is not as important as the nature of business of the organisation or occupier of the buildings: the age of the building itself, among other factors.

Table 4.5 Factors Influencing the Adoption of Automation

Items	1	2	3	4	5	RII	Rank
Protection Against Failure	-	-	4(9.8%)	31(75.6%)	12(29.3%)	4.27	1st
High cost of facilities	-	-	3(7.3%)	25(61%)	13(31.7%)	4.24	2nd
Poor Operation and Maintenance Activities	-	-	4(9.8%)	31(75.6%)	6(14.6%)	4.05	3rd
Initial Cost of Installation	-	-	7(17.1%)	26(63.4%)	8(19.5%)	4.02	4th

High Implementation Cost	-	-	7(17.1%)	26(63.4%)	8(19.5%)	4.02	4th
Availability of Information	2(4.9%)	2(4.9%)	3(7.3%)	22(53.7%)	12(29.3%)	3.98	6th
Adaptation to Changes	-	-	11(26.8%)	21(51.2%)	9(22%)	3.95	7th
The ineptitude of D ecision Makers	-	-	12(29.3%)	23(56.1%)	6(14.6)	3.85	8th
Management Strategies	1(2.4%)	6(14.6%)	3(7.3%)	20(48.8%)	11(26.8%)	3.83	9th
Staff Strength	1(2.4%)	5(12.2%)	6(14.6%)	17(41.5%)	12(29.3%)	3.83	9th
Need to Reduce Maintenance Cost	1(2.4%)	-	12(29.3%)	21(51.2%)	7(17.1%)	3.81	11th
Age of Building	-	6(14.6%)	5(12.2%)	22(53.7%)	8(19.5%)	3.78	12th
Demand for Information	-	2(4.9%)	9(22%)	27(65.9%)	3(7.3%)	3.76	13th
Global Competition	1(2.4%)	9(22%)	-	22(53.7%)	-	3.71	14th
Ownership of Building	1(2.4%)	3(7.3%)	10(24.4%)	20(48.8%)	7(17.1%)	3.71	14th
Inappropriate S election of Facilities Management Personnel	-	4(9.8%)	7(17.1%)	29(70.7%)	1(2.4%)	3.66	16th
Design S tandard and Inventory	1(2.4%)	5(12.2%)	10(24.4%)	20(48.8%)	5(12.2%)	3.56	17th
Cost of mistakes	1(2.4%)	4(9.8%)	12(29.3%)	21(51.2%)	3(7.3%)	3.51	18th
Lack of Demands by Building Owners	-	8(19.5%)	5(12.2%)	27(65.9%)	1(2.4%)	3.51	18th
Lack of Skilled Personnel	1(2.4%)	5(12.2%)	9(22%)	26(63.4%)	-	3.46	20th
Low Level of Awareness	1(2.4%)	6(14.6%)	12(29.3%)	20(48.8%)	2(4.9%)	3.40	21st
Strategic Resource	2(4.9%)	10(24.4%)	9(22%)	18(43.9%)	2(4.9%)	3.20	22nd
Numbers of Floors	-	16(39%)	10(24.4%)	6(14.6%)	9(22%)	3.20	22nd
Rate of Churn	2(4.9%)	12(29.3%)	10(24.4%)	17(41.5%)	-	3.02	23rd
Employee Expectation	2(4.9%)	16(39%)	6(14.6%)	15(36.6%)	2(4.9%)	3.00	24th
Interoperability	3(7.3%)	12(29.3%)	15(36.6%)	10(24.4%)	1(2.4%)	2,85	25th
Age of Organization	2(4.9%)	22(53.7%)	7(17.1%)	3(7.3%)	7(17.1%)	2.78	26th
Faulty Designs and Failures	4(9.8%)	21(51%)	4(9.8%)	12(29.3%)	-	2.59	27th

Lack of Graphical Interface	3(7.3%)	20(48.8%)	16(39%)	2(4.95)	-	2.41	29th

Table 4. 6 depicts the test of assumptions on the adequacy of the matrix and the significance of the factors influencing the adoption of automation in the facilities management of high-rise buildings in the study area. With a determinant level of .001, the prediction that the listed factors affect the adoption of automation in the facilities management of high-rise buildings in the study area is valid. More so, the Kaiser-Meer Olkin Measure of Sampling of .770 is greater than .70; this indicates that enough items were predicted by each (principal factor component). Bartlett's test also has a significant value of .000, less than .05, implying that the variables are correlated highly enough to provide a basis for factor analysis.

Table 4.6 KMO Bartlett's Test

Kaiser- Meyer Olkin Measure of Sampling	
Adequacy	.770
Bartlett's test of Approximately Chi Squared	433.488
Sphericity df	.91
Sig.	.000

Table 4.7 shows how the variance was divided among 29 possible factors. Four factors have eigenvalues (i.e., a measure of explained variance) greater than 1.0, which serve as a standard criterion for a factor to be valid.

Table 4.7 Total Variance Explained

Component	**Initial Eigen Values**			**Rotation Sums of Squad Loadings**		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
1	12.098	41.717	41.717	9.064	32.254	31.254
2	7.449	25.686	67.403	8.869	29.857	61.11
3	5.683	19.596	87.000	7.146	24.642	85.754
4	2.153	7.424	94.423	2.514	8.670	94.423
5	.469	1.617	96.041			
6	.355	1.223	97.264			
7	.330	1.138	98.402			
8	.289	.996	99.397			
9	.053	.184	99.581			
10	.052	.179	99.761			
11	.022	.075	99.836			
12	.021	.071	99.907			

13	.071	.058	99.967	
14	.010	.035	100.000	
15	2.879E-	9.929E-	100.000	
16	8.765E-	3.022E-	100.000	
17	5.001E-	1.724E-	100.000	
18	4.337E-	1.495E-	100.000	
19	1.717E-	5.921E-	100.000	
20	2.078E-	7.165E-	100.000	
21	8.930E-	3.079E-	100.000	
22	9.612E-	3.314E-	100.000	
23	3.941E-	1.359E-	100.000	
24	3.715E-	1.281E-	100.000	
25	-	-2.260E-	100.000	
26	-	-9.796E-	100.000	
27	-	-4.981E-	100.000	
28	-	-8.953E-	100.000	
29	-	-1.358E-	100.000	

Extraction Method: Principal Component Analysis

The Rotated Component Matrix presented in Table 4.8 shows loadings of the variables on each Factor, which is paramount in understanding the analysis results. All 29 variables were sorted into four overlapping groups of factors, which are (the nature and management style of the organisation, diffusion of information technology into facilities management, nature and level of sophistication of the building and type of software used by facilities managers**).** Factor 1 accounted for 31.3% of the variance; Factor 2 accounted for 29.9%, while Factor 3 and Factor 4 accounted for 24.6% variance and 8.7% variance, respectively. Each of these variables has a loading greater than .50, which shows the reliability of the test. Conclusively, principal component factor analysis with varimax rotation was conducted to assess the underlying structure for the twenty-nine items of the factors influencing the adoption of automation in the facilities management of high-rise buildings. These items were aggregated into four principal factor components: Nature and Management styles of the organisation, diffusion of information technology into facilities management, nature and level of sophistication of the building and type of software used by facilities managers.

The first factor accounted for 31.3% of the variance; the second accounted for 29.9% of the variance, while the third and fourth factors accounted for 24.6% and 8.7%, respectively. The first component has nine (9) variables loaded highly on it. These variables are the rate of churn (0.977), employee expectation (0.977), lack of skilled personnel (0.977), inappropriate selection of facilities management staff (0.982), strategic resource (0.982), ineptitude of decision makers (0.982), age of organisation (0.982), management strategies (0.982), staff strength (0.982). These factors are grouped under the principal component "nature and management style of the organisation". The second component factor also has nine (9) highly loaded variables. These variables include high implementation cost (0.952), lack of demand by building owners (0.961), cost of mistakes (0.961), adaptation to change (0.961), global competition (0.964), availability of information technology (0.965), initial cost of installation (0.965), low level of awareness (0.967), demand for information (0.967). This factor was named diffusion of information technology into facilities management. The third component

factor has eight (8) highly loaded variables. These variables are high cost of facilities and space (0.761), design standards and inventory (0.946), need for reduced maintenance and logistics (0.946), poor operation and maintenance activities (0.946), age of building (0.967), management strategies (0.967), number of floors (0.967), protection against failure of buildings (0.978). This factor was named the nature and level of sophistication of the building. At the same time, the fourth component factor has three (3) variables highly loaded on it. These variables are lack of graphical interface (0.959), interoperability (0.959) and faulty designs and failures. This factor was named the type of software used by facilities managers. The result presented in the table shows that all these factors significantly affect the adoption of automation in facilities management of high-rise buildings in Lagos, Nigeria.

Table 4.8 Rotated Component Matrixes

Rotated Component Matrix	**Component**			
	1	**2**	**3**	**4**
Rate of Churn	.977			
Employee Expectation	.977			
Lack of Skilled Personnel	.977			
Inappropriate Selection of Facilities Management Staff	.982			
Strategic Resource	.982			
The ineptitude of Decision Makers	.982			
Age of Organization	.982			
Management Strategies	.982			
Staff Strength	.982			
High Implementation Cost		.952		
Lack of Demand by Building Owners		.961		
Cost of Mistakes		.961		
Adaptation to Change		.961		
Global Competition		.964		
Availability of Information Technology		.965		
Initial Cost Installation		.965		
Low Level of Awareness		.967		
Demand for Information		.967		

High Cost of Facilities and Space			.761	
Design Standards and Inventory			.946	
Need for Reduced Maintenance and Logistics			.946	
Poor Operation and Maintenance Activities			.964	
Age of Building			.967	
Management Strategies			.967	
Number of Floors			.967	
Protection Against Failure of Buildings			.978	
Lack of Graphical Interface				.959
Interoperability				.959
Faulty Designs and Failures				.751
Eigenvalue	9.064	8.869	7.146	2.514
% Variance Explained	31.254	29.857	24.642	8.670
Cumulative % Variance Explained	31.254	61.11	85.754	94.423

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization

a. Rotation converged in 5 iterations.

5. Conclusions

Factors influencing the adoption of automating systems in high-rise buildings were examined to identify factors peculiar to developing countries and provide information that could enhance advancement in facilities management practice. The study adopted a quantitative research approach, administering 53 structured questionnaires on purposively selected facilities managers of high-rise buildings. The study revealed that CAFM is the most popular and the most used automating system. In contrast, the choice of automating systems was significantly influenced by the cost of acquisition, technical capability of personnel, organisation strategy, system availability, organisation need and ease of use. It was also revealed that the need to protect buildings against failure is the most significant factor influencing the adoption of automated systems in the management of facilities in high-rise buildings.

The study concluded that the use of automating systems presents facilities managers with innovative ways of ensuring the functionality of the built environment through the integration of people, place, process and technology. However, building operators should ensure that the initial acquisition cost does not solely determine their choice of automating systems. Staff expertise level of compatibility of the system, among others, should be considered.

It must be noted that this research work could have been more robust if the authors had access to information available in all the identified ninety-five (95) commercial high-rise buildings.

Further research can be carried out on the comparative analysis of adopting automating facilities management systems between residential and commercial high-rise buildings.

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The Actors' Symbiosis in the Recurrence of Slums after In-situ Housing Redevelopment Initiatives. Perspectives from Namuwongo Slum, Kampala City

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Abstract

This paper examines the roles played by various actors in household mobility and the eventual reoccurrence of slums in the city of Kampala amidst the slum upgrading initiatives.The paper adopted a case study approach, utilising a mixture of both qualitative and quantitative techniques. A total of 60 semi-structured questionnaires were administered to the Slum Community, and 40 interviews were held with various key informant respondents. The analysis was primarily done through content analysis. The results indicate that the influence of slum upgrading actors in the low-income household mobility and reoccurrence of the Namuwongo slum was exhibited through three thematic areas. These included tracking the residential mobility tendencies, fit-for-purposes of the upgrading programs/initiatives, and actor collaboration. This paper concludes that actors' collaboration and participatory involvement in low-income slum-dwelling households should enable the adequate fit-for-purposes of the in-situ upgrading initiatives. This could go a long way in limiting slum reoccurrence as the key drivers of household mobility would be understood and well incorporated into the programs.

Keywords: *household mobility, in-situ upgrading, Namuwongo slum, Kampala*

1. Introduction

The linkage between the success of In-situ housing redevelopment initiatives and the participation of low-income households in slums in global south cities is not new. For instance, it has been experienced in Bihar, India (Li, Alakshendra, & Smith, 2021), Durban, South Africa (Patel, (2013), and several cities in Africa, Asia and Latin America (Bah, Faye, Geh, et al., 2018). Concurrently, SDG No.11 indicates that more than half the human population lives in

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cities and predicts that by 2050, two-thirds of humanity's 6.5 billion people will be urban (UN-Habitat, 2009; UNDP). Owing to this prediction, to achieve sustainable development, mandatory emphasis must be put on the significant transformation of how we build and manage urban spaces because the trend of slums is becoming a more important feature of urban life. In that regard, making cities sustainable means creating safe and affordable housing and building resilient societies (Zhongming, Linong, Xiaona, Wangqiang, & Wei, 2020) and economies through investment in public transport, creating green public spaces, and improving urban planning and management in participatory and inclusive ways.

The demand for adequate housing for low-income households has maintained a steady rise. Based on the statistics by the Government of Uganda (GOU (2016) and GOU (2020), by 2022, Uganda is expected to require more than 3 million housing units. However, about 60% of the entire estimated Kampala city population is accommodated by slums (Brown, 2014; Mukiibi, 2012). The current estimates are about 62 slums (Goodfellow, 2010; Jones, Bird, Becky, & Hass, 2016). Rugadya (2007) indicates that the emergence of slums in Kampala City has been gradual and sustained over the years (see also Muchadenyika and Waiswa (2018). Therefore, the systematic upgrading of slums provides new opportunities for city governance in which slums are embraced, tapped into and incorporated into the mainstream urban development agenda to promote sustainable and inclusive cities.

Olthuis, Benni, Eichwede, and Zevenbergen (2015) suggested that slum upgrading is one of the preferred measures to address urban challenges. Such challenges include flooding, accessibility to infrastructure, sanitation, and crime. The challenges, if unaddressed, may lead to persistent slum recurrence due to residential mobility. In-situ slum upgrading, therefore, has been credited for being practical and humane (Coelho, 2016; Mahadevia, Bhatia, & Bhatt, 2018). In suggesting implementing policies for slum upgrading redevelopments, Handzic (2010) focused on legalised land tenure, commonly known as land regularisation. Tomlinson (2015) emphasised community-led slum upgrading through sites and services or a redevelopment approach. At the same time, Olthuis et al. (2015) emphasised location, spatial (such as locational attributes and growth patterns of slums), and participatory approaches.

There are several slum upgrading initiatives in urban Uganda, which, though well-intentioned, suffered frustrating implementations. Dobson, Muhammed, and Mugisa (2014) noted that Uganda introduced the National Slum Upgrading Strategy and Action Plan (NSUSAP) in 2008 through the Ministry of Lands, Housing and Urban Development, with the prominent one being the Namuwongo slum upgrading project. Muchadenyika and Waiswa (2018) argued that the intention of the 1986 Namuwongo Low-Cost Housing and Slum Upgrading Project (NLCHSUP) was advanced to achieve SDG 11. It was to benefit the low-income slum dwellers by improving household livelihoods and offering them access to better yet affordable housing. However, it is notable that after a few years of the project implementation, there were indications of slum recurrence in the immediate neighbourhoods of the Namuwongo slum upgrading project. A proportion of the inhabitants (project beneficiaries) stayed in the project area of Namuwongo. A considerable number of would-be project beneficiaries disposed of their allotted land parcels and instead migrated to neighbouring slums and unoccupied spaces. Other households extended a short distance away to Namuwongo wetland, which they reclaimed and established another slum at Kasanvu.

As a result of the foregoing, it is essential to thoroughly understand the drivers that pushed the perceptions of the slum dwellers, for many of them to dump the well-intentioned project and end up resettling and recreating another slum in the immediate neighbourhood. To appreciate this better, one must understand the central role of the interplay of different actors in sustaining slum upgrading initiatives. This paper explains how the actors' reluctance to appreciate the

unique household mobility drivers potentially necessitates slum reoccurrences in the wake of in-situ slum upgrading initiatives.

2. In-situ Slum Upgrading, Household Mobility Tendencies and Slum Redevelopments' Recurrence. A Theoretical Understanding

Slums are widely appreciated as urban areas characterised by poverty and substandard living conditions developed outside planning regulations and legally sanctioned housing and land markets (Goussous & Tayoun, 2022; Rukmana, 2018). The UN-Habitat (2010) additionally associates such a slum environment as a physical and spatial manifestation of urban poverty and intra-city inequality. Such association shows how crucial slum expansion should be curbed during city planning by 2030, either through in-situ upgrading existing slums or preventing new ones from springing up.

In-situ upgrading initiatives are prioritised in sub-Saharan African cities (Bah, Faye, & Geh, 2018; Dasgupta & Lall, 2009). Such upgrading programs ordinarily involve several initiatives, such as land regularisation through title deed formation and acquisition, services and utility improvement, including drainage, water, electricity, roads, and sanitation. Others include political and social inclusion through compensation of land owners and consideration of the rights of vulnerable groups, i.e. women and children. Key to these is the collaboration of stakeholders, directly and indirectly, involved in the upgrading process (see Figure 1).

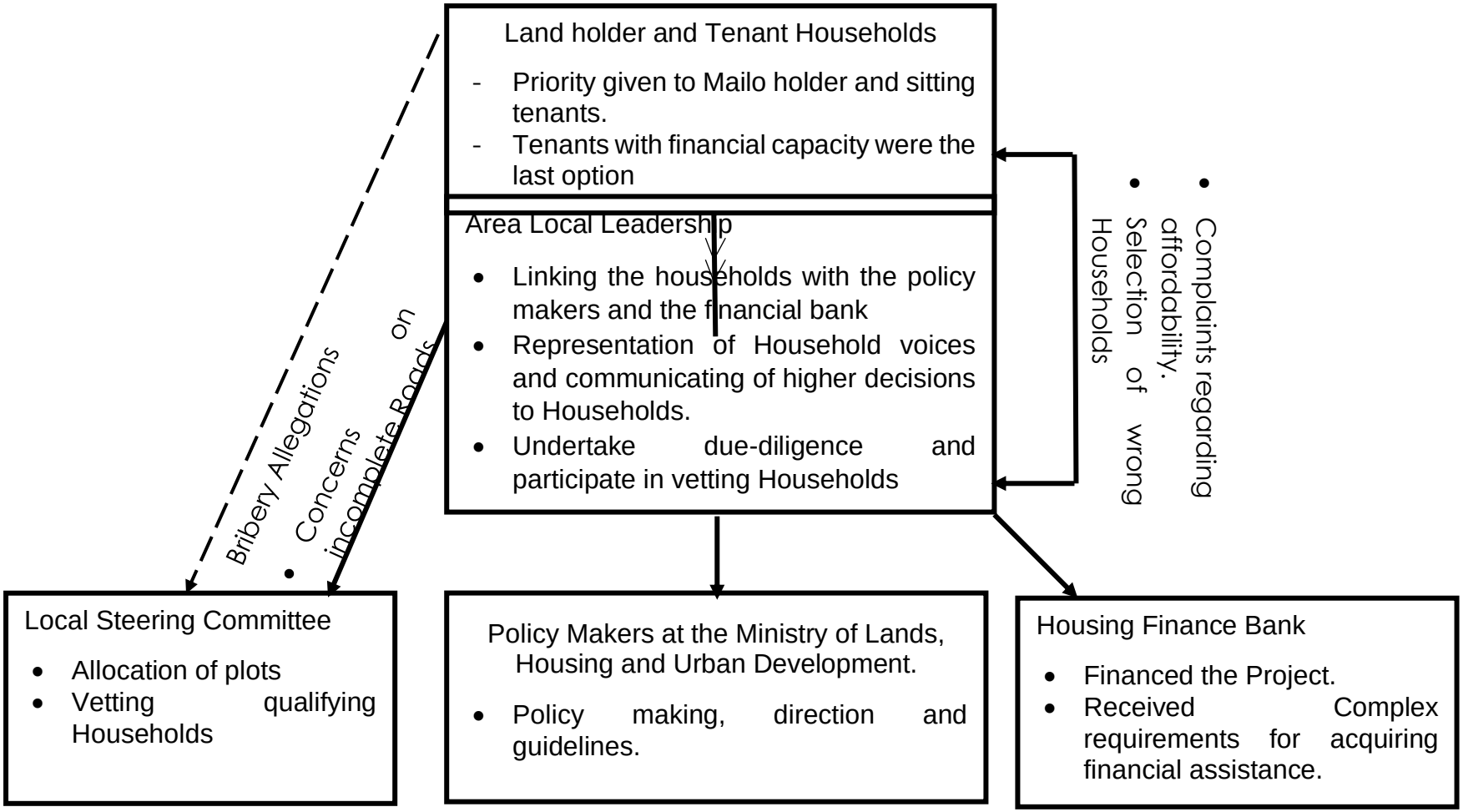


Figure 1: Conceptual Summation on Actor-collaboration in the Implementation of In-situ Slum Upgrading Project of Namuwongo

For a successful program of in-situ slum upgrading, essential collaboration among actors had to prevail. However, the linkage between the different actors was riddled with bottlenecks, primarily arising out of role overlaps and, at times, misinformation. This led to complaints of bribery, affordability concerns about the provided houses, and the selection of the wrong beneficiary households. In a way, the discontent arising from such lacuna, when unsatisfactorily handled, often led to households abandoning the project and relocating to recreate a slum in the nearby neighbourhood.

Generally, In-situ housing redevelopment may not be widely distinguished from other slum upgrading processes (Bolton, 2020). However, Turley, Saith, Bhan, Rehfuess, and Carter (2013) provide that, in its basic appreciation, In-situ housing redevelopment aids the improvement of an existing area, such as improving and installing basic infrastructure like water, sanitation and accessibility while incurring minimal relocations of households. Muchadenyika and Waiswa (2018) further indicate that the three (3) aspects of in-situ slum upgrade include policies, leadership and politics. Such variables manifest within governance context and actor interplay when deciding upon collective goals for the society and devising the mechanisms through which those goals can be attained.

An adequate understanding of the mobility trends of urban households, especially low-income ones, is essential for achieving success and fit-for-purpose in-situ upgrading programs. Low-income households in sub-Saharan Africa are commonly tied to their locations by the social capital accumulating over time (Limbumba, 2010; Mubiru, Nuhu, Kombe, & Mtwangi Limbumba, 2022). That is why any move to formal housing, much of which is being developed on the edges of cities, can potentially expose such households to new financial shocks, spatial dislocation, and the disruption of jobs and livelihoods (Williams, Charlton, Coelho, Mahadevia, & Meth, 2022). At the same time, given their socioeconomic status, low-income households have particular preferences to expect in availed housing. As Mubiru, Nuhu, Kombe, and Mtwangi Limbumba (2022) indicate, such households will pursue relocation when such preferences are met, primarily upon the influence of their social networks. Notably, once the social capital has adequately been accumulated, the households are expected to be largely immobile, with the rare relocations experienced in the immediate neighbourhood. Therefore, the different actors in the upgrading processes must appreciate the mobility dynamics and drivers of such households in the to-be upgraded slums through a participatory (Patel, 2013) and inclusive upgrading exercise. Once the concerned in-situ upgrading actors do not adequately handle the mobility dynamics, there is often a risk of the reoccurrence of slums near the upgraded projects.

In contributing to the slum mobility challenge, Badmos et al. (2020) suggest that while it is essential to curb slum growth, the approach utilised is crucial. They advocate the need for a system approach to sustainable development where slums are considered an integral part of the city. The projects should be particular on affecting the living standards and opportunities of the slum inhabitants and influencing and being influenced by the developmental perspectives of the cities and societies in which they occur.

Badmos et al. (2020) give reference to the theories on human mobility in slums, which can be summarised into four (4) clusters:

- "Movement of people from rural area to urban slums, work and then move to the outskirts of the city due to improvement in their socioeconomic status (upward housing mobility of migrants)

- Movement of people from rural areas to urban slums, work and then move to other slums due to inability to improve their socioeconomic status (slum as a sink)
- Movement of people from rural areas to urban slums, work and stay in the same slum all their lives (slum as final destination)
- Movement of people from rural area to urban slums, work and move back to the rural area."

Badmos et al. (2020) give interesting insights. It notes that although it would have been expected that migration to urban slums would follow the first theory, the shortage of affordable housing in developing country cities may permanently put many migrants in the same or similar slums, even if their income level increases. An example is given by Wesolowski et al. (2012), showing that slum dwellers in Nairobi move within the slums following the third theory, implying that slums are probably not a transition stage for prospective migrants but rather permanent throughout their lifetime.

Therefore, it is noteworthy that the existing literature, to an extent, highlights the mobility dynamics of slum-dwelling households. However, this paper extends this perspective by bringing to the fore how such mobility uniquenesses play out, fuelled by the different actors, especially amidst or subsequent to slum upgrading projects.

3. Methods

3.1 Study Design and Approach

A case study design was adopted for this study. According to Yin (1984), the case study research strategy is an empirical inquiry that examines a contemporary phenomenon within its aspects of real life, especially in circumstances when the boundaries between phenomenon and context are not clearly evident. Using a case study is derived from researchers' desire to understand the real-life phenomenon in-depth. Still, such understanding is incorporated with vital circumstantial conditioning exceedingly relevant to the study phenomenon.

The case study approach was deemed useful in allowing the researchers to undertake an in-depth assessment of the role of various actors in consciously or unconsciously influencing the housing location mobility of low-income households and the re-emergence of slums in the aftermath of In-situ housing redevelopment projects. This paper adopted a mixture of qualitative and quantitative approaches, though, to a more considerable degree, it was qualitative. Largely qualitative approaches like this one flourish when in-depth tales are needed to thoroughly understand a phenomenon (Krefting, 1991; Patton, 2015). This choice is important, especially when dealing with a population segment whose records are scanty, like the urban slum dwellers (Mubiru, Nuhu, Kombe, & Limbumba, 2022).

This paper's key units of analysis were the households that relocated to the neighbouring areas and recreated the slum after the Namuwongo in-situ slum upgrading exercise. The areas include Wabigalo, Railway reserves, Kisugu and Bukasa. Notably, evidence on mobility trends of low-income slum-dwelling households and how several actors inter-play in influencing slum re-emergence is scanty. Therefore, the Namuwongo settlement and its immediate neighbourhood were an ideal setting to gather evidence for an adequate understanding of the phenomenon.

The Namuwongo slum is one of the suburbs in Kampala that were highlighted as slum neighbourhoods of the city (Goodfellow, 2010). It is located in Makindye Division, one of the five administrative divisions of Kampala city. Lugogo borders it to the north, Nakawa to the northeast, Bugoloobi to the east, Muyenga to the southeast, Kabalagala to the south, Kibuli to the west and Kololo to the northwest. The neighbourhood is approximately 6 kilometres (3.7 mi) by road, southeast of the Kampala Central Business District. North of the railway line in Namuwongo sits a slum called Soweto comprising seven (7) zones: Industrial Area View, Go-Down, Kasanvu, Namuwongo B, Namuwongo A, Kanyogoga/ Masengere and Yoweri Kaguta (YOKA). The composition of households has a socioeconomic mix. The mix is because of the diverse locations and regions where several households migrated before settling in the case study area. Additionally, the households primarily undertake informal economic activities within the settlement and commute to the Kampala City centre.

3.2 Study Population and Sampling Procedures

The population in this study included slum dwellers in Namuwongo, specifically those residing in zones near the slum upgrading project area. Additionally, it engaged local council leaders of the area and key informants, including community-based organisations and practitioners like valuers and physical planners.

The Namuwongo Slum, according to UBOS (2014), has a population of 20,000 people. However, the researchers tracked back the population of Namuwongo Slum as it was in 1991. This enabled obtaining a realistic representation of the primary targets of the project in 1993 at its inception. Given the growth rate as indicated in Table 1, the population of Namuwongo as per computation in the year census 1991 at 3.2% was 18,773 people.

Table 1: Population Growth Rates 1969-2014

	Inter-censual Period		
Index of Population Growth	**1991 - 2002**	**2002 - 2014**	**1969 - 2014**
Inter-censual Population Increase (Millions)	7.5	10.2	24.9
Average Annual Increase ('000s)	686	850	553
Average Annual Growth Rate (percent)	3.20	3.03	2.88

Source: UBOS (2014)

Given the challenges in tracking the present locations of the targeted households and their mobility, we employed an exponential discriminative snowball sampling strategy. The exponential discriminative snowballing was also used because of limited data in the local community office. This was vital as it enabled the study to align with the aim by sieving participants from proposed referrals. When local community leaders lacked adequate data, they sought guidance from resourceful community members, especially the household heads who have stayed in the area since the upgrading project. After identifying a few participants through the local council leaders in the area, these led us to other relevant households. The eventual sample was determined by data saturation.

Unquestionably, the snowball strategy is associated with limitations regarding eventual representativeness and possible distortion in instances where the researcher delays engaging contacted respondents. That notwithstanding, this method has been tasted as relevant and dependable when it is impractical to compile a list of elements composing a population (Babbie, 2007). This sampling is also a widely used technique recommended for research

involving hard-to-reach populations (Van Meter, 1990). Therefore, the exponential discriminative snowballing strategy was used since there are no organised and reliable records on the current whereabouts of low-income households formerly targeted by the Namuwongo upgrading project to sample out using other techniques.

Upon realisation of the data saturation, the total sample size was realised to be 100 respondents. Sixty (60) respondents were slum dwellers who relocated after the upgrade. Furthermore, key informant respondents included ten (10) local area representatives, ten (10) programs technical staff and managers from community-based organisations, and five (5) and four (4) urban managers from the Ministry of Lands Housing and Urban Development and Kampala Capital City Authority respectively. Additionally, four (4) private urban land economists, four (4) private physical planners, and three (3) financial managers from the Housing Finance Bank were engaged.

The 60 slum dwellers and household heads were served with pre-elaborated questionnaires for those who were literate. The researchers administered the questions in an interview format for the illiterate respondents. Additionally, we obtained records of the household heads targeted by the 1993 project from the local council area offices. This helped sieve out only the relevant households by double-checking whether the upgrading project targeted them and later relocated thereafter. Furthermore, we interviewed forty (40) key informant respondents.

3.3 Data Analysis

During analysis, primary data was structured, coded and analysed using measures of central tendency like frequency and percentage. Qualitative data from interviews were analysed and presented in a descriptive form based on specific themes. Before that, with the respondents' consent, interviews were audio-recorded and later transcribed. Some responses were quoted verbatim in the descriptive analysis as care was taken not to lose the study's primary objective. To protect the confidentiality of the respondents, respondents were allocated pseudonyms.

4. Results and Discussion

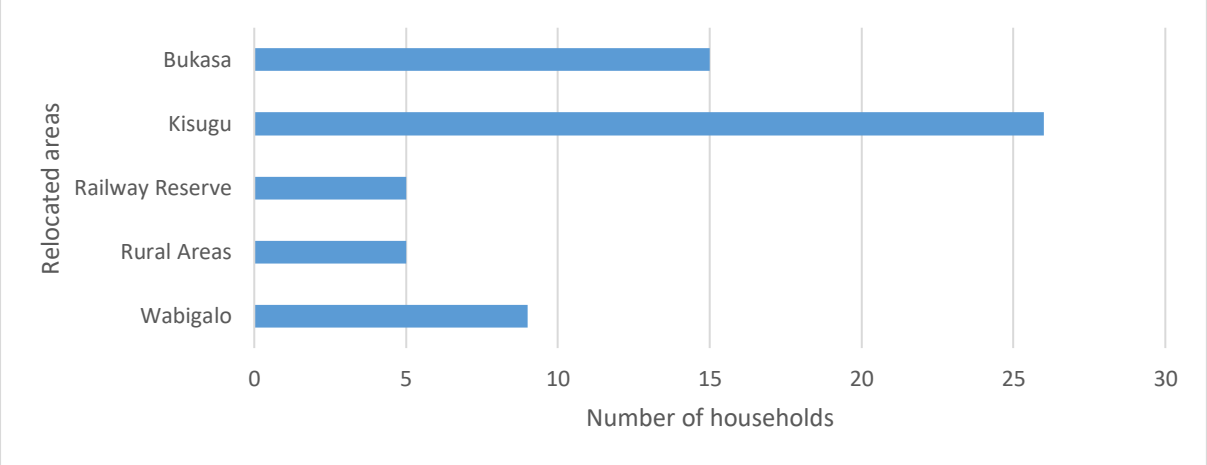
From the information gathered with the aid of both qualitative and quantitative processes, the influence of actors in the low-income household mobility and reoccurrence of the Namuwongo slum was exhibited through four thematic areas. These included tracking the residential mobility tendencies, fit-for-purposes of the upgrading programs/initiatives, actor coordination and the mismatch in expectation and preferences between the program actors and the low-income households.

4.1 Residential Mobility Tendencies of Low-income Households

A key intention of this paper was to understand the residential location history and dynamics of low-income slum-dwelling households. The residential mobility tendencies of the households in the case study area had socioeconomic connotations. Firstly, after gathering responses from the area's local leaders and the household heads, it was found that no traceable cultural roots link households' hereditary origins to the area. Approximately 85% of the respondent households reported having migrated to the area without a prior connection to a relative. Many prioritised the area as an easy link to access the Kampala central business district. Thus, the Namuwongo slum area, based on its proximity to the Kampala city centre, worked as a magnet for households from other areas within and outside the city.

After the slum upgrading project, many low-income households moved to other areas in the neighbourhood of the Namuwongo slum. The majority of the participants relocated to areas such as Kisugu. The households that previously stayed in Bukasa ranked second, and those that remained in Wabigalo ranked third (Figure 2). Some households had initially migrated from villages and settled in the case study area to obtain economic opportunities or upon marriage.

Figure 2: Areas to Which Households Relocated



Source: Primary Data, 2022

During one of the interview sessions, a local leader said:

> "Most of the people you are seeing here are new. Most of them came to work in Kampala and the industrial area. Namuwongo was a perfect area to reside since the rent is cheap and transport costs are low, and some of them even walk to work."

The above experience implies that the Namuwongo area acted as an affordable entry point for new urban low-income households migrating from the upcountry. Secondly, upon settlement in the area, gathering social networks and getting attached to economic livelihoods, households disliked long-distance relocations compliant with Gyimah (2001). With time, the initial settlers of the project area were later joined by squatters around the railway and migrants seeking better opportunities in the city but with insufficient funds to afford decent housing. The economic activities to attract new and existing dwellers were mainly in the nearby factories located in the zoned industrial area. The mobility trajectories of the slum-dwelling households were influenced in two main ways:

4.1.1 Residential Mobility due to Changes in Economic and Social Living Conditions

The participants indicated that the economic livelihood activities of the area were interrupted by the in-situ upgrading project. Initially, the small-scale businesses that households maintained within the project area had assured customers from within the settlement community. The desire to maintain such customers and networks has made many low-income households stay in the neighbourhood for a long time without long-distance relocations. However, experiences from the relocated household heads exhibited an effect of the relocations on the households' socioeconomic livelihoods. For instance, the upgrading project led many customers to abandon the project area and relocate to neighbouring areas. The households considered such customers vital for their businesses, which were situated within the settlement.

One household's head stated:

> "When my customers relocated, I was forced to relocate my shop to near where they went. Otherwise, my business was going to collapse. The occupants of the upgraded housing did not wish to buy my products; those who liked them had relocated."

Additionally, the drastic change in their standard of living led to complaints of their farming lifestyle being forced onto food buyers. As one of the household heads said:

> "We could not depend on Agriculture for survival anymore; our crops had been cut down after compensation; our option was to search for alternatives."

Another respondent indicated:

> "Most of the *Bataka* (landholders) left. The rich that moved here did not have any social relations with us. You can't even share a simple household item with them."

The preceding experiences imply that the actors in the in-situ upgrading exercise were unaware of the unique socioeconomic livelihoods of the low-income slum-dwelling households. At the same time, the steering committee members were strict on the drastic change in the livelihoods in the newly upgraded settlement, as a steering committee member said:

> "We sensitised those households to avoid operating activities like it was in the old slum environment. Some of them were uncomfortable with this, and they chose to relocate themselves, as they mostly used to act in clusters of peers."

Additionally, the responses signalled the presence of a web of local social networks among the settlement households, especially regarding the search for options to sustain their livelihoods. However, the in-situ project and its resultant displacement and relocation appeared to disentangle the social cohesion, disrupt their social capital, and disintegrate their social demographics as many of the new residents lived privately in enclosed residences. Additionally, the migrants into the project area were from different ethnicities, creating a cultural mix. These residents faced a tough decision to either stay in the project area, which they could not afford, or relocate to the nearby area, where some of their friends had moved to, which they did. Eventually, the pre-existing social networks shifted to the neighbouring areas, leading to the reoccurrence of the former Namuwongo slum.

4.1.1.1 Choosing to Shift vs Not to Shift from the Project Area

Choosing to shift or otherwise from the project area may have been deliberate, but in many instances, it was influenced by peer neighbourhood households. Based on the household responses, the respondents indicated that the majority of their peers decided to shift rather than remain in the project area. Upon inquiry as to why this was so, their responses ranged from challenges faced by the households to make down payment for the upgraded land/houses-occasionally attributed to their lack of stable household income, restrictive proposed housing structures and changes in the economic and social livelihood that made them feel as misfits.

Such experiences also signal the shortfalls by the implementing actors to appreciate the housing affordability dynamics of the slum dwellers and craft fit-for-purpose strategies to provide affordable yet adequate shelter options. The eventual shifts by the targeted households in relatively undeveloped neighbourhoods signalled the failure to fill such an affordability gap.

The gaps in harmonising affordability strategies to attain adequate housing while at the same time winning the goodwill of the intended recipients have been a concern in the literature. Generally, July, Rakhi, Maureen, Somik, and Akie (2005) argue that strategies to help the one billion people worldwide who live in slum settlements have mainly focused on slum upgrading. There has also been less attention on what enables slum dwellers to transition into the formal housing sector, focusing on affordability and flexible financing avenues. Such a scenario would have dual benefits of improving service access and escaping social stigma.

Other Scholars have discussed the contribution of the shortage of affordable housing and income levels to residential mobility tendencies of the slum dwellers under the first and third trajectories of residential mobility (Keunen & Ley, 2022; Yemmafouo, Ngouanet, Keumo Songong, Djikeng Teufack, & Djuidje, 2017). However, the mentality of slum dwellers needs to be at the centre of the discussion. Even though the city centre is the epitome of economic activity (Alonso, 1964; Dale, 2008), other aspects like household location in the periphery need to be sensitised to the slum dwellers by the responsible actors. This is where the Government actors' role in providing affordable and sustainable transport systems comes in, yet scholars have not thoroughly discussed this gap.

It is crucial to note that this discussion aligns with the housing redevelopment approach of slum upgrading. The success of such projects relies on monitoring, evaluation and implementation frameworks that are effective, participatory, transparent and integrated at all levels and, contrary to the above, lead to mobility of the inhabitants, leading to the recurrence of slums.

4.1.2 Influence of Household Social Networks

In executing their roles and ensuring that affordable and adequate housing options are provided to the slum dwellers with limited inconvenience, the actors had to be cognisant of the social milieu of the settlement households. The eventual household shifts to the neighbourhood signalled this was not adequately complied with. The social networks among the low-income slum dwellers played a fundamental role in the household mobility and eventual re-emergence of the Namuwongo slum. Kapoor, Lall, Lundberg, and Shalizi (2004) highlight that the choice of residential location by slum dwellers is bent on staying close to those sharing common socio-demographic characteristics such as language and religion, among others. This trait was exhibited in the project-affected persons of the Namuwongo slum. They occasionally indicated that they got information from relatives and family about the new area. Such dwellers, thus, sought shelter where rent and land (Kibanja) were relatively cheaper and where no restrictions were put on the nature of construction. One of the household heads said:

> "I was given shelter by the friend of my late husband here in Kasanvu. They later sold me the portion I had occupied and allowed me to pay in instalments."

The preceding experience implies that relocation and eventually reconstructing a new slum was the viable alternative. Most low-income households, "meant-to-be beneficiaries", could not afford to stay within the project area because of the seemingly unfavourable conditions. They

thus sought comfort in the areas their peers had migrated to. This experience resonates with what one of the local leaders said:

> "Most of these households are connected by friends, relatives or/and tribemates. So once one of them makes a decision, they likely convince the others to follow."

Also, as noted by Badmos et al. (2020), the location of a slum may also be a function of tribal affiliation and family linkage. Such assertion complies with an earlier observation by Mayaki (2013) that migrants prefer to settle in neighbourhoods with similar socio-cultural backgrounds. This, therefore, makes it essential for slum upgrading actors to be sensitive to the socio-cultural dynamics of the dwellers before proceeding with any initiatives that directly affect such households.

4.2 Fit-for-Purposeness of the Upgrading Programs/Initiatives

4.2.1 Communication on the Procedures for Plot Allocations to Households

It was necessary for adequate information flow and communication to ensure that the project beneficiaries appreciated the actors' intentions in the process. Several responses from household respondents echoed the inadequate communication flows. For instance, several households were unaware that they could actually apply for land parcels if they had the potential to make such payments. Some mentioned that they learnt later on that they were the primary beneficiaries since they were residents of Namuwongo as one of them said:

> "For us, we thought our landlords were the ones supposed to apply."

Another one also said:

> "But even if I had known that tenants were also beneficiaries, I did not have money to make the deposit payment."

Furthermore, a participant from the Ministry of Lands Housing and Urban Development indicated inadequate sensitisation to emphasise the benefits of tenure and how to handle the available financing options.

That implies that the ineffective enlightenment on the criteria for plot formalisation and housing acquisition to the targeted communities created a distance between the low-income dwellers who perceived the project as 'not theirs' and the inadequate research to establish the most appropriate financing options that would enable house acquisition in the upgraded project housing.

4.2.2 Perception Regarding Proposed Housing Structures

The inadequate sensitisation by the actors and limited participation from the household level bred a perception of a non-compliant and seemingly non-affordable housing solution. Eventually, the household responses indicated shortcomings of the housing appropriateness to the dwellers' expected preferences, and the conditions for the housing access created the households' unwarranted dislike of the upgrading project. By setting house acquisition conditions that some low-income dwellers viewed as segregative, the respondents classified

this as a strategy to displace them from the project area. At the same time, the project implementers, in liaison with the local leaders, packaged this as a forceful affair with limited inclusivity. For instance, there was fear created by the threatening letters received from the steering committee. The threats concerned the reallocation of plots allotted to some of the dwellers due to non-compliance to the covenants of the 5-year grace period, technically known as the initial term of the lease. That made even some of the dwellers who had picked up the proposal of plot acquisition backtrack on the idea as their income stability to afford instalments was not guaranteed. Eventually, this period influenced the decision of the respondents to either stay within the project area or relocate to affordable and more comfortable options. The targeted beneficiaries indicated they had to relocate after the grace period due to failure to develop the allotted plots. They lacked funds to construct according to proposed housing standards. A participant said:

> "My husband had died, I had the responsibility of taking care of our children, I couldn't afford the program because I didn't have money, so I couldn't comply to the grace period of 5 years."

Another lady said:

> "My father had given me where to stay and unfortunately later died, but only my brothers were given plots because they were in a position to pay, and yet I also had a share on my father's land."

At times, with threats of losing entirely on the funds injected so far and yet being unable to complete as per the leasing agreements, some allottees were sold out of goodwill and bought elsewhere. A respondent said:

> "Failure to comply with requirements led to the cancellation of a beneficiary and no money was refunded in case things turned out like that. Also, we could not petition the LC1 because we feared that the committee had the final say in deciding the matters regarding the project."

Therefore, some dwellers were made to sell their allocated plots with the narrative that they had invested in so little "application fee". Thus, if anyone was willing to pay the down payment and also pay the beneficiary for the parcel allotted to them, it was a start elsewhere in an affordable environment with perpetual interest, unlike leasehold, which necessitated annual payment.

4.3 Collaboration Among Key Slum Upgrading Actors

The in-situ upgrading of the Namuwongo slum necessitated the collaboration of several actors at different levels. Some key actors included Landholders of other interests, Local area leadership, Policy makers at the Ministry of Lands Housing and Urban Development, the Housing Finance Bank that financed the process and the local steering committee. The different actors needed to execute their roles openly, well-coordinated, and inclusively to achieve the targeted users' success and sense of ownership. However, efficient collaboration between the actors was vital if the intended objectives of the upgrading scheme were to be achieved.

4.3.1 The Steering Committee

Muchadenyika and Waiswa (2018) assert that the three (3) aspects of slum upgrade include policies, leadership and politics. Such aspects manifest within a governance context involving

deciding upon collective goals for the society and devising the mechanisms through which those goals can be attained.

Regarding leadership, politics and policies, the respondents reported that a steering committee responsible for allocating the plots was created for the smooth running of the project. Responses indicate further that during the vetting process, applicants aged 18 and above who were judged to be of good standing were interviewed by the steering committee before plot allocation. The committee team were expected to know the financial capability of applicants. This due diligence was done through the local area representatives on the committee, who were expected to possess adequate knowledge of their residents. However, the majority of respondents expressed their reservations regarding the due diligence process that was undertaken. They dejectedly announced that their applications were excluded because they did not have the potential to afford the program. Hence, the facts gathered were deemed not to reflect the socioeconomic attributes of the targeted beneficiaries.

Furthermore, the participants were asked who was given priority by the committee for plot allocation during the vetting process. They indicated that the Private Mailo owners with titles on the land to be used for redevelopment ranked first. It was presumed that their acceptance determined the success of the project. The sitting tenants/ Kibanja that had improvements on the land were considered second. Then, non-resident Government officials and tenants with income capability were considered last.

The researchers, however, established that approval of a beneficiary was on condition that a deposit had been made to Housing Finance Company. Incidentally, most residents, referred to as *"farmers"* by most respondents (about 70%), claimed not to have the capacity to pay the deposit payment *(omusingo)*. Therefore, such households only paid the application form's fee and later sold to well-to-do non-resident individuals who supposedly could make the deposit payment. However, if many of the low-income slum dwellers had been involved in the planning and questioned about their preferences, most suggested other approaches. One of the respondents expressed that:

> "They would have relocated us to another neighbourhood and let us come back when they have developed this place with low-cost houses like what they had promised, and we would have been able to pay little rent for the period that would have been stated."

Such a disconnect between the implementer's priorities and the users' expectations arose from inadequate actor coordination and participation. For a better actor collaboration, Reddel and Woolcock (2004) and Goetz and Jenkins (2001) associate the success of national policies with how Central Governments effectively engage other stakeholders. Such stakeholders like authorities, civil society, communities, and the private sector can assist in monitoring, evaluating, and implementing efforts and bridge the gap between people's needs and national policy setting.

The laxity in the actors' execution of roles was also manifested through the lack of trust arising from the bribery allegations levelled by the beneficiaries. Trust concerns affected the steering committee's credibility. One of the respondents expressed that:

> "For us, we noticed that most of the project awardees were not indigenous people, and also the leaders in the project were seen to own more than one plot after implementation."

Another said:

> "The communication was not effective. I used to hear most of the information through rumours, and also, some officials prioritised personal interests during the allocation of plots."

Such revelations, therefore, signal a gap in the program's implementation by the responsible actors. Trust issues and a combined disconnect of actors often lead targeted beneficiaries to harbour attitudes of exclusion from well-meaning projects. Such sentiments are shared by Danso-Wiredu and Midheme (2017), who have experience in Ghana and Kenya. The end result of such sentiments, if not curtailed, is the decision of the low-income households to relocate to other areas where they re-manufacture the slum neighbourhoods.

Further concerns from the respondents also related to some of the unfinished project roads, yet this was one of the outputs of the upgrading process. Additionally, concerns like inadequate community participation in creating the project design (Davidson, Johnson, Lizarralde, Dikmen, & Sliwinski, 2007), explain why there is currently mixed-up development as the community did not agree to the building standards proposed. Issues pointed out about the allocation process, which was termed as biased and unfair to the underprivileged residents in the community, clearly highlight the residential mobility of the beneficiaries of the slum upgrading project, which drove them to the creation of another slum.

The concerns raised by the poor households are buttressed by Kanji, Cotula, Hilhorst, Toulmin, and Witten (2005), who highlight that the poorer groups are consequently excluded if the costs have to be borne by those seeking formal title. This is factual as the respondents emphasised that they didn't seek financial support from the project finance manager despite their knowledge of the criteria. Such reservation was because of the perceived complexity of the requirements necessary for acquiring financial assistance, including the local council letter, an account with HFB, proof of allocation, a mortgage form, proof of an income source and a letter of approval from the steering committee. The steering committee team exploited such red tape to allocate to people who wouldn't have passed the criteria yet, leaving out the targeted households.

5. Conclusion

This paper has laid bare the role which the omissions and/or commissions of the various actors in the in-situ slum upgrading processes play in influencing the low-income household mobility and reoccurrence of the Namuwongo slum in Kampala city. Such connection was linked through three thematic areas. These included tracking the residential mobility tendencies, fit-for-purposes of the upgrading programs/initiatives, and the actual actor collaboration in the execution of their duties. It was observed that the low-income slum dwellers of Namuwongo exhibited unique socially connected attributes that influenced their lifestyles and the economic activities they pursued. Such attributes led to the nature of their short-distance neighbourhood mobility. That, combined with the inadequate sensitisation by the implementing actors of the project, created a sense of mismatch in expectations from the initiatives. This would have been sorted through the adequate coordination of actors. Still, at times, the actors collided, and the coordination often had shortfalls that, in a way, affected the efficient delivery of the in-situ upgrading idea.

Despite the access to land initiatives and economic and social livelihood restoration associated with in-situ upgrading, several bottlenecks were notable. Notably, the residential mobility

tendencies of low-income households in the Namuwongo neighbourhood slum are generally related to the responsible actors' inadequate social integration for inclusive planning. Such detachment land lack of inter-actor coordination resulted in some social groups and weaker community sections being planned for without adequate identification; the planning actors did not sufficiently understand their characteristics. Eventually, their concerns and needs were not properly focused and aligned with the preferences and requirements of the target beneficiaries. As a result, low-income slum dwellers tend to move to places equivalent to their previous status quo. They (including some project beneficiaries) thus were influenced by their local social networks to relocate and resettle in what they considered more affordable land in the immediate neighbourhood of Namuwongo.

The findings of this research are likely to guide the key aspects in the in-situ slum upgrading processes in sub-Saharan Africa and generally in the global south cities. Aspects such as social networks and the unique socioeconomic attributes of low-income households are vital in influencing the households' urban mobility. If considered by the implementing actors, these can enable fit-for-purpose in-situ slum upgrading exercises.

It is crucial, thus, to note that until the existing land and housing policies are fine-tuned to enhance the elimination barriers for low-income households, the twin global objectives of upgrading slums and preventing the upspringing of new ones from resonating to recurrence will be more challenging to realise. Therefore, in the policy formulation process, there is a necessity for exhaustive consultation from the analysts, technocrats, and other stakeholders before these decisions are made. Such would ensure harmony and proper coordination during implementation. Furthermore, coordinating actors/stakeholders while implementing the In-situ housing redevelopment approach to slum upgrading is vital. This would help any community accept the program proposed as miscommunication and ignorance, amongst other factors, prompt their mobility tendencies, which may sometimes be involuntary.

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Housing Satisfaction Among International Students in Hong Kong

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Abstract

Housing is one of the critical components that support human existence. However, access to housing is one of the challenges faced by international students. In an expensive city such as Hong Kong, this issue is exacerbated by high rental costs and a limited supply of on-campus hostel facilities. Therefore, this study examines housing satisfaction among international students studying at Hong Kong's universities, located in one of the most expensive cities in the world. Using the snowball sampling technique, data was collected from seventy-four international students of six nationalities studying at four universities in Hong Kong. Frequency distribution, mean score (MS) ranking and Chi-Square were adopted for the data analysis. The results show that 64% of the research participants reside off-campus, while the rest reside on campus. Furthermore, a majority of the respondents strongly agreed that the support from the universities for international students, in terms of scholarships and financial support to access housing first-year students, is critical. The international students opined that the universities could provide more financial assistance and accommodation support to meet rising housing costs. The Chi-square test results indicate a significant relationship between the type of accommodation and overall satisfaction with accommodation and a substantial relationship between the age of the respondents and their choice to retain their accommodation. This study has some far-reaching implications for Hong Kong universities as they need to revisit the issue of accommodation and support provided to international

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students. Furthermore, there needs to be a consideration in increasing the student housing stock to assist international students.

Keywords: *students, student housing, housing satisfaction, Hong Kong, international students*

1. Introduction

Globalisation, advancement in air travel and access to world-class university education have led to the emergence of international students. These international students attend universities outside their country of origin/birth (Parameswaran & Bowers, 2014). Usually, they need to adapt to their new environment during their study periods (Obeng-Odoom, 2012). In such situations, international students would need to secure accommodation, which could be either on-campus or off-campus. Consequently, when a university does not provide sufficient bed spaces or housing facilities on campus to cater for its students, some or most students will have to source for accommodation in the local property markets around the university (Chang, 2017; Gbadegesin et al., 2022). This suggests that such students would have to compete with other home seekers (the general public) in the open property market. Hence, students studying in expensive cities face difficulty in getting affordable accommodation.

One case is Hong Kong, which is acclaimed to be among the world's most expensive cities (Castro Campos et al., 2016; Chang, 2017; World Economic Forum, 2021), with an informal housing market marked by small-sized sub-divided units (Leung et al., 2022). Hong Kong's expensive housing market presents a dilemma for international students since studies have shown that there exists a relationship between students' housing satisfaction and their academic performance (Najib et al., 2011; Parameswaran & Bowers, 2014; Sawyerr & Yusof, 2013). Furthermore, student housing provides an avenue for fostering positive and beneficial intercultural relationships, which help international students in overcoming learning barriers (Ong et al., 2022). Furthermore, a growing number of international students enrol in institutions funded by the University Grants Committee (UGC) (Textor, 2021; University Grants Committee, 2022). This calls for an examination of student housing choices and satisfaction with those choices. Hence, this study investigates the housing satisfaction of international students enrolled in Hong Kong's universities and examines the relationship between their socio-characteristics and satisfaction.

The role of student housing in enhancing student satisfaction and academic attainment has received significant research attention. Governments, national and local, and higher institutions of learning who understand the critical role of student accommodation keep watchful eyes on demand and supply dynamics within the sector and invest appropriately to ensure students' learning progress is not hampered (Christie et al., 2002). And the reasons are not far-fetched. First, increased student satisfaction and academic attainment will continue to portray the affected institutions in a good light to potential applicants, thereby attracting more students (Roche et al., 2010). Second, students also play a vital role in boosting the local economy of the cities where their institutions are based as workers and spenders, some of whom settle and develop a career in the same areas (Munro et al., 2009).

Essentially, students constitute a valuable economic base that needs to be keenly monitored given the effects changes in student population, composition, and quality might have on local economies. The influences of international students on local economies are even more pronounced and remain a topical issue in housing studies and other related fields. By investigating housing satisfaction with accommodation among international students from two continents, this study makes a novel and significant contribution to the existing body of literature, which would be useful in shaping university and city-level policies in Hong Kong.

The findings from this study align with other studies on student housing (Najib et al., 2011; Parameswaran and Bowers, 2014; and Sawyerr and Yusof, 2013) to offer a reference on the perception of international students on the relationship between their housing and particular aspect of their studentship, which includes academic performance, and this may be vital to tackling dissatisfaction among students, especially, those of non-Chinese backgrounds.

The remaining part of the paper is structured as follows. The review of relevant literature is presented in the following section, followed by the research methodology in the third section. The discussion of findings is presented in the fourth section, followed by conclusions in the last section.

2. Literature Review

On-campus and purpose-built student accommodation in universities can be a source of positive intercultural relationships and social interaction for non-local students (Paltridge et al., 2010; Ong et al., 2022). However, this type of student housing is usually expensive and unaffordable for students, even those on scholarship; they are also not designed to meet the needs of students with families (Ruming & Dowling, 2017). Furthermore, there is growing evidence that universities admit more students than their teaching and residential space capacities (Gbadegesin et al., 2022). In some countries, university executives see student housing as a marginal issue that should not be the priority of their universities (Parameswaran & Bowers, 2014). Hence, students have chosen to seek residence in the private rental market (Morris et al., 2021; Gbadegesin et al., 2022; Zasina & Antczak, 2021). Nevertheless, even with these gaps that have pushed students into the private market for accommodation, studies (e.g., Laidley, 2014; Prada-Trigo et al., 2020; Revington et al., 2020; Ruming & Dowling, 2017) have reported that students are negatively looked upon as gentrifiers and are constituting a significant source of neighbourhood decline, crime, and rising housing costs.

Housing satisfaction is relative and difficult to measure (Waziri et al., 2014). Still, it tends to be a function of factors such as social and cultural background, financial situation, expectations, and characteristics of a building or a dwelling (Gbadegesin et al., 2022). It is generally evaluated by comparing people's expectations and the actual conditions of their housing (Thomsen & Eikemo, 2010). Najib et al. (2011) reported that students in research universities in Malaysia were satisfied with their housing facilities. The study suggested a correlation between student satisfaction with housing facilities and staying until completion of their program, with satisfied students indicating a desire to maintain residence in the housing facilities until graduation.

The housing satisfaction of students is an essential theme in housing studies. However, several global studies on the housing satisfaction of students focus on on-campus accommodation (see Adewunmi et al., 2011; Amole, 2009; Najib et al., 2011; Nazarpour & Norouzian-Maleki, 2021; Oke et al., 2017; Sawyerr & Yusof, 2013; Xu et al., 2020), with only a few focusing on satisfaction in off-campus student housing (Zasina & Antczak, 2021). Yet, since it has been established that on-campus accommodation facilities are limited, off-campus housing seems to be the principal accommodation source for students (Chang, 2017; Chang, 2018).

Zasina and Antczak (2021) revealed that most student respondents in Lodz, Poland, and Turin, Italy, were satisfied with their off-campus private accommodation. However, in terms of neighbourhood attributes, many respondents were neither satisfied nor dissatisfied with the proximity to their workplace, music or dance clubs, cultural facilities, sports facilities, and neighbourhood student atmosphere. The study revealed increased satisfaction levels when the students' accommodation is affordable, in a pleasant-looking building, and in a neighbourhood accessible by public transportation and with a student atmosphere. In the

study conducted by Thomsen and Eikemo (2010), the type of tenancy/ownership, quality of housing characteristics and location were reported as the most important determinants of student residential satisfaction. Conversely, individual facilities and demographic variables did not significantly affect housing satisfaction (Thomsen & Eikemo, 2010).

In Hong Kong, sourcing for student housing is a herculean task due to information and cost-related barriers (Chang, 2018). Chang (2017) argues that despite the limited housing facilities in Hong Kong universities, which have made many students seek accommodation off-campus, the universities are incentivised to keep admitting more international students as international students pay more than local students. Through a survey of 2000 respondents representing Chinese mainland students studying in four Hong Kong universities connected by the east rail line, Chang (2017) found that the primary factors influencing the housing choices of the respondents are accessibility of public transportation, distance to university, rent affordability and living environment. The study highlighted that female respondents also gave huge consideration to safety. Over 50 per cent of the students indicated that their accommodation is sourced through social networks (friends or relatives). The study revealed that the students lived in a clustered pattern and shared accommodation to reduce the cost of renting. Ultimately, the housing may be of less satisfaction for the students.

Chang (2018) surveyed the opinions of 1,120 Chinese mainland students studying at four UGC-funded Hong Kong universities. The east rail line connects the universities under focus in this study. The study found that the students who used housing agents to find a house were able to view more houses and spent less time searching when compared to those who relied on social media to search for houses. The study revealed that social networks (friends or relatives) were the most significant housing information source. They significantly enhanced the residential satisfaction of the students who leveraged such networks. On the other hand, social media (WeChat and Internet) provided comparatively low benefits for students searching for housing. Meanwhile, housing agents who provided access to more housing were of little benefit to the students due to the service cost.

Previous students' housing satisfaction studies (Chang, 2017; Chang, 2018; Ong et al., 2022) among non-local students in Hong Kong have only considered the views of students from mainland China. However, Hong Kong universities are home to thousands of students of different nationalities (Textor, 2021; University Grants Committee, 2022). Therefore, a gap exists in investigating international students' satisfaction with the housing options available to them since there is a link between housing satisfaction and academic performance. Hence, this study will consider the affordability and satisfaction of international students of different nationalities with their housing choices.

3. Research Methodology

A quantitative research approach was adopted for this study, being the most suitable approach to address the set aim of investigating the housing satisfaction of international students in Hong Kong, and also because of the relatively large target population of research participants (Easterbrook et al., 2008). An online questionnaire was designed using the University of New South Wales Sydney Qualtrics platform to collect data from the targeted respondents. This approach was considered appropriate because a wider coverage of the respondents can be reached simultaneously, and the data collected would be error-free to a large extent, thereby enhancing data reliability (Dix & Anderson, 2000). This data collection approach is common in the literature (Abidoye et al., 2019; Ameyaw & Chan, 2015; Oyedokun et al., 2021). The questionnaire contained four sections. Section 1 focused on the respondents' personal characteristics, while Section 2 included questions about the respondents' academic

information, followed by questions about respondents' housing in Section 3. Statements regarding the respondents' housing satisfaction were presented in Section 4, in which they were asked to indicate their level of agreement with each statement on a five-point Likert scale that ranged from strongly disagree (1) to strongly agree (5).

The respondents of this research are international students studying at universities in Hong Kong who were reached via their respective student associations. The link to the online questionnaire was sent to all registered members (students) of the associations by the individual executives of the associations. Adopting a snowball sampling approach, each student who got the link for the questionnaire was requested to share it with other students from their home country who may not be a member of the association. The data collection period was three months, and two reminders were sent during this period to increase the response rate. At the end of the data collection period, 82 responses were received. However, only 74 responses were completed adequately and deemed valid for subsequent analysis. A sample size greater than 30 respondents can be considered adequate for statistical analysis since the size of the data meets the requirement of the central limit theorem (i.e., at least 30) (see Islam, 2018). The 74 responses were, therefore, deemed sufficient for the data analysis and the findings that were made hereafter. Furthermore, Adewunmi et al. (2011) and Bianchi (2013) are previous studies that surveyed a smaller sample size (54 and 34 participants, respectively), which further demonstrates the adequacy of the sample size for this study. Figure 1 shows a brief description of the research process.

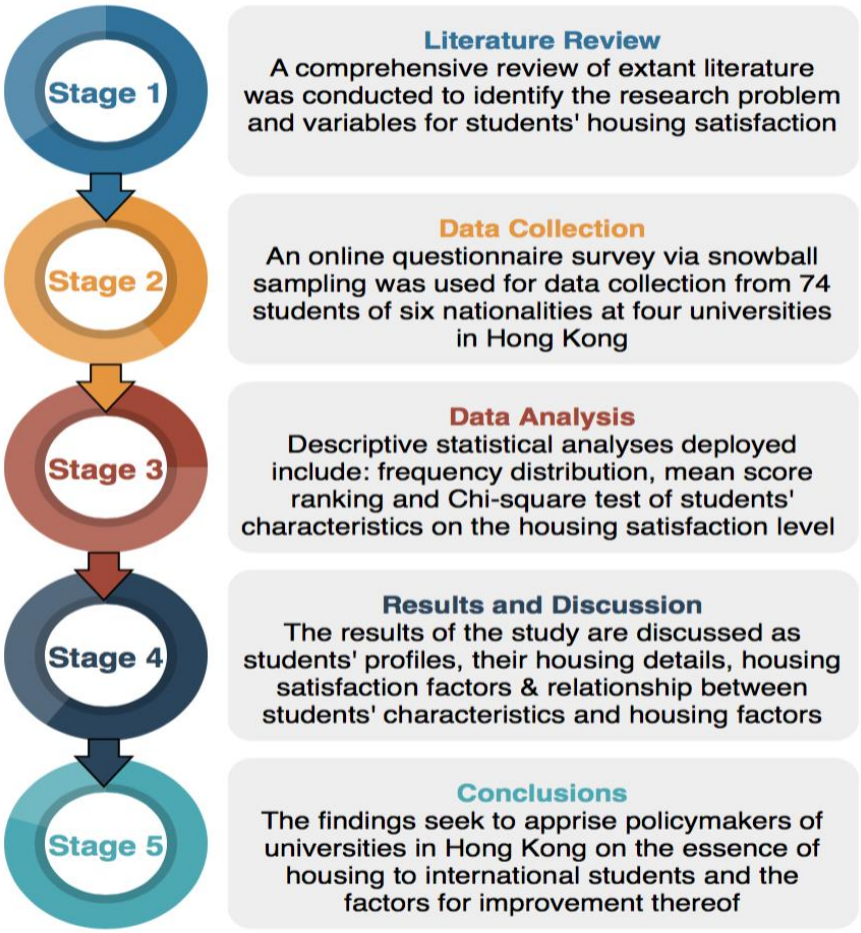

Figure 1: Research Process on International Students' Housing Satisfaction

The preliminary data showing the students' profile, demographics and housing details were analysed using descriptive statistics. In contrast, the satisfaction factors and indicators were analysed using mean score (MS) ranking and percentages of responses provided. A similar approach has been adopted in previous studies (see Najib et al., 2011; Sawyerr & Yusof, 2013; Adewunmi et al., 2017; Poon, 2019). In analysing the MS, any score between 4.00 and 5.00 is deemed highly important, an MS between 3.50 and 3.99 is deemed important, and scores below 3.50 are considered unimportant (Oyedokun et al., 2021). In addition, the Chi-square (X^2) test was conducted to examine the statistical relationship that exists between selected student characteristics and student housing factors, i) the possibility of retaining their current accommodation next academic session, ii) the possibility of recommending their current accommodation to their friends and iii) overall satisfaction with their current accommodation.

A similar approach was adopted in previous studies (see Jiboye, 2012; Abidoye and Chan, 2017). In interpreting the Chi-Square test results, the level of significance considered was 0.05 and 0.1 significance levels (see Lájer, 2007; Yenigün et al., 2011). The Cronbach's alpha test was conducted to test the data's internal consistency and reliability (Tavakol & Dennick, 2011). The alpha value ranges between 0 and 1; the closer the alpha value is to 1, the more reliable and consistent the collected data (Hair et al., 2010; Nunnally & Bernstein, 1978). For this study, a Cronbach alpha value of 0.720 was obtained, which connotes an acceptable internal consistency and reliability of the collected data. The entire data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) software (version 25.0).

4. Results and Discussion

4.1 Respondents' Profile

The demographic information of the respondents is presented in Table 1. It can be concluded that most of the students are males. The majority of the students are between the ages of 26 and 30. The respondents were students at The Hong Kong Polytechnic University, City University of Hong Kong, Chinese University of Hong Kong and Hong Kong University of Science and Technology. The location of these universities is depicted in Figure 2. The majority of the respondents are students at the Hong Kong Polytechnic University.

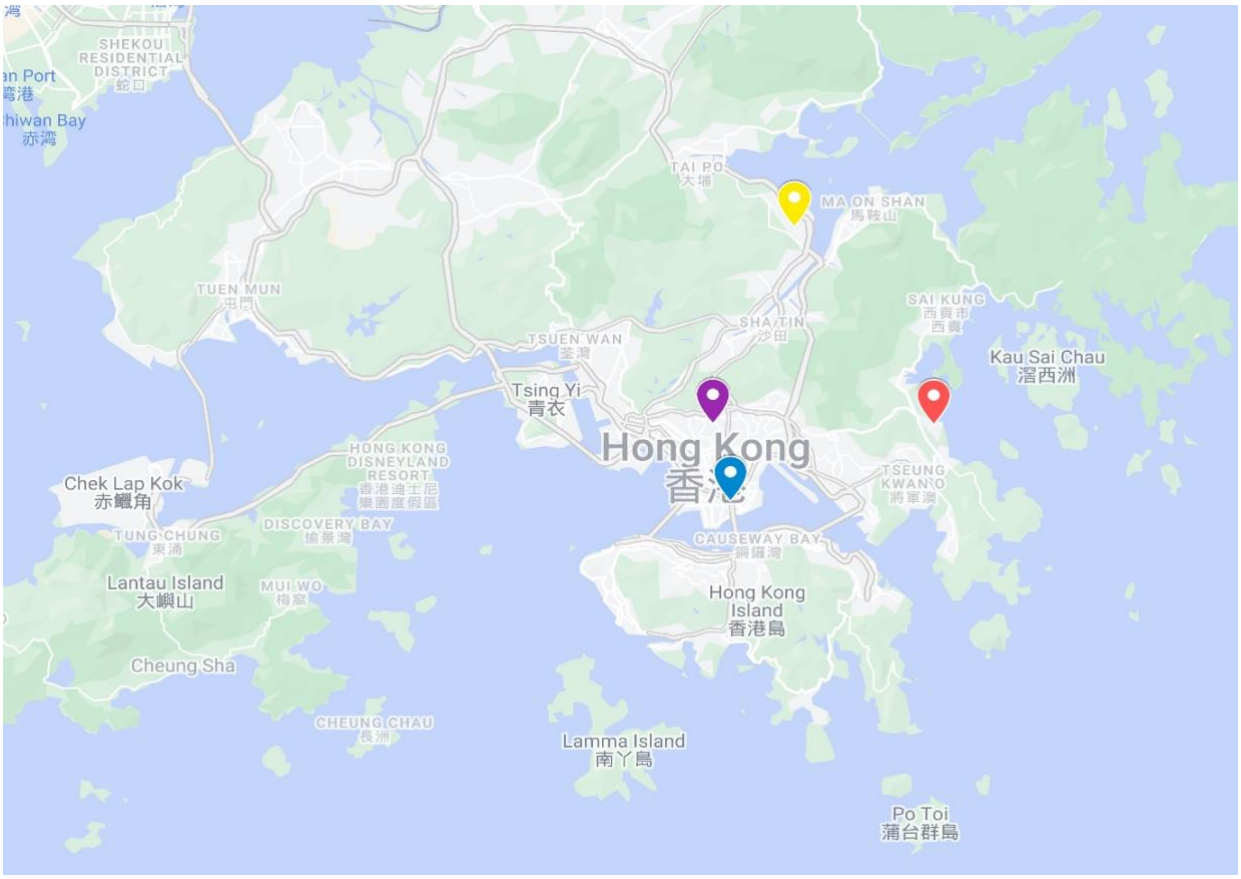

Figure 2: Map of Hong Kong with the Universities of the Surveyed Students
Source: Google Maps

Legend*:* The *yellow pin represents The Chinese University of Hong Kong; the purple pin represents the City University of Hong Kong; the red pin represents the Hong Kong University of Science and Technology; the blue pin represents The Hong Kong Polytechnic University*

Most of the respondents are studying for a PhD degree. Furthermore, most of the respondents are on full scholarships, while the remaining few who may be self-funded receive some form of support from their respective universities. The monthly stipend of the respondents is between 15,001 and 20,000 (HKD)[2]. The students who responded to the survey are nationals of the following countries: Bangladesh, Ghana, Kenya, Nigeria, Pakistan, and Palestine, with the majority being Nigerians. The nationalities of the respondents differ from the studies of Chang (2017), Chang (2018), and Ong et al. (2022), who only considered respondents from mainland China for their study on student housing in Hong Kong. This study, therefore, benefits from international perspectives through the participation of several nationalities across two continents, Africa and Asia.

[2] Rate on March 13, 2023: 1 USD = 7.845 HKD. Source: www. xe.com

Table 1: Students' Demographics

Characteristics	Response (*n*=74)
Gender	
Male	65/74
Female	9/74
Age	
18 – 25	3/74
26 – 30	43/74
31 – 35	27/74
36 – 40	1/74
University of Respondents	
The Hong Kong Polytechnic University	35/74
City University of Hong Kong	29/74
Chinese University of Hong Kong	2/74
Hong Kong University of Science and Technology	8/74
Level of study	
Undergraduate	1/74
Masters	1/74
MPhil	4/74
PhD	68/74
Mode of finance	
Scholarship	68/74
Self-funded	0/74
Both	6/74
Country of origin	
Bangladesh	4/74
Ghana	16/74
Kenya	5/74
Nigeria	36/74
Pakistan	10/74
Palestine	3/74
Monthly stipend or allowance (HKD)	
10,000 – 15,000	10/74
15,001 – 20,000	64/74

Note: HKD means Hong Kong Dollars, which is the legal tender in Hong Kong

4.2 Students' Housing Details

The information about the students' housing details is presented in Table 2. It was found that 64% of the students live in off-campus accommodation. The probable reason could be that the hostel accommodation available at each university is insufficient for all the students. The inadequate on-campus accommodation and the high number of international students residing in off-campus accommodation align with the observations of studies by Chang (2017) and Chang (2018), which show that off-campus accommodation is most popular among Chinese students in Hong Kong. Forty-three percent of the students secured their current accommodation through estate agents, which indicates that the students competed for their accommodation spaces in open market situations in the world's most expensive city. This mode of securing accommodation by international students differs from that of Chinese students. According to Chang (2018), Chinese students rely on social networks and

relationships to secure their accommodation. This could be attributed to the close culture and cultural similarity shared between Hong Kong and Mainland China (Brown & Wang, 2015), implying that Chinese students, irrespective of their non-local status, have strong ties to the Hong Kong community.

About 78% pay between 3,000 and 5,000 (HKD) per month as their rent. This rent range is somewhat similar to the sum paid by Chinese students (an average of 4,000 HKD) (Chang, 2017). Most respondents stated that the commute distance between their current accommodation and universities is about 15 minutes. Moreover, this is the same time it takes most students to get to the nearest transport facility and shopping centre.

Table 2: Students' Housing Details

Characteristics	**Response (*n*=74)**
Accommodation type	
On-campus	27/74
Off-campus	47/74
Source of the accommodation	
Through an agent	35/74
Through a friend	12/74
Through the university	27/74
Rent/month (HKD)	
2,000 – 3,000	16/74
3,001 – 4,000	19/74
4,001 – 5,000	19/74
More than 5,000	20/74
Travel time to university	
Less than 15mins	55/74
16 – 30 mins	15/74
31 – 60 mins	3/74
Over 1 hour	1/74
Travel time to the nearest transport facility	
Less than 15mins	67/74
16 – 30 mins	7/74
Travel time to the nearest shopping centre	
Less than 15mins	64/74
16 – 30 mins	10/74

4.3 Housing Satisfaction Factors

The mean score represents the housing factors that are most important to the respondents. Based on the MS presented in Table 3, the most important factors for international students are factors of support and financial assistance provided to international students to secure accommodation by the universities. The highest-ranked statement is that *the universities should provide more assistance to first-year international students*, yielding an MS of 4.74, which falls within the 'strongly agree' region. The second-ranked statement that *scholarship awarding authorities should provide more financial allowance for accommodation* has an MS of 4.69. In contrast, the third-ranked statement, an *acknowledgement that the universities were helpful to international first-year students to secure accommodation*, yielded an MS of 4.24.

The factors that were least important to the international students were the impact of travel time on the productivity of the students, the conduciveness of their accommodation to studying and the ease of securing accommodation off-campus.

Table 3: Students' Housing Satisfaction

Statements	SD	D	I	A	SA	Mean Score	Standard Deviation	Rank
The universities should provide more assistance to international students in their first-year	0 (0%)	1 (1.4%)	5 (6.8%)	6 (8.1%)	62 (83.8%)	4.74	0.642	1st
Scholarship awarding authorities should provide more allowance for accommodation	0 (0%)	0 (0%)	8 (10.8%)	7 (9.5%)	59 (79.7%)	4.69	0.661	2nd
The university authority helped secure accommodation in my first year	3 (4.1%)	3 (4.1%)	7 (9.5%)	21 (28.4%)	40 (54.1%)	4.24	1.057	3rd
I will complete my study within the expected study period	0 (0%)	5 (6.8%)	10 (13.5%)	25 (33.8%)	34 (45.9%)	4.19	0.917	4th
I am making progress in my study	0 (0%)	4 (5.4%)	7 (9.5%)	43 (58.1%)	20 (27.0%)	4.07	0.764	5th
The nature of my accommodation has a direct impact on my research/academic performance	1 (1.4%)	0 (0%)	31 (41.9%)	14 (18.9%)	28 (37.8%)	3.92	0.962	6th
I will recommend my apartment to friends	4 (5.4%)	8 (10.8%)	19 (25.7%)	31 (41.9%)	12 (16.2%)	3.53	1.063	7th
My accommodation is affordable	6 (8.1%)	13 (17.6%)	12 (16.2%)	32 (43.2%)	11 (14.9%)	3.39	1.18	8th
Overall, I am satisfied with my apartment in terms of price, location, space and distance to the university	12 (16.2%)	9 (12.2%)	5 (6.8%)	34 (45.9%)	14 (18.9%)	3.39	1.363	9th
I will be retaining my present accommodation next year	18 (24.3%)	11 (14.9%)	8 (10.8%)	24 (32.4%)	13 (17.6%)	3.04	1.475	10th
It was easy to secure accommodation off-campus	12 (16.2%)	16 (21.6%)	14 (18.9%)	32 (43.2%)	0 (0%)	2.89	1.142	11th
My accommodation is conducive to studying	14 (18.9%)	23 (31.1%)	10 (13.5%)	15 (20.3%)	12 (16.2%)	2.84	1.385	12th
The travel time to the university negatively affects my study productivity	15 (20.3%)	13 (17.6%)	24 (32.4%)	15 (20.3%)	7 (9.5%)	2.81	1.246	13th

SD: strongly disagree, D: disagree, I: indifferent, A: agree, SA: strongly agree

The respondents were posed with certain statements representing variables that determined their satisfaction with their housing choice. Table 3 presents the responses to the statement questions. Most respondents, 82.5 per cent, affirmed that the university authorities were instrumental in securing accommodation for first-year international students. Hence, it can be said that universities in Hong Kong realise the importance of facilitating the housing process for first-year international students and the importance of allowing them to adapt quickly to studying in the city. Thirty-eight per cent of the respondents disagreed with the statement that it was easy to secure accommodation off-campus. Nineteen per cent of the respondents were indifferent to the ease of securing accommodation off-campus.

In comparison, 43 per cent of the respondents agreed that it was easy to secure off-campus accommodation. The results of the statement on ease of securing off-campus accommodation indicate that securing accommodation off-campus is not much of an easy affair for international students in Hong Kong. It may be suggested that this is due to finding themselves in a new environment. Obeng-Odoom (2012) found that the accommodation source for international students depends on how long they have lived in the country.

Twenty-six per cent of the respondents thought their accommodation was unaffordable, and sixteen percent of the respondents were indifferent to the statement concerning affordability. Fifty-six per cent of the respondents agreed that their accommodation was affordable. The results indicate that international students see their housing options as affordable, contrary to the findings of Chang (2017), who found that Chinese students thought their housing was not affordable. This implies that the surveyed international students (non-local students, i.e., from non-Chinese backgrounds) receive university support to cater for their living expenses. As shown in Table 3, 64 respondents (92%) are on scholarships through which they fund their accommodation costs.

The statement on the negative impact of travel time on the study productivity of international students produced mixed results. While 30 per cent agreed that the travel time from their accommodation to the university had a negative impact on their productivity, 38 per cent disagreed with the statement, and the remaining 32 per cent were indifferent. Probing further on the productivity of the students and the linkage to their housing, 50 per cent of the respondents perceived their accommodation as unconducive for study. In comparison, 36.5 per cent agreed that their accommodation was conducive to studying. The remaining 13.5 per cent were indifferent.

Fifty-seven per cent of the respondents affirmed that their accommodation directly impacted their academic/research performance; one per cent disagreed, while the remaining 42 per cent were indifferent. The results from the statements on student housing and their productivity as well as performance aligned with the findings of Najib et al. (2011), Parameswaran and Bowers (2014), and Sawyerr and Yusof (2013) that there exists a strong relationship between student housing satisfaction and their academic performance.

Eighty-five per cent of the respondents agreed that they are making progress in their study, a minute five per cent disagreed, while 10 per cent were indifferent. Eighty per cent of the respondents were on track to complete their program in the expected duration; conversely, seven per cent were not on course to finish within the expected completion period. It could be suggested that since most of the respondents are scholarship holders on student visas, a certain level of academic performance is expected, which may lead to on-time completion of the program. This aligns with the position of Jiranek (2010) that international students on scholarship mostly finish their studies on time to maximise the visa grant period and funding.

Regarding the willingness to retain their present accommodation, 50 per cent of the respondents agreed with the statement proposed. Thirty-nine per cent of the respondents were unwilling to maintain their accommodation, while the remaining 11 per cent were indifferent. This mixed result on the willingness to retain accommodation slightly disagrees with Najib et al. (2011) findings that 59 per cent of surveyed students will keep their accommodation. Nevertheless, our findings align with the position of Obeng-Odoom (2012) that international students living in private rental units regularly change accommodation due mainly to dissatisfaction with their accommodation. Fifty-eight per cent of the respondents were willing to recommend their current accommodation to their friends, and 16 percent were unlikely to recommend it. In comparison, the remaining 26 per cent were indifferent. Our findings align with Najib et al. (2011), though to a lesser degree, as the study found that 69.9 per cent of respondents will recommend their accommodation to their friends.

An overwhelming 92 per cent of the respondents affirmed that the universities should provide more assistance to first-year international students, 1 per cent disagreed on the need for extra assistance, while 7 per cent are indifferent. This result indicates that the universities need to do more despite the current efforts being provided, as affirmed by 82.5 per cent of respondents who noted that the university provided accommodation for them in the first year. Regarding the assistance provided by the universities, 89 per cent of respondents affirmed a need for scholarship-awarding bodies to increase the financial allowance for international students. The remaining 11 per cent are indifferent. This inadequacy of scholarships for international students compared to accommodation costs has been affirmed in Obeng-Odoom (2012), with calls for Universities to review the scholarship and duration.

Chang (2017) found that the primary factors influencing the housing choices of Chinese students in Hong Kong were accessibility of public transportation, distance to their university campus, rent affordability and living environment. Thus, the research participants were asked about their satisfaction with their accommodation as a function of price, location, space, and distance to the university. Sixty-five per cent of the respondents were satisfied with their accommodation, twenty-eight per cent were dissatisfied, and seven per cent were indifferent.

4.4 Relationship Between Students' Characteristics and Students' Housing Factors

The Chi-square test of independence was used to analyse the relationship between some factors associated with the students and selected student housing factors. The result of the Chi-Square test of independence between selected student characteristics and the willingness of the respondents to retain their accommodation, the willingness of the respondents to recommend their accommodation, and the respondents' overall satisfaction with their accommodation are presented in Table 4.

Table 4: Association between students' characteristics and WTA, WTRA and OSWA

	Willingness to retain accommodation (WTA)			Willingness to recommend accommodation (WTRA)			Overall satisfaction with accommodation (OSWA)		
Characteristics	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.	Value	df	Asymp. Sig.
Gender	7.719	4	.102	5.753	4	.218	.939	4	.919
Age	20.389	12	.060	10.196	12	.599	11.589	12	.479
Present year of study	20.395	16	.203	10.635	16	.831	11.156	16	.800

Mode of finance	2.366	4	.669	4.784	4	.310	7.682	4	.104
Accommodation type	7.545	4	.110	1.892	4	.756	8.034	4	.090
Travel time to the university	13.286	12	.349	9.423	12	.666	15.995	12	.191
Travel time to the nearest transport facility	2.515	4	.642	5.144	4	.273	4.162	4	.385

Firstly, the results indicate a significant relationship between the age of the respondents and their choice to retain their accommodation. This is based on the Chi-Square value, X^2 = (12, 20.389) with a p-value (0.06), which is significant at a 0.1 level of significance. The other characteristics, gender, year of study, mode of finance, accommodation type, travel time to the university and travel time to the nearest transport facility, had no significant relationship with the decision of the respondents to retain their accommodation due to the p values which are greater than 0.05 and 0.1. This result is contrary to Li et al. (2005) findings that found a significant relationship between features of the accommodation and the willingness to retain such accommodation. Consequently, this significant relationship between the age of the respondents and the willingness to retain their accommodation may be because the international students want some semblance of stability since most of the respondents fall between 26 and 35 years of age. This aligns with the findings of Clemes et al. (2001) that students' perception of service quality varies with age, and Amole (2009) found that age is a predictor of students' satisfaction with their housing. Furthermore, Amole (2009) found that as students stay in an accommodation, their satisfaction with the accommodation increases.

The result indicates no significant relationship between the characteristics, gender, age, year of study, mode of finance, accommodation type, travel time to the university, travel time to the nearest transport facility, and the willingness of the respondents to recommend their accommodation. This is because the characteristics produced p-values greater than 0.05 and 0.1. It may be suggested that the willingness to recommend accommodation is a function of satisfaction instead of student characteristics.

Also, the results indicate a significant relationship between the type of accommodation and the respondents' overall satisfaction with their accommodation. This is based on the Chi-Square value, X^2 = (4, 8.034) with a p-value of (0.090), which is significant at a 0.1 level of significance. The other characteristics, gender, age, year of study, mode of finance, travel time to the university and travel time to the nearest transport facility, had no significant relationship with the overall satisfaction of the respondents about their accommodation due to the p values which were greater than 0.05 and 0.1. This result is unsurprising as it aligns with Obeng-Odoom (2012) that international students living in private rental units (i.e. off-campus accommodation) face disproportionate accommodation problems. Hence, it can be said that the accommodation type will determine the international student's satisfaction level.

5. Conclusions

Housing is an important issue, and for students especially, it is one issue that significantly influences their academics. However, the satisfaction of international students studying in Hong Kong, one of the most expensive cities in the world, has not been subjected to empirical study. Therefore, this research surveyed the opinions of international students studying in Hong Kong on their satisfaction with their housing choices. This study differs from previous housing studies in Hong Kong by focusing on students who are not of Chinese background.

Through literature review, it was found that while the city was acknowledged to be expensive in terms of the cost of housing, studies on student housing in Hong Kong were scanty, with the few in existence only focusing on Mainland Chinese students. This left a puzzling gap since Hong Kong universities have many international students. Consequently, a questionnaire survey was conducted to gather the opinions of international students of six nationalities studying in Hong Kong across two continents. The data analysis revealed that most international students settled for off-campus accommodation. However, the universities in Hong Kong provide support to first-year students in accessing accommodation. Furthermore, it was found that most international students received full scholarships. At the same time, the few self-funded students also received some financial support from the authorities. These factors of support to students are also ranked as the most critical satisfaction factors for students. Nevertheless, the cost of housing is still an issue, with clamour from the students for more support from the universities both in terms of increased funding and in providing more assistance to first-year international students. Our research showed that most international students were satisfied with their accommodation, and the accommodation type had a significant relationship with the overall satisfaction levels. In conclusion, the findings of this study have far-reaching implications as it presents an opportunity for universities in Hong Kong to understand how student housing is an essential issue for international students. This is reflected in the fact that the students, though benefitting from scholarships and support in their first year, still seek more funding and support.

This study was faced with some limitations, which would warrant caution in the generalisation of the findings. Firstly, the number of respondents was 74, representing a small sample size. Furthermore, a considerable number of the respondents were scholarship holders, which could have an effect on their satisfaction levels. Also, the respondents were from Africa and Asia. Therefore, future studies can consider including students from European, North American and South American countries. Furthermore, consideration should be given to how international students who do not enjoy university scholarships cope in Hong Kong.

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Leveraging on Blockchain Technology for the Sustainability of Real Estate Practice: A Systematic Review

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Abstract
Blockchain technology (BCTech) in real estate is innovative and full of potential, although it is not widely accepted and scarcely applied. To establish the potential of BCTech in the real estate sector, this study used a systematic review of the literature found in Researchgate, ScienceDirect, Semantic Scholar, IEEE Xplore, and Google Search. This was done with a view to ascertain the current challenges in real estate practice and the potential benefits of applying BCTech to mitigate or eliminate these challenges. A total of 99 publications from 2016 to 2022 were examined, and their contents were assessed using descriptive statistical tools and presented in charts and tables. Based on the review, BCTech can provide platforms for tokenised ownership, smart contracts, quick transactions and cost reduction.

Moreover, the outcome also showed that some countries have applied BCTech to land registration, with a few others to record-keeping and real estate tokenisation. In addition, the majority of the research efforts (55%) are from journal outlets published between 2020 and 2022. Finally, BCTech offers secure and transparent platforms for real estate stakeholders; hence, they have much to gain by encouraging and embracing its adoption. The study concluded that though BCTech is not yet widely used, it has a lot of potential to offer in terms of the sustainability of the real estate industry.

Keywords: *BCTech, challenges, potentials, real estate,* sustainability

1. Introduction

Cutting-edge technologies are advancing to new heights nowadays at a rapid rate. Blockchain technology (BCTech) has emerged as a popular topic of discourse in social and professional settings as yet another development in technology. In the quick-paced digital world of today, this technology has brought about revolutionary change (Walter, 2022). A blockchain – also known as "blocks" that hold data sets – gathers relevant information and groups it together. A specified storage restriction applies to each block. A block is linked to the preceding, filled block after it has reached capacity. As a result, a data-block chain is produced. Thus, "blockchain" was coined. The data is immutable and irreproducible because of the chain around the blocks. The chain also establishes a verifiable ledger of transactions that anybody may access without being able to change because this data is subsequently disseminated throughout a network of computers (Jacob, 2020; Classicattorneys, 2022;

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Venugopal, 2022). In other words, blockchain is a method of preserving records that makes it hard for third parties to modify stored data illegally. The process of documenting transactions and tracking assets is made more accessible by a blockchain, specifically a digital ledger of transactions (Venugopal, 2022; Walter, 2022).

BCTech in real estate is innovative and full of potential, even though it is still in its early stages of adoption (Classicattorneys, 2022). Transactions on a blockchain are tamper-proof and transparent. They are, therefore, perfect for real estate transactions, which are frequently quite complicated and include numerous stakeholders. Blockchain eliminates the possibility of error or fraud that is prevalent in conventional real estate practices by allowing all parties to know the transaction's status at all times (Malonson, 2022). Unlike typical traditional real estate transactions, which can take weeks or even months to complete (Shabbir, 2021), blockchain transactions are quick and effective. They can be completed in a matter of minutes. Generally, BCTech has the power to transform the workings of the real estate sector completely. It will improve transaction safety, openness, and effectiveness (Casino et al., 2019; Voigt and Rosen, 2022; Malonson, 2022).

Based on the foregoing, a large number of studies have proposed the application of BCTech to tackle the challenges of traditional real estate practice (Yarlagadda and Gampala, 2020; Ameyaw and De Vries, 2021; Saari et al., 2022; Ali and Gupta, 2022; Podshivalov, 2022; Akpokona, 2022). Some of these articles discuss the benefits of BCTech adoption in the context of land administration, documentation, registration, and management. Despite the volume of studies on BCTech's application in the real estate sector, Konashevych (2020a) emphasised that further technical analysis and empirical investigation are required to comprehend the potential of the technology. This assertion is supported by Ebekozien et al. (2022), who stressed that research efforts on utilising BCTech in Nigeria's built environment space are sparse. Moreover, Miah (2022) suggested that further research should consider BCTech's impact on real estate stakeholders (such as investors, real estate professionals, sellers, buyers and renters). This is crucial, considering that some stakeholders are sceptical about whether they will benefit from it. This may be because the subject (benefits to stakeholders) has gotten minimal attention in scholarly publications. This is evident because earlier works were on the general application of BCTech (Xu, Chen and Kou, 2019; Sharma and Bhuriya, 2019; Meiriño et al., 2019); application of BCTech to financial services (Javid et al., 2022); application to rural development (Kaur and Parashar, 2022); security application (Harbi et al., 2023); application of BCTech in manufacturing industry (Guo, Zhang and Zhang, 2023), even application to real estate (Thota, 2019; Pankratov, Grigoryev and Pankratov, 2020; Jules, 2021; Santana, Da Silva and Da Cunha, 2021; Saari, Vimpari and Junnila, 2022). However, none of the earlier reviews considered the impact of BCTech on real estate stakeholders.

As a result of the foregoing, more academic papers are needed, particularly in the Nigerian context, that can enhance stakeholders' understanding of the adoption of BCTech to combat real estate challenges and the benefits of BCTech adoption to real estate stakeholders. Hence, this study further strengthens the existing discourse on how blockchain can minimise or eradicate the challenges in real estate practice. Against this background, this study reviewed research efforts on the challenges threatening the sustainability of real estate practice and the potential of BCTech in solving these challenges. The outcome of this study will help real estate professionals better comprehend the value of BCTech. Additionally, this study is crucial for fulfilling goal 9 of the United Nations' SDGs, which centres on industry, innovation, and infrastructure. BCTech's application in real estate is an innovative way of curbing the challenges of real estate practice and thereby ensuring its sustainability.

To better situate the review, the following research questions served as the guide:

1. What are the challenges in real estate practice threatening its sustainability?
2. What are the ways BCTech can minimise or eradicate these challenges to ensure the

sustainability of real estate practice?
3. How can BCTech enhance real estate processes?
4. Does BCTech offer any benefits to real estate stakeholders?
5. What are the authors' contributions to BCTech's potential in real estate practice?

2. Materials and Methods

Concerning the research questions, the researcher used a systematic review to provide answers. The same five-step methodology used in earlier studies (Khan et al., 2003; Green, 2005; Babalola et al., 2019) was followed to conduct the review. The steps are (i) formulating research questions, (ii) identifying relevant published studies, (iii) evaluating the studies, (iv) summarising the significant findings, and (v) interpreting the findings. The first phase involved developing research questions to direct the review. The next step was to find publications to be included in the review. A literature search was conducted using databases like Researchgate, ScienceDirect, Semantic Scholar, IEEE Xplore, and Google Search. These databases were selected because they are known to be leading online research tools and databases (Turner, 2010; Joannah, 2022). The online searches were in two stages. The first stage focused on challenges in real estate. The search was conducted using phrases like "challenges in real estate", "challenges in real estate practice", "hindrances to real estate practice", "real estate challenges", and "fraud in real estate practice". The second search focused on the usefulness of BCTech in real estate. The researcher used search terms like "blockchain and real estate", "blockchain in real estate", "benefits of blockchain in real estate practice", "potentials of blockchain in real estate practice", and "BCTech for real estate sustainability" for the search.

The materials were then screened to identify papers with titles, abstracts, or keywords related to the previously mentioned terms. To ensure currency of the publications, the review was limited to 7 years (i.e. 2016–2022). The search for "real estate challenges" produced 15 pertinent publications (comprising 4 online papers and 11 journal articles). In comparison, 84 publications were found for the "blockchain" search (composed of 20 online papers, 40 journal articles, 16 conference papers, 7 theses and 1 book chapter). In all, a total of 99 documents (i.e. 15 on real estate challenges and 84 on blockchain) are included in this review. The identified publications were next subjected to screening and classification. The researcher read and reviewed the chosen papers to determine their relevance to the study. The information used in this study is entirely secondary. After subjecting them to frequency and percentage analysis, tables and charts are used to present the review's findings.

3. Challenges in Real Estate Practice Threatening its Sustainability

Real estate investment is the most significant global wealth reserve and a vital component of the worldwide economy (Saull et al. 2020). Real estate and property rights transactions are intricate and drawn-out processes requiring the approval of numerous agencies, including appraisers, lenders, attorneys, and agents (Liu et al., 2020). As a result, real estate practice and the purchase process are marked by numerous challenges. Table 1 summarises some of these challenges as identified by various researchers.

Table 1: Challenges in Real Estate Practice

S/N	Authors	Challenges
1	Wouda and Opdenakker (2019)	Fragmented market data and lack of transparency
2	Yarlagadda and Gampala (2020)	Cumbersome title management, fraud/scams and illiquidity
3	Liu et al. (2020)	High cost of land, expensive transactions (resulting from legal, brokerage, title registration, and banking fees)
4	Jane (2020)	Documentation issues, presence of brokers or middlemen, Title Management, illiquidity and fraud/scams
5	Ngwu (2020)	Fraud potential, cumbersome transaction processes, human

		errors in 'manual' land registries, involvement of numerous intermediaries, high transaction costs and corruption arising from undue bureaucracy
6	Konashevych (2020a)	Abuse of power, third-party actions, corruption, and centralisation expose data to the risk of loss
7	Mashatan et al. (2021)	Professional misconduct and fraud
8	Jules (2021)	A high number of middlemen (e.g. banks, lawyers, notaries and brokers), transaction cost, fraud and illiquidity
9	Shabbir (2021)	Onerous paperwork, high transaction cost, lack of transparency, fraud risk, slow pace of transactions and presence of middlemen
10	Ameyaw and De Vries (2021)	Lack of transparency, high cost, fragmented institutional arrangements, intrusion of unqualified middlemen, fraud and unnecessary bureaucracy
11	Zahuruddin et al. (2021)	Onerous paperwork, time-consuming registration and documentation issues, middlemen/brokers and fraud
12	Chirag (2022)	Higher risk of fraud, lack of transparency, expensive investment, tedious paperwork, a large number of intermediaries and poor transaction speed
13	Saari et al. (2022)	Trust issues, corruption, non-transparency, fraud, high costs and inefficiencies
14	Kislitsyna (2022)	Difficulty obtaining accurate property information, the possibility of fraud, a large number of intermediaries, tedious paperwork, high entrance barriers to property investing
15	Mann et al. (2022)	Space restrictions, fraud, complex process of verifying titles, lack of standardisation, and poorly maintained land records

Source: Author's Compilation (2023)

Judging from the review in Table 1, several researchers have highlighted the challenges associated with real estate practice. Thankfully, most of them are surmountable with the application of BCTech, which has prospects of transforming the real estate industry.

4. Overview of Blockchain Technology (BCTech)

In a hypothetical sense, there is no genuine definition of blockchain that the average person can easily comprehend (Ravikiran, 2022). Venugopal (2022) believes a blockchain is a set of chronologically ordered, publicly accessible records known as "blocks." The information is encrypted to ensure that the user's privacy is not violated and that the data cannot be changed. In contrast to existing financial organisations, a centralised authority does not have control over the information on a blockchain network. The data is maintained by network users, who also retain the ability to democratically approve every transaction that takes place on a blockchain network. A typical blockchain network is, therefore, a public blockchain. A digital ledger, a peer-to-peer network, and cryptographic keys are combined to form the blockchain (Venugopal, 2022; Ravikiran, 2022; Hayes, 2022).

The two varieties of cryptography keys are public and private keys. Every individual or node possesses both keys, which are used to create digital signatures. The most essential component of BCTech is this digital signature, which acts as a precise and secure point of reference for a digital identity. Each transaction must have the owner's digital signature to be valid. In a peer-to-peer blockchain network, a mathematical verification authorises a transaction. Many people work together in this peer-to-peer network to decide on transactions and other matters (Venugopal, 2022). The digital ledger is a system that houses all of these transactions. The digital ledger functions like a spreadsheet that contains every single node in a network and records every single transaction that node has ever

made. The digital signature protects the data in the ledger from being tampered with and ensures that it is exceptionally secure. The most intriguing feature of this ledger is that any user can view the data, but nobody can tamper with it (Venugopal, 2022; Ravikiran, 2022; Hayes, 2022).

4.1 Potential Uses of BCTech in Sustaining Real Estate Practice

The real estate sector stands to benefit significantly from BCTech. For example, transactions might be streamlined using platforms built on the blockchain. Such platforms provide a secure, transparent environment for all parties to follow the progress of a transaction (Casino et al., 2019; Malonson, 2022; Voigt and Rosen, 2022). In the future, blockchain-based systems will enable broader participation in real estate through fractional property ownership. As a result, the real estate market can become more democratic and present new investment options (Malonson, 2022). In the opinion of Wouda and Openakker (2019) and Walter (2022), BCTech has the prospect of reducing the need for middlemen in real estate transactions, resulting in cost and time savings, as well as increased security over traditional transaction methods and even a reduction in fraud. Soetan (as cited by Gbonegun, 2019) added that blockchain is a cutting-edge technology that adds some valuable elements to the real estate industry. These include the immutability of records and smart contracts, which shield property owners and buyers from fraud since cryptographic hash algorithms prevent data inside the blockchain from being altered.

According to a report by Gbonegun (2019), using BCTech would help mitigate several problems, including a severe lack of transparency, high taxes and fees, a lack of liquidity in the market, sluggish transaction speeds, and problems with pricing commitments. Through BCTech, there will be greater access to the market for more people, and transactions will be safer and more transparent (Liebkind, 2020). Table 2 gives an overview of some of the potential uses of BCTech in real estate.

Table 2: Potential Uses of BCTech in Sustaining Real Estate Practice

S/N	Potentials	Description	Source
1	Tokenised ownership	With BCTech, tokens can protect property against fraud or theft via verifiable ownership. By purchasing tokens for a property, numerous people can jointly own it. Tokenisation enables partial or fractional ownership of an asset. It also makes real estate a more liquid asset, enabling owners to acquire and sell their shares more quickly and easily. Consequently, tokenisation opens up the real estate market to more participants	Liebkind (2020); Pankratov et al. (2020); Yarlagadda and Gampala (2020); Shabbir (2021); Jules (2021); Walter (2022); Kumar (2022); Kurtzer-Meyers (2022); Pritchard (2022); Kim (2022)
2	Smart contract	Smart contracts automate transactions. For real estate transactions, they execute legal agreements once the stated requirements are met. This makes the transaction process transparent and certain	Liebkind (2020); Pankratov et al. (2020); Yarlagadda and Gampala (2020); Shabbir (2021); Jules (2021); Walter (2022); Kurtzer-Meyers (2022); Kim (2022)
3	Crowdfunding investment	Real estate projects can raise money from sundry investors using crowdfunding. Crowdfunding provides a platform where investors and entrepreneurs may interact and conduct secure transactions. Property	Perzhanovskiy (2021); Kurtzer-Meyers (2022)

		developers can exhibit their project scope, potential, financial needs, and profit sharing to draw investors. In a similar vein, investors might spot openings to make wise investments. Both parties can satisfy each other's needs more quickly and easily using such a platform.	
4	Decentralisation	The decentralised nature of BCTech encourages security and trust. Since all peers on the network have access to the data recorded in the blockchain, it is transparent and immutable. The system of a decentralised exchange is predicated on trust. Knowing that peers can independently verify information gives buyers and sellers more confidence when making deals. Fraudulent acts would also decrease	Liebkind (2020); Konashevych (2020a); Shabbir (2021); Kurtzer-Meyers (2022)
5	Transparency of transactions	Data is made accessible to everyone since BCTech virtually prohibits tampering with stored data. Moreover, it helps all participants keep track of every detail of transactions, so the transactions are transparent. As lots of money is involved in exchanging the rights to and ownership of property, there is a great interest in secure, quick, and straight-forward transactions; BCTech enables such transactions	Liu et al. (2020); Yarlagadda and Gampala (2020); Shabbir (2021); Walter (2022): Kumar (2022); Kurtzer-Meyers (2022); Pritchard (2022); Kim (2022); Saari et al. (2022)
6	Reduced cost	BCTech facilitates cost-efficient processing of transactions by eliminating the involvement of third parties. Due to the transparency a decentralised network provides, transaction costs (e.g., taxes, registration fees and inspection fees) can be reduced. Additionally, money is saved by cutting out the fees and commissions of middlemen. BCTech allows for the automation of various processes, thereby minimising costs	Liebkind (2020); Liu et al. (2020); Yarlagadda and Gampala (2020); Walter (2022); Pritchard (2022)
7	Reliable and accurate data	Buyers can have complete confidence in the information they receive since the data stored on a blockchain are more accurate and dependable	Liu et al. (2020); Kim (2022)

Source: Author's Compilation (2023)

4.2 Real Estate Processes BCTech Can Enhance

Several processes in the real estate space can benefit from the use of BCTech. A few of these processes that are being revitalised with blockchain implementation are:

1. ***Property management***: Property management is quite complicated, particularly when numerous players are involved. This is why it is crucial to use blockchain's data-sharing capabilities. BCTech has the potential to expedite rental payments to owners, offer top-notch due diligence across portfolios, and streamline rental collection processes when used correctly. Time and money can be saved while operational efficiency increases (Ferranti, 2021; Chirag, 2022).

2. ***Property search***: Platforms that require hefty fees and are subscription-based are commonly used by brokers, owners, tenants, and buyers. Their property information is frequently unreliable, out-of-date, or partially distorted. All of this may be avoided by utilising a real estate search engine built on the Blockchain (Chirag, 2022). A blockchain-based application can decentralise data storage and make it possible for everyone in a network to share data. It also gives brokers more data monitoring alternatives, ultimately lowering associated expenses (Chirag, 2022; Classicattorneys, 2022; Kislitsyna, 2022).

3. ***Due diligence and financial evaluation***: Extensive effort is spent on due diligence before purchasing or renting any property. To avoid legal, technical, or financial problems, many middlemen are engaged to check relevant documents. In most jurisdictions, property information is stored on paper, which anyone may alter (Chirag, 2022; Kislitsyna, 2022). However, with BCTech, all property-related documents can be digitised and kept on a blockchain for easy and secure access. This will speed up and improve the accuracy of the due diligence process (Ferranti, 2021; Chirag, 2022; Kislitsyna, 2022).

4. ***Documentation and payments***: The current process of filing property documents is time-consuming, complex, and expensive due to middlemen's extensive documentation and involvement. This becomes more pronounced in mortgage administration or overseas transactions. Blockchain can now streamline and innovate the filing process by offering verifiable digital identities for properties. Also, the advent of cryptocurrencies may make the payment procedure more efficient, e.g., making

5. It is easier to complete multi-currency transactions (Chirag, 2022).

6. ***Title/Deed management***: The majority of property titles are paper-based. As a result, there is a greater possibility of mistakes and fraud. Any fault renders the deed management procedure illegal to continue with until the problem has been fixed. Property owners must pay expensive legal fees to ensure the accuracy and legitimacy of their property titles. By using BCTech to create immutable digital records, this problem may be readily solved while also providing transparency of the entire process (Ferranti, 2021; Chirag, 2022).

4.3 Benefits of BCTech's Adoption to Real Estate Stakeholders

Blockchain is a new technology that can change how the real estate sector and its stakeholders conduct business. Real estate stakeholders, in particular, should pay close attention to this new trend because it will drastically alter real estate transactions and tremendously benefit them (i.e. stakeholders). Table 3 provides an overview of how BCTech benefits real estate stakeholders.

Table 3: Benefits of BCTech's Adoption to Real Estate Stakeholders

S/N	Stakeholder	Benefit	Source
1	Property developers	When numerous parties can invest, developers raise the capital required to launch a project more quickly and efficiently. Although fractional real estate	Kim (2022); Classicattorneys (2022)

		ownership is not new, BCTech simplifies the procedure and expands the pool of possible investors. Project financiers will not need to worry about screening investors or dealing with a ton of paperwork when asking for capital contributions from investors outside their network. Blockchain keeps track of every piece of information, makes it possible to sign smart contracts, and provides updates and briefings to all stakeholders. The information is easily accessible to investors, regulators or any other participating party. As a result, transaction time and expenses are drastically decreased, allowing developers to concentrate on the actual development of the project	
2	Property owners and investors	Prospective owners and investors might feel secure when purchasing real estate because BCTech makes misrepresenting or manipulating data impossible. They can readily invest in a property knowing its price and validity are open and honest. Additionally, tokenisation enhances the liquidity of the property market. The entry barrier for prospective buyers or investors is made lower through tokenisation. As a result, a seller does not have to wait for a purchaser who can afford the entire property before making a sale	Shabbir (2021); Jules (2021); Kim (2022); Classicattorneys (2022)
3	Residents and tenants	Renters benefit from a better leasing and living experience using blockchain, which allows them to do everything from taking virtual tours and signing leases with smart contracts to making payments or submitting maintenance requests. These features are protected by BCTech, ensuring that all parties are aware of the legitimacy of the property listing, the veracity of identities, and the encryption of personal data. International transactions may now be simpler than ever using blockchain. Given that blockchain removes geographical restrictions, conducting negotiations and leasing property in a particular country may be feasible without leaving one's home country.	Yarlagadda and Gampala (2020); Shabbir (2021); Kim (2022); Saari et al. (2022); Classicattorneys (2022)
4	Property managers	Property management today entails processing much paperwork. A blockchain-based property management system transforms all that documentation into virtually error-proof smart contracts. Payment, tenant and property history, contractor agreements, etc., are all transparently available in such a system.	Kim (2022); Kurtzer-Meyers (2022); Classicattorneys (2022)
5	Real estate professionals	Although blockchain is helpful in assuring quick and safe transactions and data-sharing, it does not displace real estate specialists, unlike other intermediaries, e.g., lawyers. Home buyers, sellers and investors will still need assistance locating the ideal property, negotiating prices, and handling	Patno (2018); Jacob (2020)

		contingencies. Real estate professionals offer clients trustworthy information, counsel, and emotional support. Thus, they will undoubtedly become more valuable.	

Source: Author's Compilation (2023)

4.4 Authors' Contributions to BCTech's Potential in the Real Estate Sector

To position this review well, it is pertinent to look into the contributions of authors on BCTech's potential in the real estate sphere. Table 4 is a detailed summary of earlier works on blockchain applications.

Table 4: Summary of Authors' Contributions to BCTech's Potential in the Real Estate Sector

S/N	Country	Author/Year	Main Research Focus/Areas of Blockchain Application	Publication Outlet
1	US	Spielman (2016)	Land registration	Thesis
2	Tanzania	Kombe et al. (2017)	Land administration and title registration	Journal
3	Sweden	Corluka and Lindh (2017)	General application	Thesis
4	Pakistan	Uzair et al. (2018)	Record keeping	Journal
5	New York	Castellanos and Benbunan-Fich (2018)	Land records	Conference
6	South Africa	Tilbury (2019)	Real estate transaction	Thesis
7	Netherlands	Nijland and Veuger (2019)	General application	Journal
8	Netherlands	Wouda and Opdenakker (2019)	Real estate transaction	Journal
9	Poland	Kaczorowska (2019)	Land registration	Journal
10	Georgia	Lazuashvili (2019)	Land registration	Thesis
11	Georgia	Lazuashvili et al. (2019)	Land registration	Conference
12	Germany	Muller and Seifert (2019)	Land administration	Conference
13	India	Shinde et al. (2019)	Land registration	Conference
14	UK	Jyotsna and Gampala (2020)	General application	Journal
15	UK	Schubert (2020)	Land records	Thesis
16	Bangladesh	Jahan et al. (2020)	Land documentation and registration	Journal
17	Russia	Pankratov et al. (2020)	Real estate transaction	Conference
18	UK	Reddy (2020)	Real estate transaction	Journal
19	India	Singh (2020)	Land records	Conference
20	India	Krishnapriya and Greeshma (2020)	Land registration	Conference
21	Switzerland	Daniel and Speranza (2020)	Land documentation and administration	Journal
22	Italy	Morena et al. (2020)	Project application	Journal
23	Italy	Konashevych (2020a)	General application	Journal
24	Italy	Konashevych (2020b)	Real estate tokenisation	Journal
25	Italy	Konashevych (2020c)	Land registration	Journal
26	Turkey	Mendi et al. (2020)	Land registration	Conference
27	Pakistan	Ali and Tahir (2020)	Land registration	Journal
28	India	Nandi et al. (2020)	Land registration	Conference

29	Malaysia	Shuaib et al. (2020)	Land registration	Journal
30	India	Madhurya et al. (2020)	Land registration	Journal
31	India	Zahuruddin et al. (2021)	Land registration	Journal
32	Germany	Schmidt and Elferich (2021)	Real estate market	Conference
33	India	Yadav and Kushwaha (2021)	Land transaction	Journal
34	Ghana	Ameyaw and De Vries (2021)	Land registration	Journal
35	Nigeria	Ibrahim et al. (2021)	Land administration	Journal
36	UK	Jules (2021)	General application	Journal
37	Australia	Perera et al. (2021)	Property transaction records	Journal
38	Bangladesh	Shithy et al. (2021)	Land registration and ownership management	Conference
39	India	Suganthe et al. (2021)	Land registration	Conference
40	India	Naikwadi et al. (2021)	General application	Conference
41	Australia	Bennett et al. (2021)	Land administration	Journal
42	Malaysia	Humdullah et al. (2021)	Land registration	Conference
43	Malaysia	Razali et al. (2021)	Land registration	Conference
44	Australia	Ullah and Al-Turjman (2021)	Real estate transaction	Journal
45	Saudi Arabia	Shuaib et al. (2021)	Land registration	Conference
46	China	Lu (2022)	Land tokenisation	Thesis
47	Finland	Saari et al. (2022)	General application	Journal
48	Singapore	Ooi et al. (2022)	Land transfer	Journal
49	India	Ali and Gupta (2022)	Land tokenisation	Book Chapter
50	Nigeria	Ebekozien et al. (2022)	General application	Journal
51	Nigeria	Akpokona (2022)	Fractionalisation of property	Thesis
52	India	Gaikwad et al. (2022)	General application	Journal
53	Croatia	Racetin et al. (2022)	General application	Journal
54	Pakistan	Khalid et al. (2022)	Land registration	Journal
55	Russia	Podshivalov (2022)	Real estate registration	Journal
56	Malaysia	Shuaib et al. (2022a)	Land registration	Journal
57	Malaysia	Shuaib et al. (2022b)	Land registration	Journal
58	Bangladesh	Alam et al. (2022)	Land title management	Journal
59	India	Mann et al. (2022)	Landholding system	Journal
60	Saudi Arabia	Shuaib et al. (2022c)	Land registration	Journal
61	India	Umrao et al. (2022)	Land registration	Journal
62	US	Miah (2022)	General application	Journal
63	India	Chatterjee et al. (2022)	Land administration and title registration	Journal
64	Malaysia	Jasimin and Nordin (2022)	General application	Journal

Source: Author's Compilation (2023)

5. Summary of Major Findings

5.1 Challenges in Real Estate Practice

Table 1 shows that the efforts of different researchers to pinpoint the challenges in real estate practice have produced non-uniform results; hence, it is necessary to have a common perspective. This will

make it simple to identify the problems and to suggest remedies. From the review, the researcher has identified eleven key challenges in real estate practice, namely: lack of transparency; fraud; corruption; expensive transactions; onerous paperwork; slow pace of transactions; the presence of middlemen; fragmented real estate market data; title management issues; illiquidity; and professional misconduct. Using this outcome, the author proposed a conceptual framework (see Figure 1) to illustrate the leading real estate practice challenges requiring intervention. From this outcome, it can be concluded that stakeholders must focus on offering solutions to the eleven key challenges identified in this study to ensure the industry's sustainability.

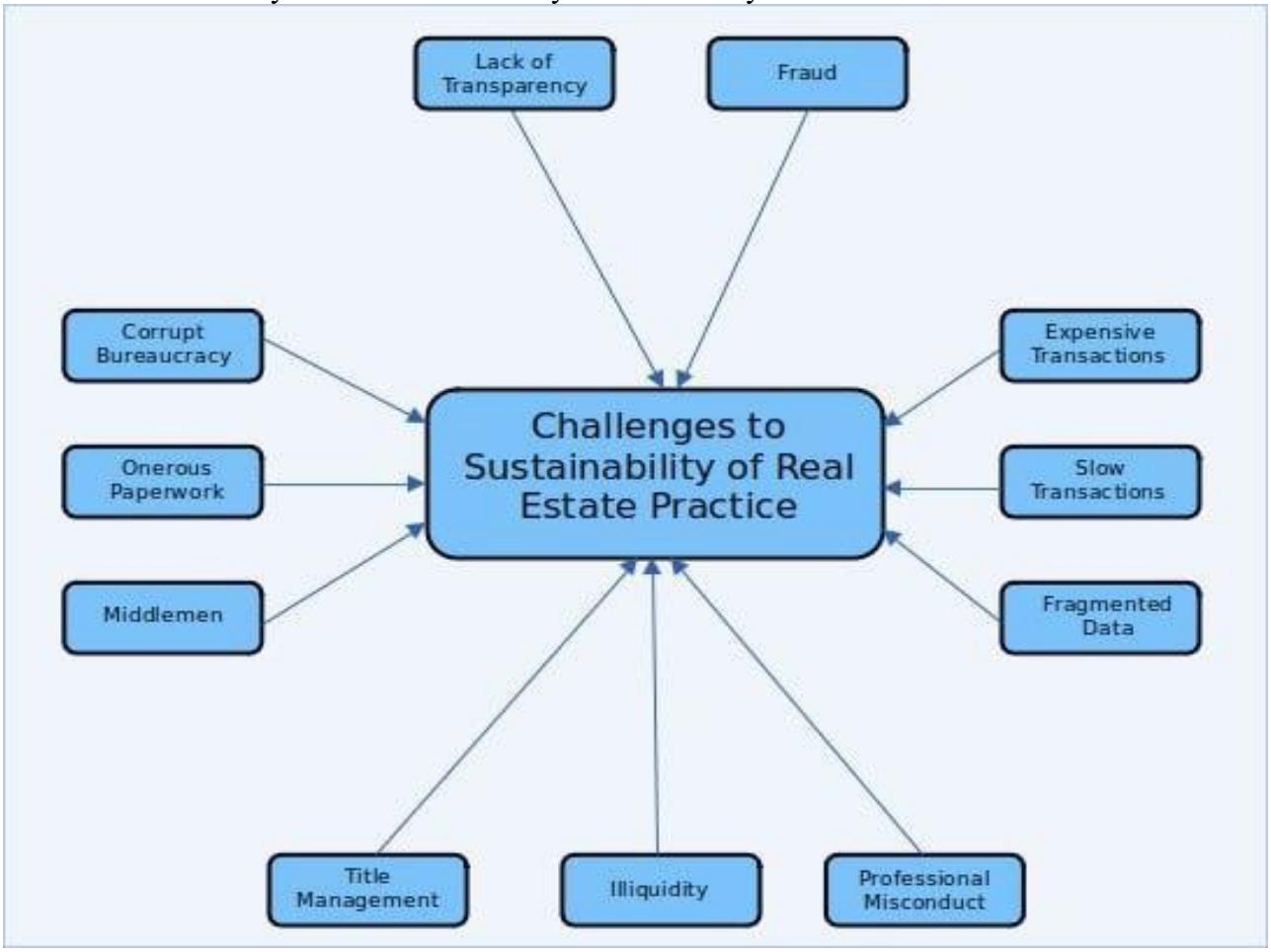

Figure 1: Challenges to Sustainability of Real Estate Practice

5.2 Potential of BCTech to Eradicate the Challenges in Real Estate Practice

Previously unresolvable issues in real estate (like those identified in Figure 1) now have BCTech-powered solutions, as indicated in Tables 2 and 6. Though the real estate industry is one of the most traditional industries, which might make accepting technological change difficult (Pritchard, 2022), BCTech should be seriously considered for adoption due to its enormous potential.

Table 5: BCTech Solutions to Real Estate Challenges

S/N	Challenges	Blockchain Solutions
1	Lack of transparency	◆ Immutable, tamper-proof transaction history
2	Fraud	◆ Tamper-proof records ◆ Smart contracts
3	Corrupt bureaucracy	◆ Elimination of middlemen ◆ Ready access to records ◆ Quick completion of transactions ◆ Smart contracts

4	Onerous paperwork	◆ Digital and complete history of ownership of assets
5	Presence of middlemen	◆ Immutability of records ◆ Smart Contracts
6	Professional misconduct	◆ Smart Contracts
7	The slow pace of transactions	◆ By design, blockchain networks enable fast completion of transactions
8	Expensive transactions	◆ Elimination of middlemen ◆ Low transaction fees are an in-built feature of blockchain networks
9	Fragmented market data	◆ Provision of complete transaction history of assets
10	Title management issues	◆ Provision of comprehensive digital records that are updated automatically every time a transaction occurs
11	Illiquidity	◆ Tokenisation

5.3 Real Estate Processes BCTech Can Enhance

The review of the processes in the real estate industry that BCTech can enhance identified property management, property search, due diligence and financial evaluation, documentation and payments, and title/deed management. This implies that if stakeholders leverage the opportunities BCTech has to offer, streamlined transactions will be common.

5.4 Benefits of the Adoption of BCTech to Real Estate Stakeholders

The review of the potential benefits of BCTech to stakeholders shows that there is a lot to gain in terms of documentation, archiving, identity management, cost reduction, and time reduction, among others. In addition, it is evident from Table 4 that BCTech offers a secure and transparent platform to real estate stakeholders. These imply that stakeholders should encourage its adoption since they stand to benefit significantly from it. Finally, from the review, non-academic papers make up the majority of the cited publications. This fact implies that there are limited scholarly articles on how BCTech benefits real estate stakeholders. This further buttresses the suggestion of Miah (2022), who advocated for more studies on how BCTech may impact real estate stakeholders. This study will, therefore, contribute to the body of knowledge found in scholarly publications.

5.5 Authors' Contributions to the Potential of BCTech in Real Estate Practice

The discussion in this section looks at the authors' contributions to the potential of BCTech in real estate practice**.**

5.5.1 Year of Publication

The evaluation of the year of publication of reviewed materials indicates that 80% (51 papers) were published from 2020 to 2022. Of this figure, 30% (19) were published in 2022. In light of this, it may be concluded that the bulk (80%) of the research work was published from 2020 to 2022. It can thus be inferred that the potential of BCTech has recently caught the attention of researchers.

5.5.2 Publication Outlets

From findings on publication outlets, out of the 64 papers reviewed, 63% (40) are journals, 25% (16) are conferences, 11% (7) are theses, and 1% (1) is from a book chapter. Moreover, the review also showed that the highest number of journals (35) were published in 2020 (11 journals), 2021 (8 journals), and 2022 (16 journals). Figure 2 depicts the results.

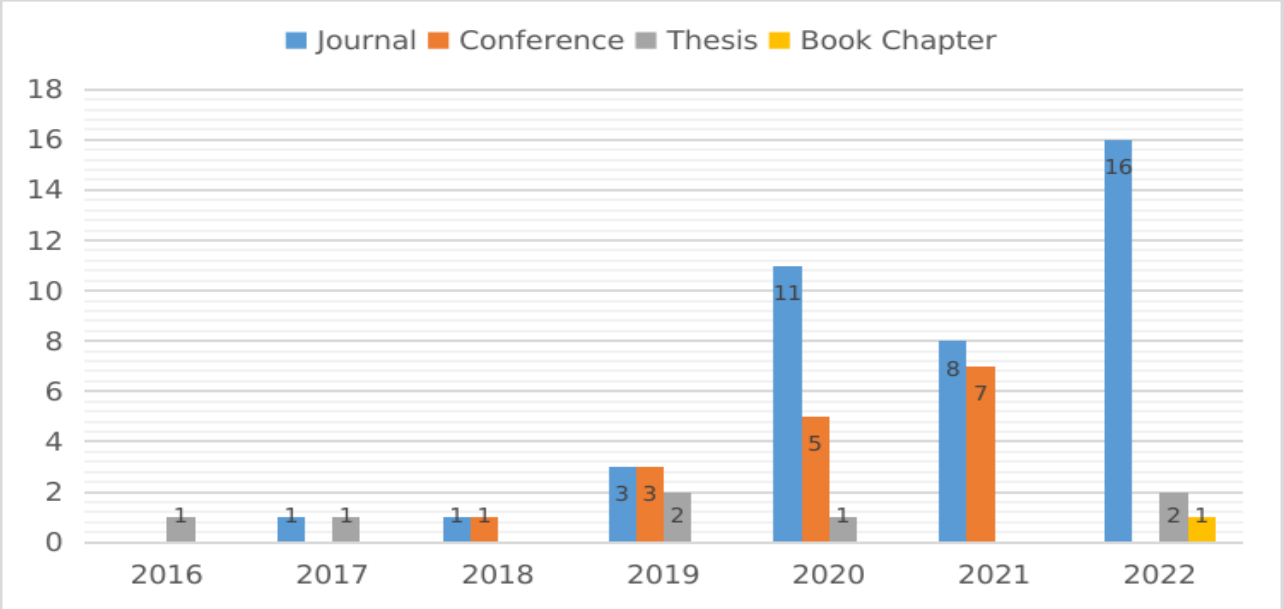

Figure 2: Publication Outlets

5.5.3 Main Research Focus/Areas of Blockchain Application

From the review, it is evident that most of the academic publications are on applying BCTech to land registration. This implies that some countries (Sweden, the UK, Estonia, Georgia, etc) have been applying BCTech to ease challenges in land registration (McKerrell, 2020). Although a few of the articles also focused on other areas, such as record keeping and tokenisation, there is a need for further academic research on other areas where BCTech may be useful, such as property search, due diligence, and financial evaluation.

6. Conclusion

BCTech will guarantee the integrity of transactions in the real estate industry because tampering with data stored on the network is impossible. Additionally, the real estate market's transparency will boost transaction dependability, increase database confidence, and drastically reduce fraud risk. BCTech will facilitate the development of a system that will enable optimised real estate transactions. This technology will make Real estate transactions quicker, safer, and less expensive.

Moreover, several authors (Li et al., 2019; Ngwu, 2020; Demestichas and Daskalakis, 2020; Lu, 2020; Brown, 2021; Kouhizadeh et al., 2021; Saheb et al., 2021; Saif et al., 2022) have identified technological, governance, organisational, knowledge, financial barriers as well as human errors (in coding and data entry) as some of the challenges confronting its adoption. To tackle these barriers, some workable solutions have been proffered (Yadav et al., 2020; Ngwu, 2020; Brown, 2021; Saif et al., 2022).

One of the topics of debates and discussions about leveraging BCTech is possible implementation challenges. Blockchain technology can be accessed on a software-as-a-service basis to ease implementation challenges. Another way of avoiding implementation challenges is by hiring consultants to lead the effort. The latter is the option utilised by the government of Ghana, which has blockchain-enabled its land registry.

There is little doubt about the advantages of BCTech (Miah, 2022). This is evident considering the number of developed and developing nations (Estonia, Sweden, Georgia, the UK, the Netherlands, Ghana, Dubai, etc) that have created blockchain-based applications to make real estate transactions more cost-effective and seamless (McKerrell, 2020). Also, in May 2023, the government of Nigeria launched a National Blockchain Policy (Adepetun, 2023; Usigbe, 2023). If so many nations are taking

the adoption of BCTech seriously, others should at least evaluate it for possible adoption.

6.1 Implications of Findings and Limitations to the Study

This study offers insight into the relevance of BCTech in sustaining real estate practice. Also, this study will contribute towards stirring stakeholders in the built environment to establish a robust framework and guidelines to adopt BCTech. This study has a few limitations. First, to ensure the currency of literature, this study was limited to 7 years, and only 99 articles were included. A further review can cover more years and articles. Finally, this paper did not elaborate on the barriers to the adoption of BCTech for real estate sustainability; hence, a follow-up study can look into this.

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