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PREFACE

Welcome to the Special Issue of the International Graduate Conference of Built Environment and Surveying (GBES) 2023 proceedings. As the culmination of rigorous blind peer review, we are pleased to present this curated selection of outstanding research papers from GBES 2023.

This Special Issue represents the pinnacle of scholarly achievement within the realms of built environment and surveying. Each paper included herein has undergone a meticulous evaluation process, ensuring adherence to the highest standards of academic excellence and innovation.

Hosted by the esteemed Faculty of Built Environment and Surveying at Universiti Teknologi Malaysia (UTM), GBES 2023 served as a dynamic platform for the exchange of ideas and the advancement of knowledge in our fields. The papers showcased in this Special Issue embody the conference's overarching theme of "Innovating Solutions in Built Environment and Surveying," offering fresh insights and transformative perspectives that promise to shape the future of our industries.

From groundbreaking research in geoinformation to innovative approaches in urban and regional planning, quantity surveying, real estate, architecture, and landscape architecture, each contribution in this Special Issue represents a significant contribution to the ongoing discourse surrounding the built environment and surveying sectors.

We extend our heartfelt gratitude to all the authors who submitted their work for consideration and commend the dedication and expertise of our peer reviewers who rigorously evaluated each submission. It is through their collective efforts that this Special Issue has come to fruition, offering readers a glimpse into the cutting-edge research and industry insights presented at GBES 2023.

As we navigate the complex challenges and opportunities facing our fields, we invite you to embark on the pages of this Special Issue and join us in celebrating the ingenuity and scholarly excellence showcased within. Together, let us continue to push the boundaries of knowledge and innovation in the built environment and surveying disciplines.

Thank you for your continued support of GBES and for your commitment to advancing our shared mission of fostering excellence and innovation in the built environment and surveying fields.

Best regards,
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Museum As a cultural and Creative Tourism Attraction: A Review on Literature

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Abstract. With people's interest in cultural tourism, the museum has become an increasingly popular form of travel in recent years. Museum offers cultural and creative products (MCCP), as an extension of museum culture, have been upgraded from souvenirs and replicas to MCCP, which are favoured by visitors. Meanwhile, the era of digital media has expanded the definition of MCCP, which has also attracted extensive attention from scholars. There is evidence that MCCP has a significant impact on improving the image of museums and on visitors' visiting experience, purchasing behaviour and loyalty. However, there has been no systematic investigation of what is the updated category of MCCP and how they transformed traditional museum exhibits through creativity. This paper provides a comprehensive review of the literature on museum tourism and MCCP, examining the various factors that contribute to its success and the potential of creative cultural products to enhance visitor experiences and the attractiveness of museums. The findings show that the literature has paid the most attention to the visitor experience, consumer cognition, and role of the museum, with less focus on the design transformation process related to creativity and innovation. This paper provides valuable literature in understanding the role of MCCP in museums as the potential of creative attraction in enhancing visitor experiences and consumption. By synthesizing the existing literature, the paper provides a comprehensive overview of the current state of research on this important topic.

1. Introduction

As a window into a city's unique culture and history, museums are considered a central factor in a city's appeal and in shaping a high quality of life. Changing the function of museums is also changing from a simple window display of historical artefacts and collections to a focus on the audience experience, balancing between an elitist and a consumerist [8]. At the same time, the role of the audience has shifted from spectator to education, entertainment, and participation in or consumption of a variety of cultural products and services.

MCCP are rooted in the cultural resources of the museum. After professional art design and commerce processing, it establishes links with visitors and makes purchases, bringing value out of the museum. With the development of society and economy, people's interest in cultural tourism has increased, that lead to MCCP gradually becoming an indispensable part of the attraction of museums and more museums in China opened museum stores recently [17].

In general, museum shops sell souvenirs, reproductions, books, stationery, postcards, clothing, audio products and other items rooted in the content of the museum and exhibition. However, due to

differences in market strategies and organizational management modes, different countries, regions and museum retailers have different profitability, product quality, feedback to consumers on the shopping experience and expansion effects on the reputation of museum collections. Some government museums and local museums (often small, local institutions) have limited resources and hard to achieve commercial-cultural gain [4]. Some scholars have predicted that in 2030, one scenario of museums will seek innovative and sustainable development with limited government support in France after interviewing 99 experts using a Delphi method [13]. It also helps to improve its current environment and operating conditions [12]. Hence, Products that are truly creative and give the audience a special experience are more likely to meet the audience's value and survival in a competitive market. Especially under the impact of the epidemic, a part of museum exhibitions have been transferred from offline to online. Thus, the definition of MCCP is still changing.

Therefore, narrative design in MCCP has been introduced. The innovation of museum products is becoming more significant not just because the tourists are bored by the traditional museum shop, but also because curators are looking for new ways to interact with tourists, increase the tourist experience and attract more visitors to come to the museum. It is becoming increasingly imperative not just to sell the local culture, but also to use MCCP to support the economy of the museum, the identity of the destination and to stimulate the reputation of local museums through MCCP. Accordingly, there are a few objectives that need to address:

1. To understand the major publication trend of scope on museum tourism.
2. To identify the definition and multicriteria roles the museums play from the past to the present to the future.
3. To investigate the relevant publication on cultural and creative products transformed from heritage using narrative design.

2. From "Curiosity Cabinet" to Shopping in Museum: An Overview

This literature review is a collection of studies published in academic journals and related books published. The following will be detailed from the perspective of literature, data collection methods and other aspects.

2.1 Major Dimensions of Museum Tourism

The studies discussed from many aspects of museum tourism and cover different dimensions of museum attraction. The exhibition, location, narrative atmosphere, management, visitor experience, cultural and creative product, new technology and value are among the most studied aspects of a museum tour. It can be seen that the experience of visitors, including the feeling of visiting museums, shopping, entertainment, receiving education and dining in museums, is the focus of the author in recent years. Moreover, articles related to museum cultural and creative products have also increased significantly. However, there has been no systematic investigation of what is the updated category of MCCP and how they transformed traditional museum exhibits through creativity. Although MCCP is mostly driven by stories dug out from museum culture, there has been only a few focus on the designer´s creativity from the perspective of narrative. Nevertheless, some research has touched upon aspects of storytelling, including emotional design and semiotic analysis.

Table 1 lists the major dimensions of museum tourism that have been extracted in the 60 literatures. Visitors and consumers became the main focus of research. More than 26% of the reviewed studies chose visitor experience as a discussion entry point under the trend of user-centre. As an important part of museum tourism, MCCP has also received academic attention. [1,6,9,11,14,17,19]. The immersive experience brought by new technology to tourists has been a hot topic in the literature in recent years. It is worth noting that the narrative runs through the architectural design, space design, exhibition theme, visual guide design, product design and other fields of the museum.

Table 1. Theme of museum tourism.

Dimensions	Number of publications
MCCP	21
New technology	4
Visitor	10
Management	5
Narrative atmosphere	2
Activities	2
Location	1
Value	1
Museum role	14

2.2 The Multiroles the Museums

There is a lot of literature on the multiroles of museums, and 11 related literatures are listed in this literature review. A museum is generally thought of as a building that protects and preserves ancient objects, treasures, and artefacts and meets the audience. In the year 1946-1947, the International Council of Museums （ICOM） birth and grows up. In 2004, ICOM opens to Asia. The most recent conference was held in Prague on August 24, 2022, to update the definition of a museum as follow：

"A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing."

Walhime divided the development of museum tourism into five stages, as shown in Table 2 [18]. Museum 1.0 originated from the temples of muses in ancient Greece. The first museum to display, exhibit, preserve and classify by stage of historical development was named the museum of Alexandria, founded in the fourth century. As a cabinet of curiosity, museums display those unusual and rare cultural treasures, which are mysterious, authoritative, noble and elite. This period as called Museum 1.0 (pre-industrial), which is based on patronage and is typical of the pre-industrial economy [15]. Thus, the Museum 1.0 was neither an economic sector nor a large audience. In the 19th century, under the process of industrialization and urbanization, modern printing, photography, film, broadcasting and other cultural industries appeared. Mass culture and increasing economic consumption determine that museum tourism will play a more complex role in the audience. Visitors' participation in museum activities, access to education, interaction, entertainment experience, enjoyment of food and purchase of cultural and creative products made up Museum 2.0 [16].

If Museum 2.0 is the expansion of the cultural market, Museum 3.0 is a broader platform for participation. Passive audiences are replaced by other forms of participation, and the roles of producers and users are reversed [15].

Museum 4.0 adds digital tools and resources to visitors' physical access. Based on the Museum 1.0, 2.0, 3.0 added customized services for visitors. Parallel to the Museum 4.0 concept, Museum 4.0 Steam pushes the boundaries of museum walls to form an informal but more participatory concept of museums [18].

Table 2. The development phase of museum tourism.

Stage	Date	Main Trait
Museum 1.0	530BCE-1899	"Cabinet of Curiosity"
Museum 2.0	1899-1969	"Collector vision-driven" "Interactive Museum"

Museum 3.0	1969-1987	Open Ended, Constructivist multi-layered, visitor-centric, informal education, encourages conversations
Museum 4.0	1987 - Present	The museum experience can be customized
Museum 4.0 Steam	1987 - Present	·Without wall（pre-visit，in-person visit，post visit） ·Visitor Predicative and Customized · Community-Based ·Open Source ·Project based, Haptic and Digital HCI

(Source: Adapted from Walhimer, 2016)

2.3 The relevant publication on cultural and creative products transformed from heritage using narrative design

The narrative design originated from narratology theory, developed and integrated with semiotics, and was introduced into landscape design, architectural design, animation design and product design in the 1990s [2]. The story of museum culture itself is presented to the audience through cultural relics, texts, images, etc. The designer forms a new narrative through element extraction to create MCCP, and the audience visits the museum shop to get in touch with the story given by the designers. The viewer makes a purchase, takes the product home, and the associated museum value is taken out of the museum, or back home, or as a gift to a friend. However, at this time, consumers will tell their own travel stories and understanding of the museum's culture to their children and relatives through stories, forming their unique narratives. Grimaldi et al. classified the definitions, typology and function of narrative in design [9]. Some articles also use specific case studies to explain how to use narrative attraction in museum planning, such as scavenger hunt strategy, social media strategy and other activities [3].

3. Commonly Used Data and Analytical Methods

Most studies have used questionnaire, observation and interview and expert consultation to collect data from visitors, employees, curators and experts. For example, an ongoing ethnography-inspired research of recent history museums in the Baltic, through a mixture of non-participant observation and in-depth interviews with staff and visitors and constitute a portion of a larger project verifying museums presenting similar subjects across Central and Eastern Europe [5]. In the questionnaire demographic information and construct variables are included based on the literature review, in-depth interviews [7,10,12]. The analysis of tourists´ preferences was a research method selected by a large number of articles. Teachers and students who are familiar with museum culture are invited to rate creative products based on the popularity, expression and usability. Some articles also use the comparative observation method to list the evolution process from cultural relics to creative product [17].

The previous literature mainly analyzed the data in the following ways: (1) Exploratory factor analysis (EFA), (2) Confirmatory factor analysis (CFA), (3) Structural equation modeling (SEM), (4) SPSS, (5) Comparative analysis, (6) Coding.

4. Conclusion and Limitation

The publication on museum tourism is a hot topic that still growing and capturing the interest of museums, design, government, cultural industry and tourism experts. This study shows that MCCP can shape a museum's brand image to some extent. In a sense, cultural and creative products are also selling museums, rather than museums selling cultural and creative products. There is a lack of research from the museum culture to a designer to audience, taking the story as the main plot which needs to be in-depth in the future. There are few documents creative thinking process of artist, and most of them are workshop creation materials. Moreover, New technology is also a factor that cannot be ignored in

promoting the development of MCCP and giving the audience a more diversified experience. Therefore, in the future, museums will play a more democratic, liberal and youthful social role.

Acknowledgement
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Factors That Cause Slow Acceptance of Data Analytics in Facilities Management in Malaysia

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Abstract. Data analytics is a relatively new science of analysing raw data in order to produce new information and make conclusions about that information. It assists organisations in extracting insights and information from their data to make informed decisions and improve performance. Facilities management (FM) is one of the industries that can benefit from leveraging data analytics in their operations. However, despite its potential benefits, the FM industry has been slow to adopt data analytics, and the factors behind this reluctance need to be understood. To address this issue, this paper aims to determine the factors that cause the slow acceptance of data analytics in Facilities management in Malaysia. A questionnaire survey among facilities managers in Malaysia was conducted, with a total of thirty-one respondents participating in the survey. The result of the survey was analysed using frequency to assess the prevalence of the various factors. Additionally, the Relative Importance Index (RII) was calculated to determine the relative significance of each factor. The result showed that organisational inefficiency is the top-ranked factor contributing to the slow acceptance of data analytics in Malaysia. While the sub-factors under every prime factor are ranked accordingly. The findings of the study could act as a basis for further studies as well as the development of strategies to promote the widespread adoption of data analytics in facilities management practices in Malaysia.

1. Introduction

The increase in the integration of data into our daily lives from various sources has led to a massive amount of information, which has driven the emergence of data analytics. Recognising that data is not merely a by-product but a potential avenue for gaining a competitive advantage in the future [1], organisations have come to understand its strategic importance. According to [2] data analytics is a set of techniques that focuses on gaining meaningful insight from huge amounts of data in order to make informed decisions. These techniques involved uncovering the hidden patterns and trends that might otherwise remain concealed enabling organisations to anticipate future scenarios and devise strategic plans accordingly.

As a result, numerous sectors have adopted data analytics to optimise their organisational processes and decision-making capabilities. This sentiment aligns with the insights by [3] highlighting the growing reliance of organisations on data analytics as a critical component of business strategy and the enhancement of decision-making processes. However, [4] argue that firms must increase their data analytics competency (the capacity of a company to successfully employ data analytics-based resources

in combination with other related sources and competencies) in order to make better, more informed, and faster decisions.

The field of facilities management recognises the increasing significance of data analytics in its operations. [5] emphasised the abundance of data generated within the FM sector, encompassing various details like maintenance work specifics, job type and required skills, time spent on the job, travel time, location, site, spatial and temporal data. This diverse data landscape presents a unique opportunity for FM professionals to leverage data analytics techniques, enabling them to gain valuable insight into their operational practices. As FM holds a pivotal role in supporting the effective functioning of core businesses, the decision-making process within this field carries significant importance. [6] highlighted the competitive and complex nature of the FM industry, necessitating fact-based decision-making and analysis for survival in the industry. Several studies have highlighted the potential of data analytics as a viable solution for FM, recognising its ability to address the challenges faced by organisations. With its promising aspects, data analytics emerges as a key pursuit for FM organisations and will be used to increase operational effectiveness in the future of facilities management [7], [8].

In addition to empowering decision-making processes, data analytics could help improve operational efficiency in numerous ways. A study by [9] found that data analytics has a positive and significant impact on organisational performance. By using data analytics in an organisation, it can help to provide organisations with meaningful insights, allowing them to make data-driven decisions and operational enhancement. For instance, predictive analytics, such as forecasting future trends, can be facilitated through data analytics and proves to be a valuable tool for organisations to derive actionable insights and improve their overall performance and efficiency [10].

Despite the growing acknowledgement of the importance of data analytics in FM, the field encounters hurdles in fully embracing this transformative approach. The FM sector often faces problems in adopting new methodologies and technologies, leading to a delay in leveraging the full benefits of transformation and technology integration. This delay can be attributed to several factors, as identified in a study by [11] in the context of sustainability in FM practices, the most significant barriers are lack of understanding, focus and commitment of management in grasping the potential and risks. [12] on the other hand stated that to reap the benefits of new technologies and remain competitive, organisations must undertake large-scale changes in the operating system, business models, and organisational structure, which renders various problems such as cost, lack of required competencies, and resistance to change. Therefore, a lot of factors could contribute to the conservative adoption of technology in the FM sector.

In recent years, the FM sector has experienced the emergence of new technologies, leading organisations across diverse industries to enthusiastically adopt and integrate them into their operations. However, despite this wave of technological progress, the FM sector has exhibited a slower uptake in fully capitalising on the immense potential offered by these advancements. Embracing technology within the FM industry can yield numerous benefits for professionals in the field, FM professionals [9] highlighted firms that employ data analytics become proactive and future-oriented, lowering client acquisition costs by 47% and increasing firm revenue by 8%. However, there is still a lack of research focused on understanding why the FM sector continues to be slow to adopt data analytics. To fill this gap, this study aims to identify the factors that contribute to the slow adoption of data analytics in facilities management in Malaysia.

2. Literature Review

2.1 Facilities Management

Facilities Management (FM) is gaining increasing recognition as a crucial contributor to the overall effectiveness of many organisations in the world [13]. The integration of processes inside an organisation to maintain and develop the agreed services that support and increase the effectiveness of its primary activities and user conveniences is known as Facilities Management [14]. These services include building and equipment maintenance and repair, utility management such as water and energy usage, waste management and the execution of security and safety measures. Its responsibilities extend

beyond mere maintenance and operations and encompass creating a comfortable environment that supports the core business, improves building occupant efficiency, optimises productivity, and cultivates a conducive atmosphere for innovation.

According to IFMA, FM can be defined as "an organisational function which integrates people, place, and process within the built environment with the purpose of enhancing the quality of life for individuals and improving the productivity of the core business". It can be summarised that FM is a multidisciplinary field that includes the management of numerous components of a physical environment to guarantee optimal operation, productivity, and sustainability.

2.2 Technology in FM in Malaysia

Limited technology adoption has been identified as a key factor impacting the quality of FM services in Malaysia, as reported by [15]. This lack of technological integration, as stated by [16], has resulted in low service quality within the country. Therefore, it becomes crucial for FM to recognise that offering excellent service is not merely a goal but a fundamental driver for overall organisational success. The enduring demand for FM is highly consistent and important as reflected in the timeless saying, "As long as buildings exist, there will be a demand for facilities management" [17]. Given its critical role in the built environment, it is imperative to initiate necessary improvement and implement reforms within the FM sector.

The current condition of FM in Malaysia calls for a strategic and forward-thinking strategy to maximise the potential of technology. The Malaysia FM sector may improve operation efficiency, remain competitive, and satisfy the increasing needs of the built environment by embracing innovation and actively adopting technological solutions. FM in Malaysia may position itself for long-term growth and success in the digital era through collaborating, sharing expertise and being willing to embrace change. Based on a survey by [13], Hong Kong and Singapore have shown clear signs of improvement in the FM sector, whilst Malaysia shows mixed signals, with minimal visible progress and a lack of practical advancements. This emphasises the importance of Malaysia's FM sector to proactively address current gaps and accelerate the pace of technological integration. By doing so, the industry can unlock several benefits and foster major advancements in productivity, market position and overall service delivery.

2.3 The Role of Data Analytics in FM

The rapid expansion of data analytics tools, as well as the acceptance of the concept in the public and corporate sectors, leaves little time for academic discourse to evolve and mature [18]. Facilities management is a complex field that covers all areas of real estate, space, environmental control, health and safety, and support services [19]. To effectively manage these resources, facilities managers rely on accurate data and insights to make informed decisions and optimise operations. Data analytics is the process of evaluating large datasets to identify unseen patterns, market trends, and other business insights to improve decision-making and its connection to other data-driven technologies [20], [3], [21]. By leveraging the power of data analytics, Facilities managers may improve their ability to proactively address maintenance needs, optimise resource allocation, and offer superior service quality in a data-driven FM environment.

In today's modern era of FM, the seamless integration of data from diverse sources, including IoT devices and building systems, plays a pivotal role. The Internet of Things (IoT) represents the evolution of the internet, enabling processing devices integrated into everyday ecosystems to independently transmit and receive data [22]. Within this interconnected landscape, sensors and IoT devices continuously collect and transmit data on various aspects of facilities operations, such as energy consumption, temperature, humidity, occupancy levels, and equipment performance. This wealth of data can be analysed using advanced analytics techniques to derive valuable insights. Additionally, [23] support this by highlighting how sensors and IoT devices are connected to a smart network and therefore gain communication capabilities and are able to collect FM-related parameters in the form of Big Data. Therefore, FM practitioners can unlock the potential of this data by using the power of data analytics,

enabling informed decision-making, resource optimisation, and improving facilities management outcomes.

2.4 Impact of Data Analytics

Data analytics has become an important tool because only valuable information is analysed and retrieved, which makes it essential for the FM sector [10]. The impact of data analytics in FM is profound and has the potential to revolutionise the way facilities are maintained. According to [24], the current technological advances in data collection and analysis of massive data sets are likely to lead to revolutionary changes in business, and society. Therefore, it could bring benefits to the organisations. [8] highlighted data analytics allow for the discovery of important information and hidden values, which may then be used to assist evidence-based decision-making. The ability to analyse data and derive actionable insights enables FM teams to handle maintenance needs proactively, predict equipment failures, optimise energy use, and provide a better customer experience.

[25] classified data analytics into four types which are **Descriptive Analytics**: Organise data in visual formats, allowing for easy understanding and insights. Next, is **Predictive Analytics**: Utilise the available data and tell what is expected to happen in the near future. **Exploratory or Discovery Analytics**: This discovers a surprising relationship between parameters in large data sets. The collection and analysis of data from many sources provided the extra potential for insights and fortuitous discoveries. Lastly, **Prescriptive Analytics**: Based on the data acquired, opportunities to optimise solutions to current problems. In other words, the analysis advises us on what to do to achieve a goal. These analytics enable the execution of maintenance initiatives. FM teams can foresee future issues and plan maintenance tasks before problems occur. This proactive strategy reduces downtime, increases equipment lifespan, and lowers the expenses associated with reactive maintenance.

2.5 The Adoption of Technology in FM in other countries

The integration of technology in the FM industry has become increasingly prevalent in countries all over the world. This trend may be seen in countries such as the United States, the United Kingdom, Australia, Singapore etc. Facilities Management firms in the United States, for example, have adopted technology to streamline their operations and boost productivity. This includes monitoring and maintaining equipment using computerised maintenance management systems, Internet of Things devices, and advanced analytics. Many academics have extensively discussed this topic, which has become the subject of study in recent years. This is supported by a study conducted by [26], A significant scientific output was observed in the UK, Australia and China and the findings indicate a substantial increase in the number of publications with an annual growth rate of 220.11%. This demonstrates the increasing interest and recognition of the role of technology in Facilities Management.

The implementation of technology in FM is not limited to specific countries but is a global phenomenon. A prime example of this global trend can be seen in a case study conducted by [8], which focuses on the California Institute of Technology (Caltech). In the study, Caltech revamped the structure of its FM department to incorporate data-driven decision-making processes specifically tailored for educational facilities. This transformation allowed the FM department at Caltech to improve the overall efficiency of FM on campus. Consequently, this case study serves as a compelling example of how embracing technology in FM can drive substantial improvements in operational efficiency and service quality.

Technology in the FM industry extends beyond data management and data science and encompasses a wide range of tools and solutions. Notably, technologies such as Building Information Modelling (BIM), Computerised Maintenance Management Systems (CMMS) or Building Automation Systems have found widespread use in FM. These technologies have a disruptive impact on the FM sector. BIM, for instance, is the process of creating and managing information about a building over the course of its existence [27]. In addition, many countries including the United Kingdom, Italy and Brazil have pushed for BIM adoption [28]. Whilst CMMS enables companies to manage their equipment by arranging inspections and maintenance, as well as management supervision procedures and service documentation

[29]. On the other hand, BAS controls the conditions of the interior environment automatically [30] where it automates and manages vital processes within a building. In addition to that, smart cities have also been utilising technology to improve facilities management.

Furthermore, the concept of smart cities has also leveraged technology to improve facilities management. Cities such as Agra, Chandigarh, Vadodara, Bengaluru, and Kakinada have effectively harnessed technologies like IoT, telehealthcare and data analytics [31]. Smart cities integrate technology, data analytics and proactive maintenance practices to create sustainable, efficient, and user-centric urban environments.

Among the various technological advancements, data analytics has emerged as one of the critical components in technology that have the potential to enhance FM practices in other countries. A well-designed data analytics strategy enables organisations to access and analyse massive amounts of data, extracting relevant and actionable insights [31]. The convergence of IoT and Data Analytics has transformed the field of FM, allowing organisations to use real-time insights to improve decision-making and operational efficiency. For instance, in a case study conducted by [22] on Al Nabooda Chulia Facilities Management Co LLC (AN.C), the integration of IoT and data analytics has reduced management costs and improved FM performance and service quality. By leveraging data analytics, FM professionals can unlock new opportunities, promote innovation, and build sustainable and thriving built environments.

Overall, technological adoption in FM is a worldwide phenomenon with many countries recognising its transformative impact. Nations are improving operational efficiency, sustainability, and overall service quality in the FM business by embracing technologies such as Building Information Modelling (BIM), Computerised Maintenance Management Systems (CMMS) and Building Automation Systems (BAS). This ongoing global trend emphasises the widespread acceptance of technology as a critical enabler of good facilities management.

2.6 Factors that Cause Slow Acceptance of Data Analytics in Facilities Management in Malaysia

The use of data analytics in facilities management has the potential to transform how businesses manage their physical assets and operations. However, the gradual acceptance of data analytics in Malaysia can be attributed to several contributing factors. According to a notable study undertaken by [5], the field of data science (which includes data analytics) has received little attention within the facilities management sector, despite the potential benefits that have been realised in other disciplines. This lack of emphasis on data analytics in FM can be linked to a number of factors, including a historic dependence on manual methods and a reluctance to embrace technological advances.

To shed light on the underlying reasons for this gradual uptake, a study by [32] relied on an extensive analysis of previous research. The list of the factor sources in Table 1, presents all factors from various sources. Through this comprehensive review, they identified three primary factors and eight sub-factors that collectively contribute to the slow adoption of data analytics in Facilities Management. The three primary factors identified in the study are technology integration, organisational inefficiency, and financial constraints. The first primary factor is technology integration, where according to [33] there is a lack of integration of data analytics technology is due to a lack of technical support and use of analytical techniques. This integration hinders the effective implementation and utilisation of data analytics in FM in Malaysia. The second primary factor is organisational inefficiency, which refers to the organisational barriers that impede the adoption of data analytics in FM. These barriers include resistance to change, staff constraints and data management issues. According to [34], organisational barriers have been one of the main hindrances to the adoption of data analytics. Addressing these issues is crucial for organisations to fully realise the potential of data analytics and resulting in enhanced operational efficiency and informed decision-making processes. The third primary factor identified in the study is financial constraints. This factor refers to the financial challenges faced by organisations in implementing data analytics in FM. Inadequate financial resources or financial readiness to bear the costs of data analytics and implementation can result in substantial failure, which can hinder the data analytics process [35].

Furthermore, in the study, eight sub-factors that contribute to the slow adoption of data analytics were identified. For the first prime factor technology integration, the sub-factors include are software interoperability, lack of knowledge in technology, cyber security and data privacy and data quality issues. For software interoperability, the lack of compatibility and interoperability between FM software and data analytics tools restricts the seamless integration and utilisation of data analytics in FM. This is consistent from a study by [36], the data source systems created by different vendors do not speak the same language hence the FM industry had been long troubled with interoperability issues between its diverse systems. For the second sub-factor lack of knowledge in technology, organisations must have a deep understanding and expertise in data analytics to implement analytics in FM. In line with [37] the more knowledge that is created and shared, the easier it is for an organisation to adapt new technology and more likely to survive. Moreover, organisations must also address the sub-factor of cybersecurity and data privacy. According to [38], there is great public concern about the improper use of personal data, particularly through the linkage of data from numerous sources. In addition, buildings might be regarded as simple targets for organised criminals looking to conduct research on a company as part of a targeted attack [36]. Lastly, sub-factors in technology integration are data quality issues. Data quality is crucial for effective data analytics in FM. However, many organisations struggle with data inconsistencies, inaccuracies, and incompleteness. Inconsistent data collection and report creation led to a data gap in the process [8].

In addition to the sub factors in technology integration, there are also sub factors in organisational inefficiency consist of work culture, lack of staff and data management. Work culture is a very important factor in the organisation. It is the organisation's foundation and is critical since it permeates all functions, even technological advances [37]. By addressing the work culture and fostering a data-driven mindset, organisations can create an environment that values data analytics in FM. Additionally, the lack of staff with adequate knowledge and skills poses a challenge to the implementation of analytics in FM. Data scientists, as many people call the quantitative geniuses who can transform data into actionable insight, are scarce in the market [39] This is also supported by [40] who stated data analytics nowadays lack trained personnel or staff with analytics skills. Lastly, the sub-factors included is data management. Data management plays a critical role in ensuring the success of data analytics in FM. Data is unstructured and arrives at a rate that prevents traditional methods of gathering and processing it from keeping up [39]. [40] also adds the ability to process enormous datasets and vast amounts of data remains a key barrier for older data processing programs and relational database management systems. Hence, data management is crucial to ensure the data is accurate, consistent, and easily accessible.

Following the sub-factors in the third prime factor which is financial constraints, companies must carefully consider the costs associated with implementing data analytics in FM. Lack of budget is usually considered as the biggest challenge in adopting data analytics. A significant financial burden is imposed by the high cost of digital infrastructure and data analytics technology [35], [34]. However, this is contradicted by [38] even though the cost of full integration is often prohibitively expensive, and analytical requirements change frequently, "pay-as-you-go" integration solutions offer an appealing "relaxation" to the management. Other than that, the expensive maintenance cost of data analytics systems can also deter organisations from investing in such technology and it is the second sub factor in financial constraints. Although it is affordable, establishing and maintaining analytics infrastructure costs a significant amount of money [39]. Overall, understanding and addressing these factors could play a crucial role in accelerating the integration of data analytics in ushering in transformative changes within the FM sector.

Table 1. Factors categories in previous studies

References	Categories of Reasons	Reasons	Description
[41], [8], [36]	**Technology integration**	Software interoperability	- Data processing software - Need to insert data manually - Issues between diver systems
[42], [34], [36]		Lack of knowledge of technology	- Lack of competence - Employees prepared knowledge - Falling behind in human expertise and talents
[36], [40]		Cyber security and Data Privacy	- The inability to control data has consequences - Strong security infrastructure
[8]		Data quality issue	- Inconsistency in data collection and report creation
[43], [44], [39]	**Organisation inefficiency**	Work culture	- Impact on organisation positively and negatively - Resistance to early adoption of technologies - Cultural change
[8], [40], [39], [41]		Lack of staff	- Lack of trained personnel - Lack of skilled staff with analytics skills - Scarce in the market - Shortage of qualified individuals
[40]		Data management	- Ability to process large datasets
[36], [8], [39]	**Financial constraints**	Lack of budget	- Expensive add-ons - FM struggle to have financial stability

The adoption of data analytics has grown in various industries as organisations recognise the value of leveraging data for decision-making and to achieve a competitive advantage. Data analytics has gained attention due to its ability to provide insightful and actionable information that can drive business success [45]. During the journey of embracing new technology, there are various factors found during the implementation. These factors can influence the adoption of data analytics within organisations and determine their success in utilising this technology.

The advancement and growth of social networking, e-commerce websites, improved mobile technologies, search engines, and new digital technology have increased the amount of data [46]. Consequently, there is a growing need for organisations to effectively manage and analyse this vast amount of data including temperature, humidity, energy, and operational data [36]. FM also faces the challenge of managing a substantial amount of data covering almost the entire lifecycle of a building [26], making the adoption of data analytics essential in addressing this challenge. The primary goal of this research is to identify the factors that lead to the slow adoption of data analytics in Malaysian Facilities Management (FM). By undertaking an in-depth examination of existing studies and investigating the underlying causes for this delayed uptake could help overcome the barriers and accelerate the integration of data analytics within the FM industry in Malaysia. Tackling these problems are critical step towards realising data analytics' revolutionary potential and supporting its efficient use in FM practices.

3. Methodology

This study was quantitative in nature and used online questionnaires to collect data for efficient and convenient data gathering. To accomplish the objective of this study, the researchers initiated a comprehensive procedure of identifying the respective companies. Fifty facilities management companies in Malaysia were identified from the Malaysian Association of Facilities Management (MAFM) website and various directories. All fifty facilities management companies were approached to participate in the survey. After several follow-ups, 31 companies responded to the survey. Thirty-one companies is reasonable and sufficient as suggested by [47] and [48]. It is acknowledged that responses from all 50 companies would be ideal. However, 31 responses out of 50 constitutes 62% of the total identified population and could provide a generalisable understanding of the factors impacting the slow acceptance of data analytics in facilities management in Malaysia.

This survey consisted of two-parts Part **A**: Main Factors Affecting to the Slow Adoption of Data Analytics and **Part B**: Detailed Factors Influencing to the Slow Adoption of Data Analytics in FM. In Part A, the focus was on the factors contributing to the slow adoption of data analytics in FM. The respondents were presented with three main factors identified as potential factors: technology integration, organisational inefficiency, and financial constraints. They were asked to rate these issues based on whether they agreed or disagreed with their influence on the slow adoption of data analytics in FM. The Likert Scale was used, with a rating of 1 (Strongly Disagree) to 5 (Strongly Agree). The study aimed to measure respondents' perceptions and insights regarding these aspects and their impact on the adoption of data analytics in the FM sector by obtaining their evaluations. This quantitative approach provides a formal framework for gathering the perspectives of the participants, enabling a comprehensive analysis of the perceived factors to data analytics adoption in FM in Malaysia.

Part B of the study included a detailed exploration of the factors influencing to the slow adoption of data analytics in FM was conducted. Technology integration, organisational inefficiency and financial constraints were the main factors that were examined. Under the main factor of **technology integration**, sub-factors such as software interoperability, lack of knowledge on technology, cyber security and data privacy and data quality issues were identified. The following major issues, **organisational inefficiency**, the included sub-factors are work culture, lack of staff and data management. Lastly, under the main factor of **financial constraints**, two detailed sub-factors were considered: lack of budget and expensive maintenance costs. Respondents were given a series of statements representing these precise sub-factors and asked to rate their level of agreement or disagreement with each statement. The responses were given on a Likert Scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The study aims to acquire deeper insights into the detailed subfactors.

Frequency calculation was used to establish a descriptive occurrence and distribution of various responses on the factors. This achieved objective 1. The result from objective 1 was then used to establish the Relative Importance Index (RII) to determine the criticality of the factors. The RII formula is as shown below (1).

$$\boldsymbol{RII} = \frac{\sum \boldsymbol{W}}{(\boldsymbol{A} * \boldsymbol{N})} \tag{1}$$

Where:
RII - Relative Importance Index
W - is the weight assigned to each factor by the respondents ranging from 1 to 5; such 1 indicates the least implying (Strongly Disagree) and 5 indicates the most implying (Strongly Agree)
A - Highest weight (in this case is 5)
N - Total number of respondents

4. Result and Discussion

Table 2. Frequency Main Factors

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Technology Integration	0	1	10	12	8
Organisational Inefficiency	0	2	6	13	10
Financial Constraints	0	3	6	11	11

Table 3. Main Factors

Factors	RII	Rank
Technology Integration	0.7742	3
Organisational Inefficiency	0.8000	1
Financial Constraints	0.7935	2

Based on Tables 2 and 3, among the three main factors, "organisational inefficiency" is considered as the most influential factor with an RII of 0.8000. This finding emphasises the importance of resolving organisational inefficiencies plays a significant impact in the successful deployment of data analytics. These inefficiencies might manifest resistance to change, lack of staff and data management. In previous research, the study by [35], organisational structure has been widely mentioned as one of the most significant barriers that influence the success of data analytics projects.

Followed by "Financial Constraints" with an RII of 0.7935 highlighting the influence of financial considerations in impeding the broader adoption of data analytics. For organisations with limited financial resources, the costs involved with data analytics adoption, such as investing in complex technologies, training and maintenance can pose substantial challenges. This finding resonates with studies by [35], [36], which highlight that data analytics adoption is costly and in need of a cost-conscious approach to cover the initiatives.

Lastly, "Technology Integration" is the third rank main factor with an RII of 0.7742. This shows that the inconsistent integration of data analytics within existing organisational systems affects the adoption and wider acceptance of data analytics. Research by [49] declared that data analytics integration is one of the significant leading variables in setting the manner that would support the industry's efficiency.

Table 4. Frequency Technology Integration Sub-Factors

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Software interoperability	0	4	8	11	8
Lack of knowledge in technology	0	3	4	8	16
Cyber security and data privacy	0	3	6	8	14
Data quality issue	0	1	9	13	8

Table 5. Technology Integration Sub-Factors

Sub-Factors	RII	Rank
Software interoperability	0.7484	4
Lack of knowledge in technology	0.8387	1
Cyber security and data privacy	0.8129	2
Data quality issue	0.7806	3

According to Table 5, the top ranked sub-factors is "Lack of knowledge in technology" with RII=0.8387, This shows that the technology knowledge gaps lead to the slow adoption of data analytics. According to [50] over two-thirds of skills are deemed significant in today's employment needs and one of the essential abilities is technology competencies. Addressing these knowledge gaps necessitates focused

training and upskilling programmes that provide staff with the capabilities they need to use data analytics.

Meanwhile, "Cybersecurity and data privacy" with RII=0.8129 is the second highest rank reflecting the critical relevance of data protection and privacy considerations in moulding stakeholders' readiness to embrace data analytics. This finding also supported from past research by [51] the difficult challenge of integrating data analytics in organisations due to factors such as data security and privacy, as well as technological variety, all of which have a negative impact on its adoption.

Followed by "Data quality issue" with RII=0.7806 emphasising the low of reliable and high-quality data to gain trust in the analytics process. [52] mentioned the importance of high-quality data in an organisation is to derive meaningful business outcomes. Without high-quality data, it contributes to the slow adoption of data analytics in organisations.

Lastly, the sub-factor in the fourth rank is "Software interoperability" with RII=0.7484 highlighting compatibility issues among various software systems leading to reluctance of adopting data analytics in FM. Incompatible software systems can obstruct data flow and integration, making it difficult for organisations to fully exploit data analytics.

Table 6. Frequency of organisational inefficiency sub-factors

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Work culture	1	1	6	12	11
Lack of staff	0	2	5	12	12
Data management	0	3	4	12	12

Table 7. Organisational Inefficiency Sub-Factors

Factors	RII	Rank
Work culture	0.8000	3
Lack of staff	0.8194	1
Data management	0.8129	2

Tables 6 and 7 show the highest ranked sub-factors is "Lack of Staff" with an RII of 0.8194. This result accentuates that workforce constraints play in impeding the seamless integration of data analytics initiatives and hindering widespread adoption. This is consistent with a previous study by [53] highlighted that it is critical for the maintenance department to have staff that are knowledgeable and skilled in all aspects of maintenance work. Without adequate staff especially in the specialised area, it will lead to the hindrance of adoption of data analytics in the organisation.

Secondly, in "Data management" with an RII of 0.8129, organisational inefficiencies in managing and governing data may lead to reduced trust in the accuracy and reliability of the data used for analytics. Inadequate data management practices, such as uneven data governance, inadequate data control, or a lack of data standardisation, can lead to a loss of trust in the accuracy and reliability of analytics data.

Lastly, the third rank sub factors are "Work culture" with an RII of 0.8000, unwillingness to change in work culture to adapt to new technology discourages the innovation of data analytics. This finding is similar to [54] who reported that employee resistance to change is a major cause of the innovative system's failure and negatively affects the relationship between intention to utilise and actual use of data analytics.

Table 8. Frequency Financial Constraint Sub-Factors

Description	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Lack of budget	0	1	7	12	11
Expensive maintenance cost	0	3	8	9	11

Table 9. Financial Constraints Sub-Factors

Factors	RII	Rank
Lack of budget	0.8129	1
Expensive maintenance cost	0.7806	2

Based on tables 8 and 9, the sub-factors that were examined as top-rank sub-factors is "Lack of Budget" with RII=0.8129. The critical role of finance may hinder the broader implementation of data analytics where organisations may find it challenging to allocate sufficient resources to invest in these kinds of technologies. This issue has been reported by [55] where facility managers are constantly under pressure to save cost while increasing efficiency and productivity, forcing them to balance facility requirements against financial constraints. Hence, they choose not to adapt latest technological advancements to save their budget.

Secondly, the second highest sub-factor is "Expensive maintenance cost" with RII=0.7806. This result emphasises the influence of continuing operating expenses in data analytics endeavours. The high expenses of operating data analytics systems and acquiring appropriate technologies may be a substantial impediment. According to [53] the budget allocation for maintenance work is shrinking year after year and as a result, managers confront challenges in carrying out maintenance tasks due to lack of funds. Since data analytics requires high maintenance services, thus many organisations opt to not implement data analytics in their organisation due to expensive maintenance costs.

5. Conclusion

This research delved into the adoption of data analytics in the FM sector, aiming to identify the factors that influence its delayed uptake. Through a comprehensive analysis of survey responses, key insights were collected to assist in overcoming these issues and promoting the widespread usage of data analytics in the FM industry. By understanding and addressing these key factors, decision-makers in the FM sector can focus strategies to overcome barriers and promote extensive data analytics integration by identifying and addressing these critical aspects. The analysis in this study gave valuable quantitative data and insights into the factors that lead to data analytics' delayed adoption in FM.

According to the RII analysis results, all of the components evaluated in this study have RII scores close to 1. This study demonstrates that each element has a substantial impact on Malaysia's slow adoption of data analytics in FM. The RII values which are close to 1, indicate a significant relationship between the identified characteristics and problems encountered while implementing data analytics in the FM sector.

The sub-factors analysis under "Organisational inefficiency" shed light on workforce-related problems, data management inefficiencies, and the need to develop a suitable work culture. While in the analysis of the sub factor in "Technology integration" emphasised the necessity of addressing knowledge gaps, maintaining data privacy and security, improving data quality, and encouraging software compatibility to promote smooth integration. Furthermore, the sub-factors under "Financial constraints" highlighted the financial constraints issue in adopting data analytics and the costs associated with it to maintain are known as major obstacles.

These findings provide an in-depth insight into the multiple factors or barriers to data analytics adoption in FM in Malaysia. To address these issues, strategic interventions such as targeted training and upskilling programmes, cost-effective data management systems, build a data-driven organisational culture are required. By overcoming these factors, organisations may unleash the revolutionary power of data analytics, paving the way for improved decision-making processes, optimised operational efficiencies, and long-term growth in the quickly changing landscape of data-driven enterprises. Overall, this study adds to the body of knowledge on the subject of data analytics adoption and serves as a significant resource for stakeholders seeking to leverage data-driven practices for organisational success in facilities management.

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A Bibliometric Analysis of Consumer Satisfaction of Internally Displaced Persons in Nigeria

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Abstract. Satisfying the needs of internally displaced persons (IDPs) is crucial to enhance their general well-being and productivity. This is the core goal of humanitarian agencies in areas where their services are needed. In Nigeria, the growth of IDPs is alarming, with their living conditions worrisome in spite of intervention through relief agencies' provision of relief materials. This study examines the satisfaction level among IDPs in Nigeria through Bibliometric analysis using Scopus extracted journals and Vosviewer to identify co-occurrence of keywords, co-authorship, country, and distribution, trends of publication growth, analysis on IDPs research in Nigeria in order to identify the distribution of publications, and gaps in the research and the present knowledge of the factors. The research was able to pinpoint keywords and the clusters of terms that make up the main research areas of food, security and, nutrition; Water, Sanitation and, Hygiene (WASH); Shelter and Settlement and, Health. This study will help to identify challenges at the IDP camps and aid policy makers use the research findings to measure performance in terms of customer satisfaction and the timely delivery and distribution of relief materials to IDP camps. Although, studies on IDPs have been carried out in different themes and areas, but not centred on IDPs satisfaction, therefore, this study is very critical to Nigeria as millions of people are displaced and research of this nature will bring about the satisfaction of IDPs for a productive life.

1. Introduction

[1] asserted that "*To better understand and meet the needs of IDPs, more resources and research are needed"*. In addition, according to Maslow's hierarchy theoretical studies, life can be deemed generally satisfying when these three criteria are met: the person achieves his or her life goals; the desired conditions are provided for his or her life and that of his or her family; and the individual's ideals and foxes are realized [2]-[4].

[5] opined that the logistics capability of retail operations significantly affects final consumer satisfaction. According to [6] a community-based, preventative strategy is the most effective way to protect the IDPs' health, and it depends on satisfying the following crucial health needs that includes; water, food, shelter and sanitation, security, clothes, blankets and other domestic needs, etc.

Achieving satisfaction and pleasant adaptation to future life changes is an essential issue in the studies of Internal Displaced Persons (IDPs) [7]-[9]. According to the Guiding Principles on Internal Displacement, IDPs are *"persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or*

human-made disasters, and who have not crossed an internationally recognized state border" [7], [10], [11]. According to [1], globally, there about 71.1million IDPS out of which 62.5million is as a result of conflict and violence in 65 countries and territories.

In other words, Nigeria accounts for about three million, six hundred and forty six (3,646,000) IDPs[1]. Hence, Nigeria ranks among the ten highest IDPs globally. Meanwhile, UNHCR's final budget for IDPs globally stood at $10.714billion globally for about 112.6 million for forced displaced persons and stateless people in 135 countries worldwide [12]. In addition, conflict is one of the major causes of the forced displacement of people from various homes [13]-[15], [6]. In Nigeria, the Boko Haram insurgency, banditry, ethno-religious conflicts, kidnapping, alongside other social vices has forced over three million people to flee for safety within Nigeria as internally displaced persons (IDPs) [17], [18].

Unfortunately, women, children, and the elderly are a significant proportion of the displaced persons who continually need basic, and psychological support [19]-[22]. The insurgency has not only forced people to flee for their safety, but it has also made it impossible for them to access water, food, shelter, and access to livelihoods [23], [24].

Result from studies have shown that displaced persons in Nigeria are faced with several challenges in their new dwellings, these include; lack of land ownership, living in substandard shelters, inadequate power supplies, use of unhygienic toilets, social isolation, and anxiety [17], [18].

[25]asserted that seemingly, the satisfaction of one level of need will influence the desire for and pursuit of other parts of human needs. Therefore, psychological theorists rate the requirements for safety and security behind the needs for physiological necessities like food, clothes, and shelter. [26], [27] argued that, customer dissatisfaction with disaster relief programs is often expressed through complaints, particularly when the things recipients did receive are not what they had anticipated. Meanwhile, [3] affirmed that, customers are not consistent; they are flexible in nature, and since the logistics service is exclusively for customers, the logistics service provider must be versatile as well and their strategies and objectives.

Satisfaction connotes a mixture of comparative level of expectations and perceived experience [28], [29]. Furthermore, [28]-[31] argues that consumer satisfaction could be influenced by both the product itself and the experience around its purchase. The main goal of humanitarian agencies is to satisfy the needs of IDPs and protect human dignity [32]. IDPs satisfaction is a measure of how happy IDPs' are with the services provided by humanitarian agencies in terms of the provision on their needs such as food and non-food items, shelter, health, and other socio-economic services[33]. However, uncertainties still surround IDPs' satisfaction in Nigeria. [34], [35] noted that consumer satisfaction is defined as a consumer evaluation of whether the service meets the customer's needs and expectations since every client has diverse expectations, depending on the situation. In this context, IDPs are referred to as consumers because they are the final user of relief materials provided by humanitarian agencies to meet their daily needs. In addition, they are often called victims in humanitarian logistics [36], [26].

Many research papers on different aspects of internally displaced people (IDPs) in Nigeria have been published, but little has been done in the way of article reviews. However, there haven't been any bibliometric analyses or evaluations of research production on internally displaced persons (IDP) in Nigeria published. Therefore, the aim of this study is to evaluate research on internally displaced persons (IDPs) and to identify its key characteristics.

Hence, a bibliometric analysis was conducted to evaluate the expansion of published works, countries and institutions actively involved influential articles, citation analysis, global collaborations, and journals that contribute to the field of research on internally displaced persons (IDPs). The goal is to notify academics about research gaps and effective publishing avenues, as well as Nigerian government officials and other IDP stakeholders, about areas that require research investment.

2. Methods and Materials

It is difficult for researchers to investigate current knowledge and future directions in any research subject because of the constantly expanding volume of publications of research on any issue [37]-[39]. Nonetheless, specific strategies, such as bibliometric analysis, are used to address the issue of a large

quantity of information that is available and the broad range of study themes and methodology [40], [41]. Additionally [42], [44] emphasized that bibliometric analysis enables scholars and researchers in gaining a comprehensive or even in-depth grasp of the general growth and consistently in a continually flowing state. Bibliometric is a rapidly expanding area of research that is already a recognized part of scientific inquiry and a quantitative approach to document [45], [46]. Hence,[(45], [47] noted that, the need for bibliometric came from the realization that no researcher could keep up with the rate at which literature was growing and changing using traditional bibliographic approaches and skills. However, bibliometric involves a quantitative analysis of several aspects of literary works that deals with a particular theme [48]-[50] in publication, authorship, and coverage by secondary journals, thereby providing valuable insights into the advancement of knowledge within the relevant domains. Therefore, this study presents bibliometric indicators of published literature pertaining to IDPs in Nigeria.

A bibliometric study was used to examine the bibliographic characteristics of articles on consumer satisfaction of Internally Displaced Persons (IDPs) in Nigeria which have been published between 2009 and June, 2023. The time period was selected since it coincided with the beginning of Nigeria's insurgency and the country's largest IDP displacement.

3. Data Source and Search Strategy

Data collection and pre-processing was conducted between July 7th and 15^{th,} 2023. Scopus database and Microsoft excel were used for the data analysis. Figure 1, presents the bibliometric workflow for the study. In bibliometric analysis, documents are retrieved from one single database and analyzed quantitatively and qualitatively. In this current study, SciVerse Scopus, developed by Elsevier, was used to elicit publications of Internally Displaced Persons (IDP). Meanwhile, Scopus database was selected for this study because of its numerous advantages over other databases such as Web of Science, Medline, and Google Scholar [37], [38], [42]. The data for this study was gathered using the Scopus database. According to scientific publications, the most extensive resources for performing bibliometric analysis are Scopus and Web of Science (WoS), but Scopus offers several advantages, among which are more content is covered by Scopus, which is also easier to use and offers personalized profiles for authors, institutions, and serial sources. Moreover, a higher number of unique sources are indexed by Scopus than by WoS which includes its concise and precise manner of handling bibliometric database indicators.

Specifically, the study examine the growth of publications, authorship, and geographical distribution, international research collaborations, important themes discussed, and highly cited articles pertaining to IDPs in Nigeria. After defining the databases, the search term: TITLE-ABS-KEY (internally AND displaced AND persons OR people) AND PUBYEAR > 2008 AND PUBYEAR < 2023 AND (LIMIT-TO (AFFILCOUNTRY , "Nigeria")) AND (EXCLUDE (LANGUAGE , "German") OR EXCLUDE (LANGUAGE , "Russian") OR EXCLUDE (LANGUAGE , "French") OR EXCLUDE (LANGUAGE , "Spanish")) were chosen.

The main topic of this study was research documents which include in the title, abstract, and keywords. The retrieved data were exported from Scopus as CSV and the exported data was prepossessed using Microsoft Excel, data cleaning, merger of similar keywords and author names, and exclusion of unwanted words were carried out. Data analysis was achieved carried using Scopus Journal Analyzer for publication performance analysis which include Yearly Analysis of Distribution of Articles, Documents by Source of Publications, Document Distribution by Countries, most active institution, Subject Area. VOS-viewer was used to analyze the co-occurrence of authors and for keyword analysis. See the bibliometric workflow in figure 1.

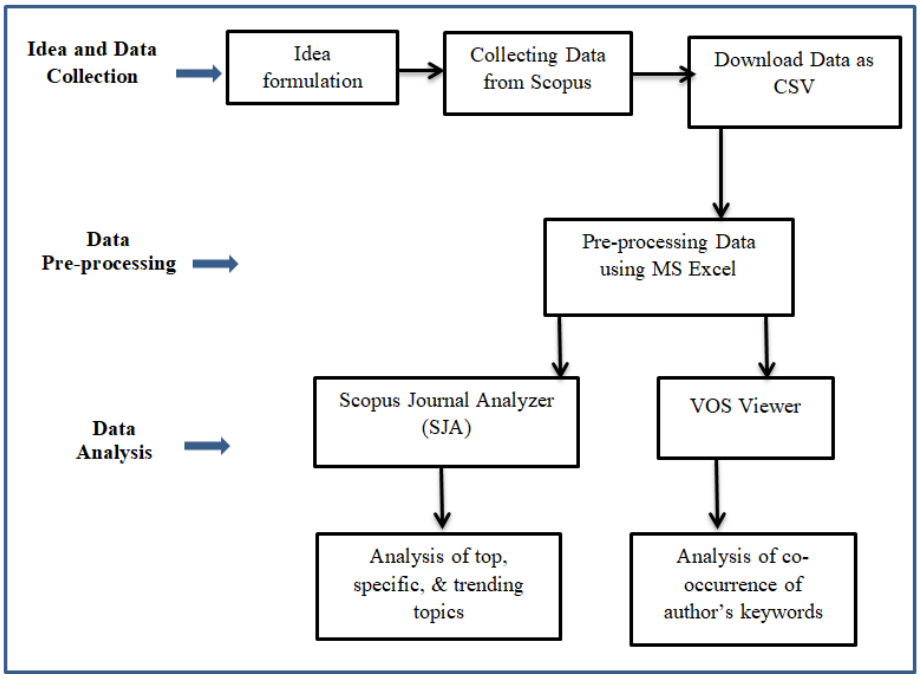

Figure1.Bibliometric Workflow

4. Data Analysis

4.1 Year Analysis of Distribution of Articles

Figure 2 shows the year analysis of publications on Internally Displaced Persons (IDPs) in Nigeria from 2009 to 2023. According to the analysis's trend, Nigeria has consistently published articles on internally displaced people. However, there has been a rising trend in publishing since 2017 as indicated. The highest publishing was in 2022 with a publication of about 45. This is closely followed by 2020 and 2021 which had 27 and 26 publications respectively, while the lowest was in 2010 with 0 publications, according to the figure. However, there is a downward trend in 2023 from 45 publications to 15 publications respectively as at July, 2023. The result further shows that, there has been a consistent journal publication yearly on IDPs in Nigeria.

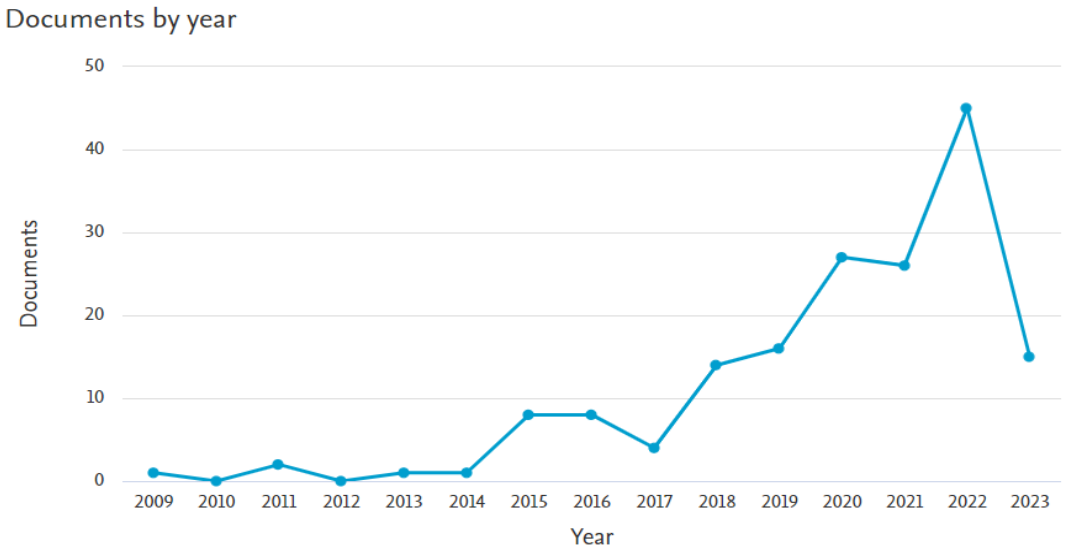

Figure 2. Analysis by Year of Distribution of Articles

4.2 Analysis of Documents by Source

Analysis of publications sources of research documents is as presented in Figure 3. Although, there is no mention of earlier publications from 2011 to 2021, Journal of Migration and Health had the highest number of 5 publications in 2022. The Journal of Refugee Studies, which has had 4 publications and has consistently published materials on the subject area since 2011, comes in second place. Beginning in 2020, the IFIP Advances in Information and Communication Technology Journal and the Journal of International Women Studies each had three publications. Undoubtedly, more sources will be included in paper journals as they become more prominent. The trend indicated that Journal of Refugee Studies dominates the sources of publication on IDPs consistently.

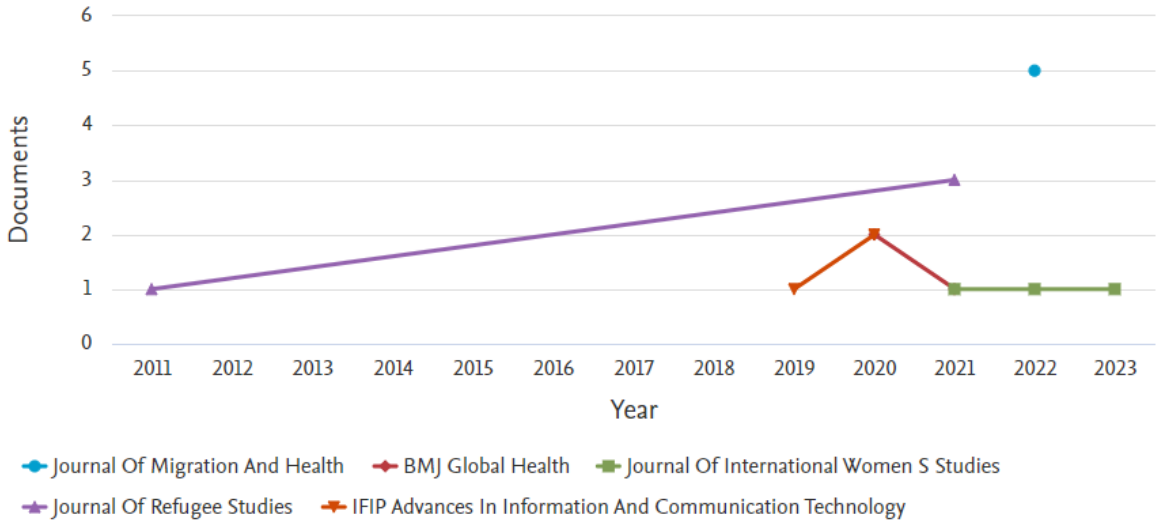

Figure 3. Analysis of Documents by Source of Publications

4.3 Analysis of Geographical Distribution of Contributors

About 10 countries were retrieved from the Scopus database, as shown in Figure 4. Nigeria, with roughly 118 publications, has the most authors who contributed to the publication of journal articles on the topic

among these 10 countries. This may not be unrelated to the recent wave of displacement that has occurred in Nigeria since the Boko Haram insurgency started in 2009. Therefore, this is buttressed by the Global Reports on Internal Displacement that Nigeria is one of the 10 nations with the highest number of internally displaced persons in the world [51], [52]. However, the United States with 26 publications, while United Kingdom had 21 publications respectively. Austria and Malaysia had 6 publications each. Germany and Switzerland are the two nations with the fewest publications—5 publications each. In the analysis of the geographical distribution of contributors, Nigeria dominates the list of contributors. This trend of publication might not be unconnected with the rising displacement of IDPs due to insurgency and other social vices such as kidnapping, banditry on a large scale in Nigeria.

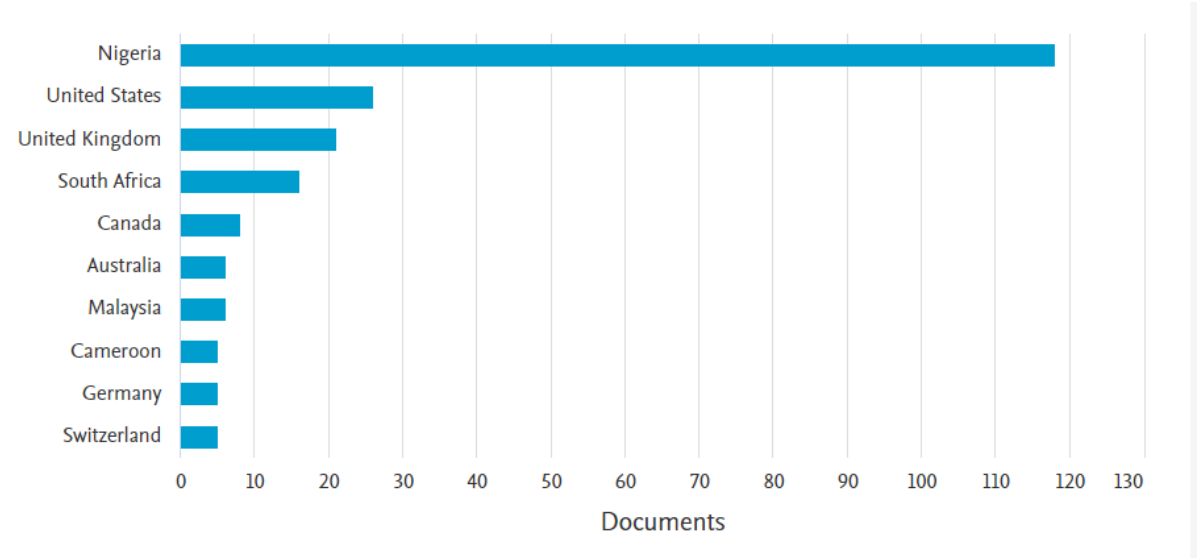

Figure 4. Analysis of Geographical Distribution of Countries

4.4 Institutional Analysis and Distribution of Papers

The institutional distribution of papers is depicted in Figure 5. The University of Nigeria (UNN) Nsuka has the most publications with roughly 49 over the time period under consideration. The University of Maiduguri comes in second place with a total of 8 publications published. It should be mentioned that the University of Maiduguri is situated in the region of Nigeria with the highest number of internally displaced persons. While Ahmadu Bello University and the University of Ibadan each had seven publications each, Covenant University had eight. University of Lagos has five publications, making it the university with the fewest. The analysis indicated that, University of Nigeria is the leading University with the highest number of publications on IDPs. University of Maiduguri closely followed which is also an indication that the University of Maiduguri is located where we have the largest concentration of displacement in Nigeria.

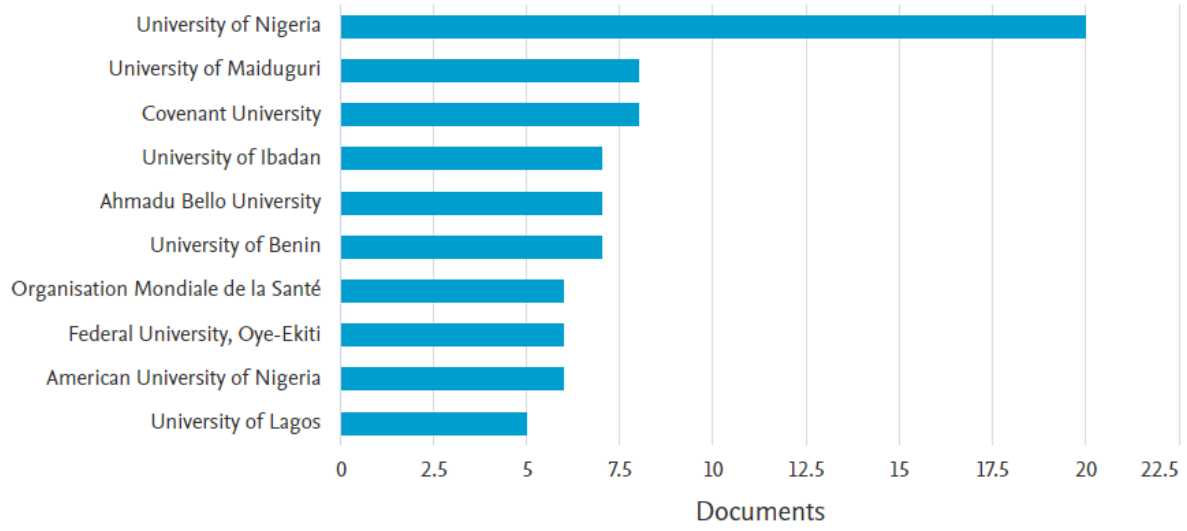

Figure 5. Institutional Analysis and Distribution of Papers

4.5 Analysis by Subject Area

Many subject areas of Internally Displaced Persons in Nigeria were explored in Figure 6. Accordingly, in figure 6, Social Science has the most publications (about 101 publications, or 38.8%), closely followed by Medicine (about 58 journals, or 25.3%), which has the second-highest number of publications. Engineering and business management, two other domains of human efforts, each had five publications, with a percentage of 1.9%. About 29 journals in other domains were present, accounting for 11.2% of the subject matter area's overall analysis. Furthermore, the connections of the authors showed that the internal displacement (IDP) study was within realms connected to almost all sectors of human activity due to the uniqueness of human existence and basic needs.

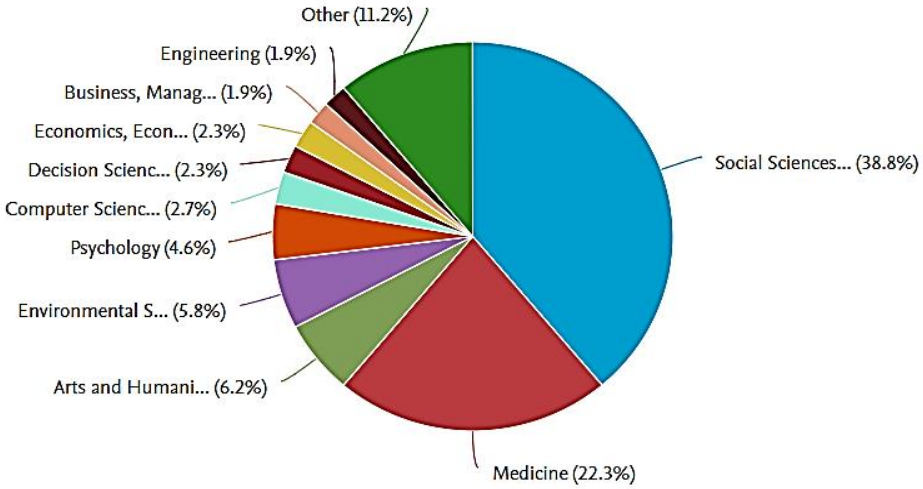

Figure 6. Institutional Analysis and Distribution of Papers

4.6 Analysis of Authorship and Publications Distribution

The majority of the authors have been consistent in their publications, as shown in Figure 7. However, Ifeagwazi, C.M. and Chukwuorji J.B.C. are the top writers, with 7 and 6 journals, respectively, to their credit. However, as seen in the figure, two other authors each have four publications, while about four authors have the same number of three publications.

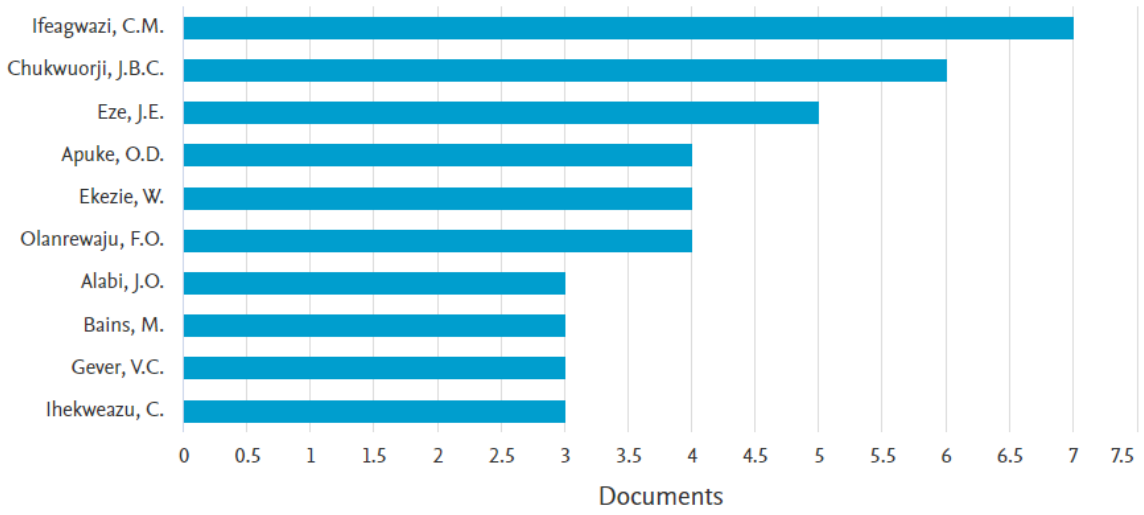

Figure 7. Analysis of Authorship and Publications Distribution

4.7 Co-occurrence of authors keywords

The Co-occurrence of keyword network is depicted in Figure 8. Result from Vos viewer shows a total of 999 keywords of documents between 2009 and 2023 the result dwelled on 4 occurrence of a keyword as a minimum criteria, however, 79 keywords meet the threshold. The co-occurrence network displays a node which represents keywords. The co-occurrence of two keywords is indicated by a link between two nodes; the thicker the line, the more frequently the keywords occurred together. Colours are used to represent keyword cluster, were in figure 8, three 3 major clustered are presented which include colour Red, Blue and Green. “Internal Displaced persons”, “Insurgency” and “Child” are the major keywords in red cluster, “health service”, “mental health” and “coping behavior ” are predominate in Blue cluster and “gender issues”, “depression” and “psychology” are dominate in Green cluster.

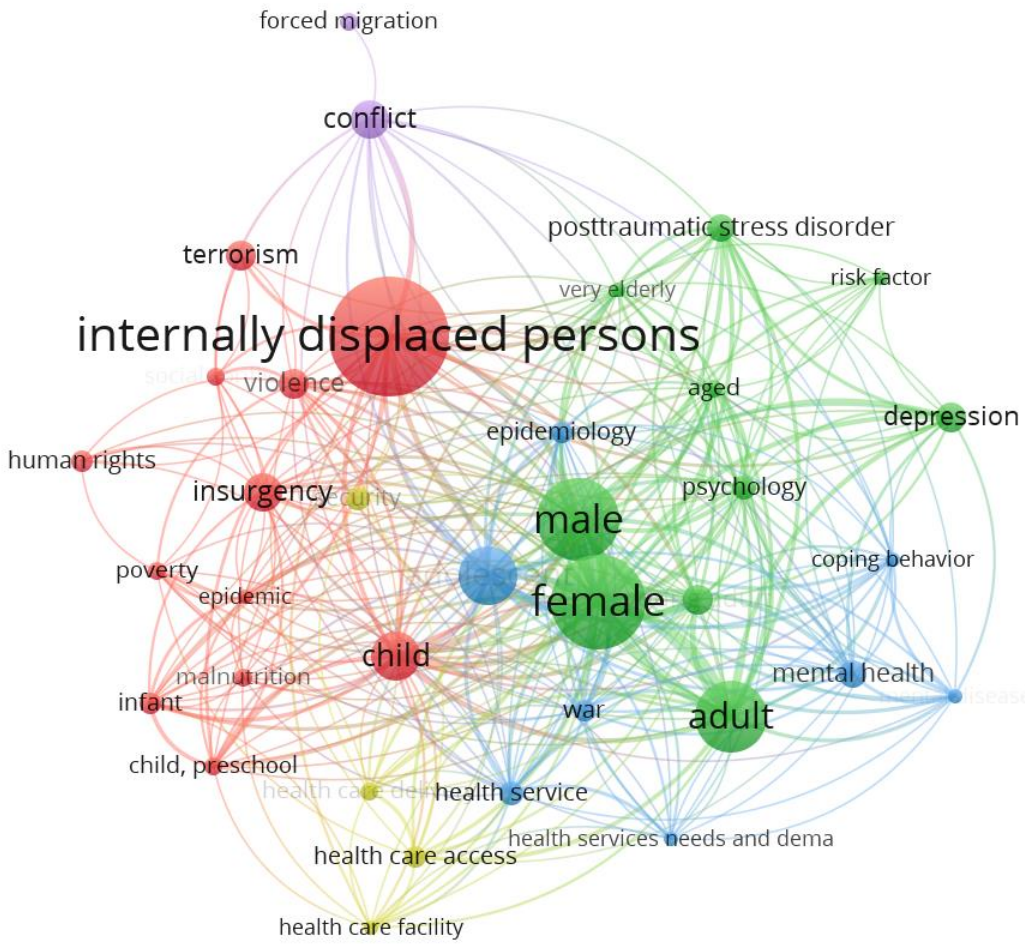

Figure 8. Keyword co-occurrence network of publications

4.8 Co-citation analysis of cited authors

Figure 9 shows the co-citations of publications by authors. Result from Vos viewer shows a total of 9,107 keywords of documents between 2009 and 2023, the result dwelled on 20 authors as a minimum criterion; however, 16 authors meet the threshold. Specifically, 3 clusters were identified which include; Custer Red with Olarewaju E.T. as dominate author, the cluster relates to "IDP resilience", also, cluster Green with Ugochukwu, U, relates to "Emergency Response" and the last cluster, Blue with Ifeagwazi, C.M, this relates to Psycho-social behaviour among IDPs.

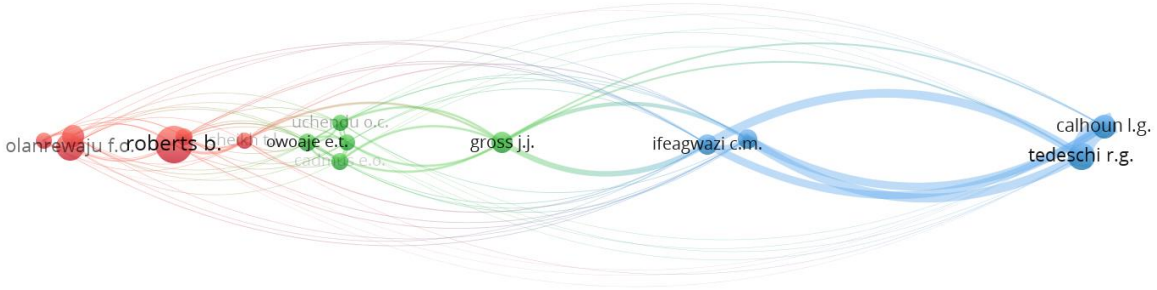

Figure 9. Keyword co-occurrence network of publications

5. Discussion

Generalized bibliometric analysis of Internally Displaced Persons in Nigeria from 2009 to 2023 is presented in this paper using Scopus, the publication performance and science mapping analysis of documents are presented and discussed intuitively as follows:-

- The production of document in the study has been on the rise since 2017, with the highest volume of publications in 2022. This steady increase in IDP population was buttressed by various researchers [18], [53]. Furthermore, [1] argued that, "*The extent, complexity, and scope of today's displacement crises are increasing, and new dimensions are being added to this phenomena by variables including food shortages, health challenges, climate change, and intensifying and protracted conflicts"*
- Journal of Migration and Health has more influence in the production of documents relating to IDP and migration. The prominence of the open source journal is its wide scope in any topics relevant to Migration and Health as well as provision of and access to healthcare and related topics.
- In geographical distribution, Nigeria has the highest publications on satisfaction of IDPs in Nigeria; however, USA and number of European countries were active in document production.
- University of Nigeria Nsuka is the leading institution in document production on IDPs in Nigeria, followed by the University of Maiduguri and Covenant University. Six (6) of the top 10 institutions with influence on IDP research are located in the Southern part of Nigeria while two (2) in the Northern part of the country
- In terms of subject area, Social science conducts more research in the study area compared to other area of study, and closely followed by researchers in the medical field. However, due to the associated problems and human engagement, practically every aspect of human endeavor can be observed in the internally displaced persons (IDPs) ecosystem.
- Ifeagwazi, C.M., and Chukwuorji J.B.C. are the most influential authors in publications on internally displaced people in Nigeria over the period under study.
- The major keywords include; Internal Displaced persons", "Insurgency", "Child", "health service", "mental health", "coping behavior", "gender issues", "depression" and "psychology". This will assist researchers for further studies.
- The focus of authors is in the area of IDPs satisfaction in this study include; "IDP resilience", "Emergency Response" and Psycho-social behaviour among IDPs.

6. Conclusion

The bibliometric analysis is based on Scopus publication from the 2009 to May, 2023, VOS viewer and Scopus Journal Analyser (SJA) is used to analyse the characteristics of documents and science mapping for the study. Highest volume of documents on IDPs satisfaction in Nigeria was produced in the year 2022. Journal of Migration and Health is more influential in the production of documents relating to IDP and migration. In term of geographic distribution, Nigeria have the highest publications on satisfaction of IDPs in Nigeria. University of Nigeria Nsuka is the leading institution in document production on IDPs in Nigeria. Ifeagwazi, C.M., and Chukwuorji J.B.C. are the most influential authors in publications on internally displaced people in Nigeria. "IDP resilience", "Emergency Response" and Psycho-social behaviour among IDPs are the major focus of authors in the study area.

This paper therefore provides a bibliometric analysis, which is a significant tool for researchers to understand research trends and publications pertaining to internally displaced persons in Nigeria.

This work will without a doubt help academics focus on the topic's journals and further develop scientific themes in other parts of IDPs in Nigeria while taking into account their needs, challenges, and satisfaction.

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Level of Maintenance Services Quality in Residential Colleges

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Abstract Building maintenance is a crucial aspect of a building's life because it ensures the structure and quality of the building are in good condition. Maintenance is required for all buildings, including public universities, mosques, and historical facilities. Public universities require efficient maintenance services for administrative buildings, residential colleges, and academic buildings. Students at public universities will benefit from the convenience and comfort of residential college facilities. There are issues related to maintenance, such as quality of service, inefficiency in building cleaning, and unscheduled garbage collection. This paper aims to identify the level of maintenance service quality and determine the ranking of maintenance service quality significance in residential colleges. ServQual model dimensions will be used to achieve its objectives and discussed as a procedure for measuring service quality. The level of service quality to prioritize can be determined using this ServQual dimension. Public universities need to consider how students view and anticipate maintenance service quality. The gap between perceptions and expectations indicates that university services should be reviewed. The study will show the difference between experience and expectations for each dimension of ServQual service quality in residential colleges public universities that will help various parties implement better quality services.

1. Introduction

Throughout the construction industry, building maintenance has grown as well. Building maintenance involves all buildings, such as public institutions of higher learning, government office buildings, mosques, and historic buildings. Public institutions of higher learning are places of learning and teaching with various buildings. Institutions of higher learning have faculty buildings, halls, mosques, cafeterias, stadiums, and residential colleges. [1] state that living in a residential college is essential for students to have a fulfilling life. [2] cites evidence that high-quality residential college conditions and facilities benefit university student enrollment. [1] said schedules must be followed throughout residential colleges to ensure students' safety and comfort.

[3] states that buildings must be maintained effectively so that students receive the right services. Providing safe and comfortable services is essential to student safety. It is necessary to perform regular maintenance work to ensure building infrastructure remains in proper shape, according to [4]. Regular maintenance work also prevents safety hazards and maintains building function. [5] stated that the

quality of components and materials, top management support, an efficient organization structure, maintenance managers' competence, and staff training determine the effectiveness of a maintenance system. Residential colleges are dissatisfactory not only because of broken windows and lifts but also due to lack of facilities and environment, says.

Building maintenance problems often occur, especially in residential colleges, such as financial constraints, maintenance time delay problems, a lack of skilled teams, poor work service quality, maintenance management problems, and maintenance reporting procedures. The Electronic Complaint System (ECS) reports that UTM must handle 7000 to 9000 damage reports annually. Regarding its residential college, UTM must provide the best service to its students. [7] discusses how service performance is an issue in maintenance companies, particularly in terms of service performance. [8] stated that deficient service quality is a significant issue in maintenance management in Malaysia. [9] also debate whether Malaysia's maintenance efficiency is less encouraging. In addition, maintenance staff need more training and evaluation reports, delaying maintenance projects [10]. Therefore, the quality of maintenance work is crucial, regardless of the building's type or condition.

2. Maintenance in Residential College

University management ensures residents' comfort and safety. University buildings offer various amenities and facilities, mainly residential colleges. Residential colleges also strive to provide students with a learning environment that promotes collaborative work and personal growth. [11] defines the maintenance of a well-run facility as a combination of technical, supervisory, and management actions. [12] states that maintenance involves two areas: repair and maintenance. As per [4], maintenance is a procedure or technique for minimizing building damage. Residential colleges provide temporary student residences for educational institutions.

[13] defined a residential college as a student's primary residence that assists students in learning to achieve an objective education. [14] say residential colleges are places where students live since they are far from educational institutions. Residential colleges are residences or services universities provide to students who continue their studies there. Numerous studies have attempted to interpret service quality definitions. [15] stated that university management needs to implement service quality theory by analyzing processes, scope of work, and other elements to provide satisfactory quality to students. [16] interpret service quality as comparing consumers' expectations with the services' acceptability. Customer expectations and perceptions are crucial to satisfactory service.

2.1. Category of Maintenance

2.1.1. Planned Maintenance

According to [11] planned maintenance is a type of problem-solving that ensures maintenance work is done. There are documents, reviews, resident issues, and previous data and information. According to [1], this planned maintenance is based on the time spent performing maintenance in a facility. According to [17], planned maintenance is the execution of maintenance tasks following a schedule established in response to building maintenance requirements. Additionally, scheduled maintenance is maintenance work deliberately planned and developed. The two categories of planned maintenance; preventive maintenance and corrective maintenance.

2.1.2. Unplanned Maintenance

[1] observed that unplanned maintenance is the work of replacing or repairing fan equipment or facilities that have been damaged. This applies to lighting, plumbing, and toilet pumps. When unexpected damage occurs, this maintenance action will be implemented. [17] says there are two scenarios for unplanned maintenance. The first circumstance happens frequently during maintenance work. The second state, which calls for repairs, is characterized by sudden defects and damage. As a result, while some maintenance and repair tasks can be planned ahead of time, others are still being determined. Unplanned maintenance is more expensive than planned maintenance.

3. Model ServQual (Service Quality)

[15] says university administration must implement service quality theory and examine processes and the scope of work, among others. [16] define service quality as the difference between a customer's expectations and how a service meets those expectations. Expectations and perceptions of the customer are essential parts of quality work. [18] explained that service quality is the gap between clients' expectations and perceptions. [18] discussed the main objective of service quality in considering the service criteria offered.

Students' perceptions of service quality in areas including management and administration, residential colleges, bedroom convenience, administrative quality, services and facilities, and main amenities were also the focus of previous research. The concept of service quality is closely related to the perception of students who are customers at residential colleges. The ServQual model studies are related to the Service Quality Model 1985 study. [18] discuss five dimensions: tangible, reliability, responsiveness, assurance, and empathy.

3.1. ServQual Dimension

3.1.1. Tangible

These dimensions include physical facilities, equipment condition, and personal appearance. Tangible dimensions are tangible and visible features. [19] define this dimension as things that provide real services for users. Customers can feel the real thing in this dimension, as stated by [6].

3.1.2. Reliability

Reliability is the ability to provide accurate and reliable services. This dimension is defined as the ability of service providers to offer proper assistance in the study by [18]. From these dimensions, elements can be determined, including meeting students' needs, delivering genuine services to students, and performing services efficiently. [6] defines reliability as the capability of an organization to provide accuracy and reliability. Therefore, the customer's perception of this dimension can influence clients' future interactions with the service provider.

3.1.3. Responsiveness

Responsiveness is a willingness to take action by helping students and providing services promptly. The ability of residential college administration to respond quickly to student requirements, their level of availability for assistance, and other factors are among those considered when evaluating this dimension [18]. [6] says this dimension includes staff members' willingness and maintenance services to help students.

3.1.4. Assurance

Assurance is the expertise and professionalism staff members possess and can offer to clients. Maintenance service staff exhibit a compassionate approach when dealing with students or residents of residential colleges, as demonstrated by [6]. In addition, staff receive guidance on overcoming difficulties with students.

3.1.5. Empathy

The term empathy defines how a service provider treats and values each client. University maintenance and asset management need to understand and solve problems related to residential college students. For maintenance services to positively impact students, according to [6], maintenance management must develop a perspective related to this element of empathy.

4. Methodology

The residential college of Universiti Teknologi Malaysia (Skudai campus) is where the current study was carried out. Universiti Teknologi Malaysia has 10 residential colleges (Skudai campus). Taro Yamane's calculations indicate that 100 participants at UTM Skudai must fill out questionnaires as a result of the study. At UTM Skudai, the questionnaire was distributed to 100 selected random respondents. Residential college students who live on campus made up the respondents. This study uses descriptive analysis techniques to determine the level of service quality. It evaluates rankings for maintenance service quality with the relative index approach. Furthermore, the highest and lowest service quality levels were effectively acknowledged by the Relative Index approach.

4.1. Methods of Data Analysis

When collecting data and information has been completed using methods essential to the objective. Data and information must be organized to carry out the data analysis procedure. For the study's first objective, the researcher employed the Descriptive Analysis Technique in conjunction with the "Statistical Package for Social Science" (SPSS) computer software. Researchers apply this specific type of analysis because it is more effective and provides more systematic results. In addition, the researcher analyzes the analytical data briefly using tables, graphs, and diagrams. This researcher's first objective is to apply descriptive statistics such as mean, percentage, and standard deviation. This first objective is measured by evaluating the level of service quality in the ServQual Dimension. The researcher applied the Relative Index approach to achieve the second objective. To accomplish this goal, a structured questionnaire was created using aspects of the ServQual Model. To ensure the reliability of the questionnaire items, the Cronbach reliability test employs a coefficient of 0.8, representing the optimum reliability of a question item.

5. Results and Discussion

5.1. The level of maintenance services in residential colleges

The researcher has identified the quality of maintenance services in residential colleges. This study's results are based on a service quality gap analysis between tangible, reliability, responsiveness, assurance, and empathy. The analysis was conducted using descriptive analysis by summing the mean for each dimension. Based on these five service quality dimensions, the largest gap between expectation and perception is assurance, with a gap of -0.426. In the questionnaire given to respondents for assurance, the dimension refers to satisfactory and effective maintenance work. Providing good maintenance work is the responsibility of the maintenance management.

The second gap analysis is empathy, with a gap of -0.412, with questions such as whether the maintenance party always prioritizes students in providing the most efficient service and whether the maintenance party understands the needs of students in residential colleges. Residential college staff should understand students' needs, as that is where learning starts. The responsiveness dimension's last position had the lowest gap value, -0.244. Compared to other dimensions, the responsiveness dimension has the smallest difference between perception and expectation average values. As a result, the university and maintenance can resolve the maintenance issue quickly and efficiently. The difference between the assurance dimension's mean value gap and the responsiveness dimension's is -0.182. Table 1.1 The researcher has shown a comparison graph regarding the difference in perception and expectation as follows:

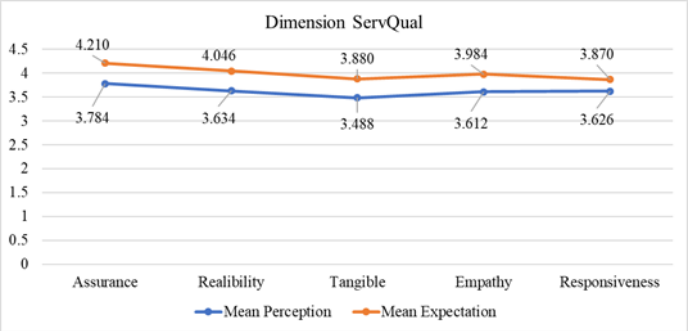

Figure 1. Gap Analysis Dimension ServQual

5.2. Ranking of the quality of maintenance services in residential colleges

The researcher achieved the second objective of determining the ranking of quality maintenance services in a residential college. Researchers used the relative index to analyze the data for the second objective. Researchers already know the most critical dimensions of residential college service maintenance. The first objective is identifying which dimensions have gaps the university needs to address. However, this relative index shows that empathy is the most important element in maintenance services in residential colleges. With a total gap between expectation and perception of -0.120, it is clear that this dimension of empathy is the first and most significant ranking. Maintenance services should be provided for students to understand their problems and needs while at a residential college.

There is only a -0.244, responsiveness gap for the first objective. Still, after analysis, responsiveness is the second significant element in maintenance services, with a gap relative index of -0.116. As a result of this analysis, the university and the maintainer must always be ready to assist students with maintenance problems immediately. This response includes punctuality and efficient and professional staff. Questions were asked, such as whether residential college staff responded quickly to students' maintenance problems. In addition, how long does it take maintenance staff to resolve the problem? In addition, the following rankings are based on tangibles, assurance, and reliability.

Finally, the dimension that obtained a low relative value of the index was -0.066, the reliability dimension. This indicates that students' confidence in the perception of the maintainer in solving the problem of expected damage. The relative gap between empathy and reliability dimensions was 0.054. It is, therefore, essential for the university to provide the best service possible. Table 1.2 The researcher has shown a comparison graph regarding the difference in perception and expectation in the relative index as follows:

Table 1. Gap Analysis Dimension ServQual

Dimension ServQual	Perception Relative Index	Expectation Relative Index	Gap Relative Index	Ranking
Empathy	0.738	0.858	-0.120	1
Responsiveness	0.680	0.796	-0.116	2
Tangible	0.692	0.790	-0.098	3
Assurance	0.770	0.858	-0.088	4
Reliability	0.684	0.750	-0.066	5

6. Conclusions

A university should prioritize maintaining high quality maintenance services. These can also be determined using the ServQual dimension. This is because this dimension will highlight the elements that must be prioritized when providing student services. Universities need to consider how students perceive and expect maintenance service quality. The gap between perceptions and expectations shows that university services need review. In this study, the university is responsible for providing quality services to students in residential colleges. When students are at university, much of their time is spent in residential colleges. Therefore, the university must consider the factors that must be prioritized for students to feel secure and at home in a residential college. This research illustrates the importance of service quality in ensuring customers are satisfied with their products or benefits. Service quality studies can help various parties implement quality services.

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Passive Design Building: A Cost Analysis in Zhangjiakou District

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Abstract. Passive design construction projects have gained popularity due to their many benefits compared to active design buildings. Zhangjiakou district has a distinctive climate characteristic with a temperature ranging from -20℃-15℃ for nine months a year. This certainly requires special building design to accommodate energy usage during the cold climate. This paper aims to study the energy cost efficiency using cost analysis between passive and active design buildings. As a basis for comparison, buildings within similar typology were selected to ensure consistency in analysis. Through cost analysis studies of the construction and operational cost of passive buildings, the hard and soft costs of passive and active building design were determined to provide a reference for in terms of cost measurement and assessing the feasibility of adopting passive buildings in Zhangjiakou region. A comparative analysis using the cost and operational data show that when a building designed with 90-110 m2 gross floor area, the construction cost of passive buildings is relatively high compared to actively designed buildings, with an increase of about double relative to passive buildings. However, considering the simulated cost in-use, passive design building have potential to offset the high construction cost of HVAC system used in active buildings which in average accounts for about 32 percent of the construction cost. From this analysis, passive buildings have huge potential for lowering cost-in use which subsequently beneficial for long-term investment. These findings highlighted the potential implementation of passive design buildings in Zhangjiakou province to reduce its occupancy cost generally and energy cost specifically due to its distinctive climate characteristics.

1. Introduction

Active design of buildings often involves high-cost energy use. Firstly, there are high technological requirements. Active design requires the application of advanced technologies and equipment, such as high-efficiency heating systems and intelligent control systems. The development, manufacture and installation of these technologies require corresponding investments. At the same time, the maintenance and upkeep of these technologies also require specialised technicians to operate and manage them, which increases operating costs. Meanwhile, active design usually requires a large supply of energy, such as electricity and gas. The procurement and use of these energy sources cost a certain amount of money. For some energy-intensive equipment, such as air conditioning and heating systems, their energy consumption is relatively high, resulting in energy costs taking up a significant proportion of the building. In addition to this, active design usually requires the installation of a variety of equipment and systems to achieve automated control, energy management and other objectives.

The installation and commissioning of these devices require certain costs, and regular maintenance and servicing is required to ensure their proper functioning. These maintenance and upkeep costs also add to the cost of the building. In summary, the active design of buildings often involves high costs mainly because of the need to apply high technology, large amounts of energy supply, and inputs for equipment installation and maintenance. The harsh winter climate in the Zhangjiakou region makes traditional active buildings require large amounts of heating energy to maintain comfortable indoor temperatures, leading to high energy consumption and expensive of Operation and Management costs. However, the special climatic characteristics of the Zhangjiakou region can provide favourable conditions for the development of passive buildings. The region has long and harsh winters, but is sunny with long hours of daylight. Passive building design concepts and technologies are designed to reduce energy consumption and O&M costs by maximising the use of natural resources such as sunlight and air flow. In response to this issue, many building models based on energy-saving concepts have been gradually proposed both domestically and internationally, including passive building. However, in Zhangjiakou, due to the technological level and construction cost, passive housing is not widely used, due to the anticipated high construction cost.

As far as passive building construction cost analysis is concerned, the construction cost could be analyzed in terms of both hard and soft costs. Hard costs refer to the costs directly related to building structure and physical construction, including but not limited to rigid costs such as building structure, building appearance, building equipment, building materials, etc. Soft costs refer to the costs related to building use and daily operation, which mainly include design and planning, energy optimization, etc. Soft costs refer to the costs associated with the use and daily operation of the building, including design and planning, energy optimization, quality control, operation costs, and other elements. By comprehensively analyzing the hard and soft costs through cost analysis, the construction cost of passive buildings could be furhter assessed in a more comprehensive manner. This is will assist in making decision especially in long-term investment especially when it involves energy saving, emission reduction, indoor comfort, etc as the client's requirements. Therefore, the outcome of will provide cost analysis judgement in highlighting the economic benefits of passive design housing in the hope to further proposes strategies to promote passive design housing in Zhangjiakou.

2. Literature review

2.1 Passive Buildings

Sun Lili (2023) used the Brooke project as an example to introduce passive buildings. She pointed out that the construction of passive buildings should follow the principles of adapting to local conditions and balancing comprehensively, and based on this, pay attention to energy conservation in layout, form, enclosure, and renewable energy utilization. [1] Ren Baosen (2023) designed passive buildings from three aspects: thermal insulation system, door and window system, natural lighting and ventilation system. [2] Zhao Jungang (2022) and others pointed out in their research that during the construction of passive buildings, it is necessary to first analyze the regional field and climate, select the best building type, design the best enclosure structure, set up a reasonable ventilation and lighting system, strengthen the application of Renewable resource in all links, and pay attention to the application of three-dimensional greening, component shading, coating materials and other passive technologies. [3] Sun Mingyu (2022) analyzed passive buildings in northern China as an example and pointed out that in order to design passive buildings that meet local requirements, it is necessary to arrange the building layout reasonably, control the building spacing appropriately, organize good natural ventilation, control the building shape, and calculate the optimal window to wall ratio. [4] Li Yao (2022) introduced the energy-saving design of passive buildings from both the exterior and interior perspectives. In terms of exterior design, factors such as climate, wind direction, and sunlight need to be considered; In terms of internal design of buildings, attention should be paid to the design of enclosure structures, door and window systems, fresh air heat recovery systems, and the application of new energy and new technologies. [5]

2.2 Benefits of passive buildings housing development

Passive housing not only has incremental economic benefits but also has extensive incremental environmental benefits, which are conducive to the protection of the natural environment.

a) Pollution reduction benefits. Compared with traditional buildings, the emissions of construction waste, construction waste, construction wastewater, etc., of passive buildings are significantly reduced, thus reducing the damage to the natural environment due to various new energy technologies are used such as passive rooms. During the process of converting these new energy sources into electrical energy, harmful gases such as CO and CO2 are basically not generated, so the passive room does not need to invest funds to treat these toxic gases and waste, thereby improving the environmental benefits of the building. At the same time, Li Yanfang (2022) improved the application of new energy also reduce the procurement of coal and other resources, thereby reducing investment in coal resource procurement. [16]

b) Relieve the heat island effect. Today, the problem of modern environmental destruction is becoming more and more serious, and the Urban heat island effect is becoming more and more common, which makes the urban temperature rise significantly. In order to cope with this situation, urban residents use air conditioning systems in large numbers, leading to the further intensification of the Urban heat island effect. After adopting the passive building mode, the application of natural ventilation systems or new energy technologies can be strengthened, reducing coal energy consumption, reducing the heat value generated inside the city, and facilitating the regulation of urban temperature, thereby reducing the use of air conditioning systems by urban residents, thereby improving the energy efficiency of air conditioning system operation.

c) Building usage efficiency. Since passive rooms are more environmentally friendly and emit less polluting gases. Wang Mulin (2022) introduced the surrounding air of the building is good, with less acidic substances, which could reduce the corrosive effect on the building structure and infrastructure, prolong the service life of the building, and thus create higher building efficiency. [17]

2.2.1 *Incremental social benefits.*

The incremental social benefits of passive buildings are the additional social gains or positive impacts of passive buildings relative to conventional structures. The specific benefits are composed of the following.

a) Residents' health benefits. Passive housing has less damage to the environment, improving the urban environment, reducing air pollution and other issues, leading to illness among residents, and improving their physical health. Therefore, there is no longer a need to spend significant amounts of money on disease prevention and control.

b) Improve work efficiency. Due to the better indoor and outdoor environment can create a good living and working environment for residents, thereby improving their work efficiency and indirectly creating higher economic benefits for residents.

c) Energy saving social benefits. Qi Yufeng (2022) improved when using passive rooms, they can automatically generate electricity through their own solar and wind power systems, reducing the demand for municipal electricity and creating certain energy-saving social benefits. [18]

d) Social benefits of heating. The central heating fee consists of two parts: residential heating fee and municipal subsidy. During the use of passive rooms, the demand for central heating is relatively low, reducing the operation of central heating and thus reducing government subsidies for heating enterprises.

2.3 Factors affecting passive buildings development

Yang Huan (2023) analyzed the main factors affecting the development of the passive architecture talent system through a model approach, starting from both the degree of cause and centrality. [6] Through analysis, it can be found that the reasons for the lag of China's passive design construction includes insufficient publicity efforts, insufficient government organization of training relating to passive design

construction skills, and the failure of enterprises to cultivate construction talents actively. Zhao Li (2021) and others used the entropy weight method to analyze the influencing factors of passive building cost risk from four aspects: decision-making, design, construction, and cost in-use. Through analysis, it can be found that factors such as material selection, equipment quality, personnel quality, and construction technology all have different impacts on the cost of passive building construction. [7] Qi Yongcheng (2021) analyzed the incremental cost-effectiveness of passive buildings through the currency fuzzy comprehensive evaluation method. Analysis shows that passive buildings have significantly improved incremental cost-effectiveness compared to traditional or also known as active buildings, with a maximum energy savings of over 25% annually.[8] Li Qiangnian et al. (2020) found that the main reasons for the low response on the development of passive buildings are: high initial incremental costs, lack of government guidance, incomplete standard systems, and lack of government incentives. [9] In response to these issues, corresponding promotion strategies have been proposed, including strengthening initial incremental cost control, increasing guidance from government departments, developing a sound standard system, and designing well-designed incentive policies. Based from the aforementioned factors resolving passive design building, this paper seek to analyse passive design building specifically in Zhangjiakou area, Hebei Province, China from the construction cost versus cost in-use persepctive.

3. Research methodology

This paper will analyze the economic benefits of passive buildings in the in Zhangjiakou area, Hebei Province, China, through qualitative and quantitative methods. The specific steps are as follows:

3.1 Delineate the analysis aspects:

The analysis of the economic benefits of passive buildings is divided into two aspects, namely the construction cost and cost in-use. The total construction cost of a standard design active building and passive building collected as a basis of comparison. Building design and elements were further analysed to produce cost data for both building designs.

House within similar typology were selected to ensure consistency in data analysis. For this research purposes, 200 m^2 gross floor area (GFA) with a minimum 3.00-meter floor height and 15 storey were selected from the Hebei Provincial Department of Housing and Construction. The Elemental Cost Analysis (ECA) for both building types were further analysed to study the impacts on cost in-use from the building materials' perspective. This is some of the aspects considered in passive design building elements. Data were updated using cost index to ensure similar basis of comparison due to inflation and interest rate. Cost in-use collected to analyse the economic benefits of passive design also based on building's ECA to determine any cost, saving energy consumption and operating costs based on either building materials use, the system use or other building typology aspects

3.2 Cost analysis:

Cost analysis based on ECA conducted to assess the construction cost of passive and active buildings comparison based on construction cost were furhter elaborated based on elemental cost analysis and cost per meter square of building to demonstrate the difference between passive and active building design. This is critical to support the cost in-use of both building design especially on the system and material used. Second analysis focused on the cost in use of both design to justify the differences as well as highlighting the advantages and disadvantages of both building design in terms of capital investment.

4. Cost analysis of passive housing

4.1 Development Cost Composition

There are several cost components involved in the construction of passive houses, namely land cost, hard costs and soft costs. Different stages of passive building housing construction involves the following development costs:

a) Initial incremental costs, including consulting costs and design costs;
b) Medium-term costs, including construction technology costs, airtightness testing costs, and acceptance costs;
c) Post-production costs, including operating expenses and scrap costs. Among them, the mid-term construction technology cost accounts for the highest proportion, approximately 40% of the incremental cost of the entire project. [10-12] Therefore, in this study, the total cost only selected the construction technology cost.

4.2 Cost in-use of Passive Design Housing Development

It refers to the changes in economic benefits that occur after the construction of passive buildings, mainly including:

a) Maintenance structure and energy-saving benefits of air conditioning. During the construction process of passive rooms, energy-saving and environmental protection concepts have been incorporated into the structural design and construction of exterior walls, roofs, and windows. Environmentally-friendly building materials have been used to enhance the insulation effect of the building and reduce energy consumption during air conditioning operations. At the same time, the air conditioning system's design has also adopted advanced energy-saving technology. The conversion efficiency of the air conditioning system is high, and the indoor space temperature and humidity are adjusted reasonably while consuming lower electrical energy. [13]
b) Renewable energy conservation. During passive housing construction, new energy sources , such as solar, wind, Tidal, Geothermal, etc., are widely used. By applying these new energy sources, the demand for traditional energy for passive housing is significantly reduced, thus providing help for the passive housing to use electricity, hot water, etc.
c) Energy saving and economic benefits of heat recovery systems. Passive rooms usually establish a heat recovery system to recover excess indoor heat and convert it into electrical energy storage, in case other new energy systems cannot be applied, to provide electrical energy to the passive room and ensure its regular use. [14]
d) Land saving economic benefits. Many modules in the traditional Hydronics cover a large area and affect the utilization rate of land resources. During the construction of passive housing, the Hydronics can be re-planned. On the basis of ensuring that the Hydronics meets the daily heat demand of residents, the floor area of the Hydronics can be reduced so that more land can be used to construct public service systems such as status, thus creating certain economic benefits.
e) The government is doing its best. At present, local governments in our country have formulated corresponding incentive policies for environmentally friendly buildings. When construction enterprises establish passive housing, government departments will provide subsidies to enterprises according to policy requirements to create certain economic benefits for comfort. [15]

4.3 Construction Cost Calculation

Buildings usually comprise many structural modules, such as exterior walls, roofs, mezzanine ceilings, and individual floor slabs. Each structural module has completely different construction processes, materials used, and construction periods, making it necessary to invest additional costs in each structural module of the building. Therefore, this article selects passive houses and traditional residential buildings as the research objects and calculates the construction cost separately. Due to the limited space in this

article, only the exterior walls were analyzed. The construction of the exterior walls of the two buildings starts from the interlayer and continues until the Parapet. The materials used in the passive room are 5mm cement mortar, 240mm Graphite modified expanded polystyrene foam board (GPES), and 5mm anti-crack mortar, and the comprehensive unit price is 370 yuan/m2; When constructing traditional exterior walls, 20mm cement mortar, 50mm Graphite modified expanded polystyrene foam board (GPES), 20mm expanded glass bead insulation mortar, and 5mm crack resistant mortar are used. The comprehensive unit price is 251 yuan/m2, with a 119 yuan/m2 difference between the two. After calculating and analyzing the cost of each structural module, the results shown in Table 1 can be obtained. From this table, it can be seen that the construction cost of traditional buildings is 499 yuan/m2, while the cost of passive houses is 1429 yuan/m2, which has increased the cost by 930 yuan/m2. Among them, the external windows and energy environment system have the most increment and should be a critical link in the cost control of passive houses. However, it should be noted that from the perspective of the entire life cycle, the comprehensive cost of passive houses is 1509 yuan/m2, while the comprehensive cost of traditional buildings is 791 yuan/m2, which has increased the cost by 718 yuan/m2. This indicates that when the buildings are used in the future, the applicable investment of passive houses is much lower than that of traditional buildings, which can reduce 212 yuan/m2. After a period of time, the passive houses can recover the additional investment costs.

4.4 Calculation of comprehensive benefits

According to the formula shown in the literature [19], the comprehensive benefits of passive housing and traditional building construction can be calculated, and the results shown in Table 2 can be obtained. [20]

Table 1. Cost Table for Passive Housing and Traditional Building Construction

Structure Module	Passive house	Traditional Architecture
Exterior wall	238	162
Roof covering	38	22
Mezzanine ceiling	13	0
Household floor slab	67	58
Internal partition wall	20	15
External window	480	162
Energy Environment System	430	0
External window shading	118	0
Heating system	0	80
Detailed Construction of Heat Bridge	25	0
Subtotal	1429	499
Basic reserve fund 3%	43	15
Management fee 2.5%	37	13
Heating fee	0	115
Air conditioning fee	0	143
Total	1509	791

Among all incremental benefits, government incentives account for the highest proportion, while mitigating heat island benefits, extending lifespan, and saving electricity benefits are not very good and need to be a critical factor in controlling the cost of passive housing [21-22].

Table 2. Calculation Results of Comprehensive Benefits

Benefit	Index	Incremental Benefit (Yuan)	Ratio (%)
Economic Benefit	Envelope Structure and Air Conditioning Energy Conservation	190222	14.18
	Land saving benefits	159071	11.86
	Government incentives	724167	53.99
Environmental benefits	Emission reduction, and pollution gases	34891	2.60
	Relieve heat island	9041	0.67
	Building usage income	6479	0.49
Social benefits	Residents' health	34890	2.61
	Improving work efficiency	109079	8.13
	Energy saving benefits	4997	0.37
	Cancel heating	68410	5.10
Total		1341247	100

5. Result

5.1 Overview of the findings

The study results show that passive buildings face some challenges in the Zhangjiakou area from the perspective of pre-construction investment. Compared to general civil buildings, passive buildings have nearly double the investment in the primary materials cost, making more investors choose general civil buildings as the investment object. [23] This phenomenon may be attributed to the relatively new technology of passive buildings and the high cost of associated equipment. However, the study also found that passive buildings still have some potential for development under full life-cycle considerations, especially considering late-stage energy costs. Passive buildings are able to significantly reduce energy consumption and operating costs by optimizing the building structure and adopting advanced energy management systems. [24] Although the investment is higher at the initial stage of construction, these savings in energy costs will gradually make up for the initial investment gap over time. However, to promote the development of passive buildings, there is a need for policy support on the part of the government. This includes developing appropriate incentives, such as favorable tax and subsidy policies, to reduce investment costs. There is also a need to strengthen the research and promotion of passive building technologies and to provide training and support to increase awareness and acceptance of passive buildings in the construction industry. In addition, supporting energy storage systems are crucial to promoting the development of passive buildings. [25] Passive buildings often meet most of the energy demand by reducing energy consumption. However, in extreme cases, such as power cuts, energy storage systems are needed to ensure the building can operate normally. Therefore, improving the supporting facilities of the energy storage system is also one of the essential directions for the development of passive structures in the future.

In summary, the study results show that although passive buildings face some challenges in their early development in the Zhangjiakou area, they still have some development potential throughout the life cycle. The government should provide policy support to promote the development of passive buildings and enhance the construction of supporting energy storage systems. This will help promote the development of sustainable buildings in the Zhangjiakou region and achieve a win-win situation for both the economy and the environment.

6. Conclusion & Discussion

In summary, modern architecture should attach greater importance to passive housing and, based on the actual situation of the Zhangjiakou region, follow the principles of sustainable development, comfort,

innovation, and regionalism to design a reasonable construction plan for passive housing. Based on ensuring that the functions of passive housing meet the requirements, reduce the investment in building costs, and enable passive housing to play a more significant role in social development and environmental protection. However, despite the potential and advantages of passive buildings regarding energy efficiency and environmental protection, their development within Zhangjiakou still faces a series of limitations. To promote the development of passive constructions in Zhangjiakou, there is a need to strengthen the development of relevant regulations, improve the quality of professionals, enhance publicity and promotion efforts, and provide more economic incentives and support measures. However, considering that the source of data information on which this paper is based is the enterprise's current year's construction data, the cost measurement is based on sub-parts of the project. Therefore, the applicability still needs to be further studied. In the future, the cost of installation works of passive civil buildings will be the object of study, and the economic efficiency of passive constructions in the Zhangjiakou region will be further measured by way of a case study to provide a more effective reference for the development of regional passive civil facilities.

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Appendices

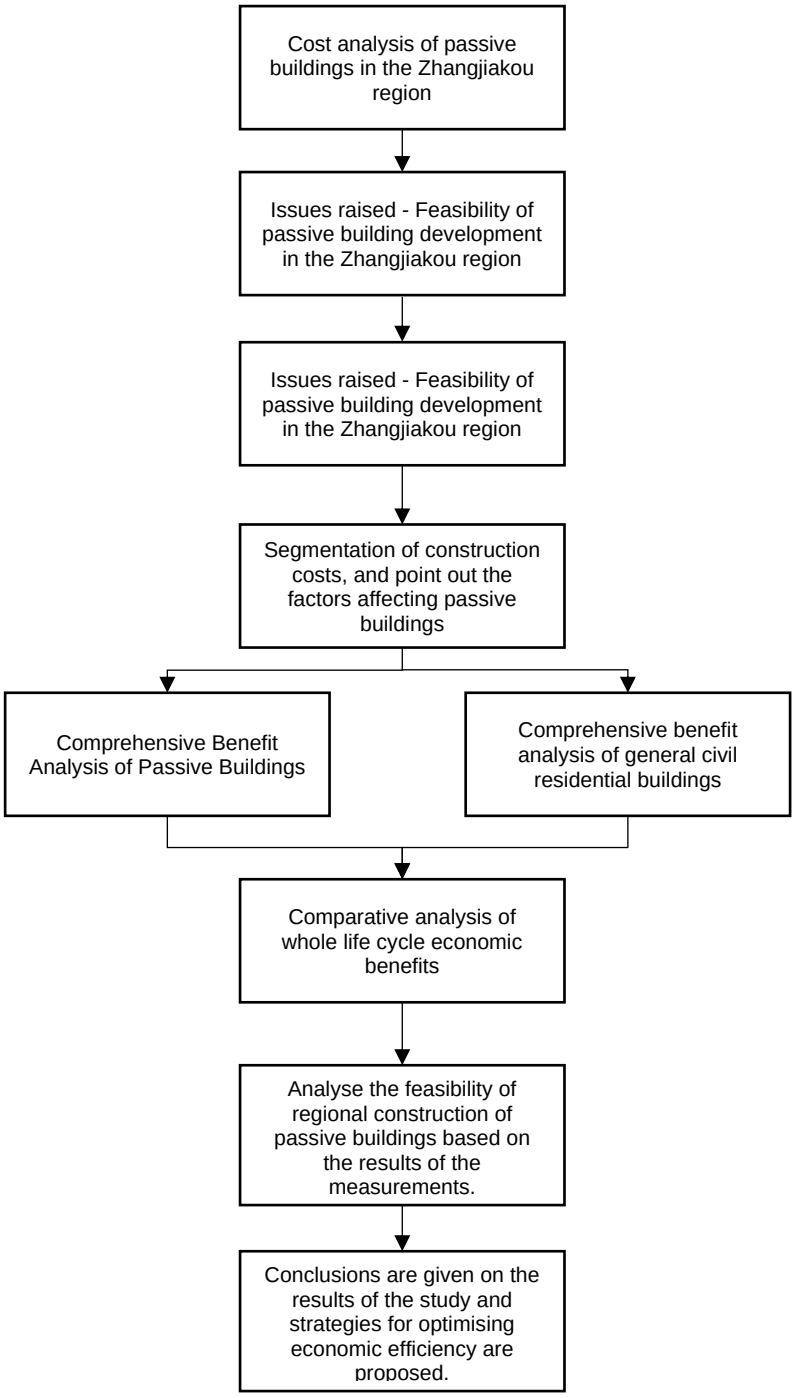

Figure A1. Zhangjiakou Regional Passive Building Economic Benefits Research Pathway

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Potential of The Establishment of A Single Authority for Affordable Housing Provision in Malaysia

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Abstract. Affordable housing in Malaysia encompasses a few types that cater for different segment of population. These are provided either through direct provision by the public sector or offered through the open market via the supply and demand mechanism. However, to ensure accessibility to housing for all segments of the population, the role of public sector is significant. These roles are carried out within the federal and state institutional framework with involvement of various agencies. Various researchers have identified the institutional framework such as the regulatory policies, the regulatory implementation and its effectiveness as one of the main challenges in housing provision. Therefore, an efficient institutional set up is favourable to ensure sufficient affordable housing provision. Institutional setting includes a better coordination for all agencies involved with affordable housing provision. A single authority has been suggested as a better set up for a more efficient affordable housing provision. The objective of this paper is to identify the strength of a single authority and to investigate the potential to establish a single authority in Malaysia that deals with matters related to affordable housing provision. Johor Bahru was chosen as the case study as the administrative matters related to housing differs between states. Content analysis from literatures on authorities for housing and thematic analysis was carried out. The in depth interview was carried out with respondents chosen based on a purposive sampling. Findings indicated that a single authority is potential to be more efficient to provide housing for the mass population. However, its establishment in Malaysia is facing challenges which can be categorised to legislative aspect for example jurisdiction between federal and state government as well as overlapping of interest between different authorities and agencies

1. Background of Study

Housing provision in Malaysia has always seen a very positive involvement of private sector where their role in Malaysia housing provision is considerably noteworthy since the second Malaysia Plan (1971 – 1975). They are simultaneously considered as entrepreneurs and risk- takers [9,11]. Literatures on

housing provision in the aspect of housing institution indicated that the government institutional set- up in Malaysia is complex and complicated with the inter relation and overlapping bureaucracy between agencies. This has affected the efficiency of the housing delivery system. Therefore, to achieve a better government delivery service, coordination among the vertical and horizontal government agencies are the most crucial area for improvement [7,14].

Involvement of private sectors in the affordable housing provision should be associated with the housing development process that is implemented within an institutional framework. The institutional framework has been identified by various researchers as one the main challenges in housing provision. These challenges include issues such as the regulatory policies, the regulatory implementation and its effectiveness. [1,2,8,10,14]. The separation of federal and state government jurisdiction was also highlighted as creating coordination issue among the authorities in housing provision [10,14].

Strategy Paper 6 for 11th Malaysia Plan (2016-2020) indicated lack of integrated planning and implementation as one of the issues and challenges in the provision of affordable housing. Among the key agencies include Ministry of Housing and Local Government (*Kementerian Perumahan dan Kerajaan Tempatan - KPKT*), Ministry of Rural and Regional Development, Ministry of Agriculture and Agro-based Industry, Perbadanan PR1MA Malaysia and SPNB. These multiple agencies have at their jurisdiction role and responsibilities in relation to affordable housing provision. An improved coordination among these multiple authorities involved in developing affordable housing for different target groups is required to encourage provision of an affordable housing. Apart from the multiple agencies overlapping roles and responsibilities in matters related to the development of affordable housing, the lack of an integrated database on housing supply and demand has hindered planning and implementation of affordable housing schemes throughout Malaysia.

2. Aim and Objective

The objectives of this paper are established to address the issues highlighted. The objectives in relation to the issues discussed are firstly to study the advantages of the establishment of a single authority for affordable housing provision. The second objective is to study the potential of the establishment of a single authority for affordable housing provision.

3. Literature

Literature on housing development in general and specifically in affordable housing will be discussed. This is to provide the framework for the paper.

3.1 Housing Development

Housing is a basic need for the mass population. Discussion will refer to housing need and demand where housing need refers to a more basic requirements as compared to demand. Acknowledging the importance of the need for housing leads to the question of its adequacy. Adequacy is the key in housing provision where it is imperative to provide adequate units according to affordability [13]. Houses is provided either by ownership or rental. The concept of affordability is referred to as purchasing affordability, mortgage repayment affordability and income affordability [4]. However, it can be said that generally, affordable housing is centred on the idea of income affordability.

3.2 Planning and Institution

Planning is explained as an efficient administration, social reform and civic design that produced the professional practice known as urban or city and regional planning [3]. Among the common planning tasks would be activities such as promoting development, regulating changes, correcting market failure and maintaining order against threat of chaos. A variety of activities could be associated to planning which include element of future planning, development control and design. Institution such as the government or market provide the framework within which planning operates. The effective operation

of the institutions could reduce uncertainty during the planning operation and activities. Less uncertainties within the institutional framework would make our expectations more reliable.

3.2.1 Legislation in Housing Planning The private sector developers are governed by the Housing Developers (Control and Licensing Act 1966; Housing Developers (Control and Licensing) Regulations 1989 and Housing Developers (Housing Development Account) Regulations 1991 [5]. According to these regulations, developer must obtain licenses, advertising and sales permits from the Ministry of Housing and Local Government before undertaking any housing project in the country. Therefore, to enable these private developers to participate in the industry they are expected to apply for the licenses and permits at the Federal level. In Malaysia, apart from regulating the real estate activities, federal government provides policy frameworks in general terms. However, the policy is translated into more detailed and strategized manner at state. At the state level the policies are expressed in the structure and strategies plans for each state. Finally, at the local government levels the specific requirements elaborations will make the prepared plan more detailed [2].

3.2.2 Planning Framework for Housing Development In Malaysia, housing provision involves a three tier government that are federal, state and local government. The inter relation of these governments in the current housing development mechanism is outlined with each government bearing specific authority. Besides the federal government; the state and local government also have statutory power to formulate specific housing policy and related legislation. Therefore, the housing development in Malaysia is governed by various legislations either in the form of acts, laws, regulations and guidelines. These are enforced either at the state or federal level.

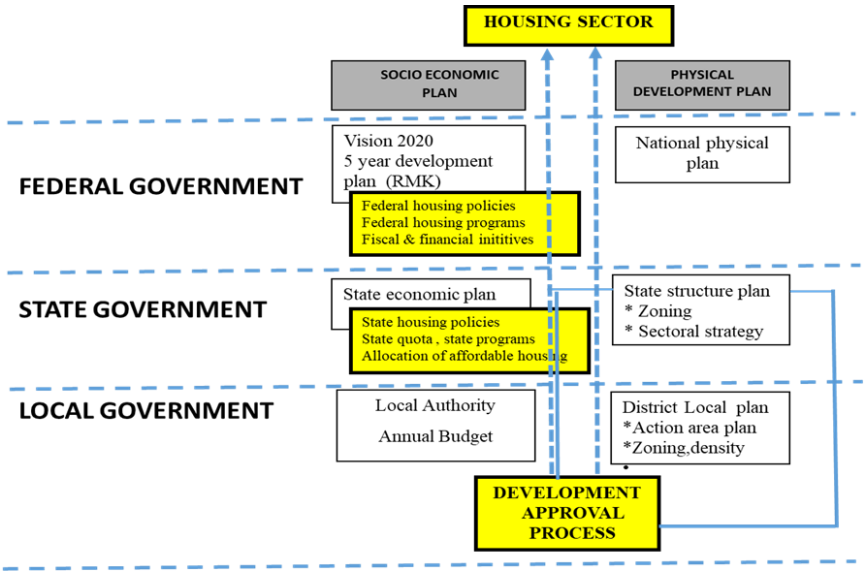

Figure 1. Malaysia housing institutional framework

Figure 1 depict the relationship between the public and private sector in the housing provision within the Malaysian institutional framework. These relationships are very significant in the aspect of structure. Among the factors identified by Habitat III (2016) are the structure of institution. The structure of the institution is either centralised or decentralised, the frameworks for engagement with civil society and key stakeholders, allocation of responsibilities/authorities between level of government and effective multilevel governance system. [15]

4. Methodology

Literatures from other countries' experiences with their housing governing bodies will be analysed to establish the advantages of having a single authority to manage all aspects of housing provision. A purposive sampling of main players that have been involved with federal affordable housing programmes in Johor Bahru.

5. Analysis

5.1 Advantages of A Single Authority

The Singapore experience was indicated through a general look on its housing governance and policies. [12]. This is followed by the Australia experience to get some context for a multi -level governance [6] Both explanations are as shown in Table 1

Table 1 Experience of Singapore and Australia

SINGAPORE	AUSTRALIA
HDB (Housing Development Board) is a public housing authority established in February 1960 under Singapore's national development ministry in response to the housing crisis experienced. HDB's most urgent task upon its establishment was to provide low-cost public housing to a growing population, particularly low-income groups who lived in high-risk dilapidated housing structures. The condition of these places were overcrowded with unsanitary living conditions. The HDB launched more than 51,000 housing units and set aside at least 10,000 low-cost flats for low-income groups located near central areas within the first 5 years of its establishment. Approach practiced: 1. HDB (Housing Development Board) being one and single entity to deal with housing provision for the nation 2. Land price is controlled – most land belongs to the government. Land that HDB apartments are built on is owned by the government over a 99-year lease period, thus reducing land acquisition costs, which results in more affordable housing. 3. The use of Land Acquisition Act that enable the government to acquire land for public purposes 4. Funding of housing through Central Provident Fund (CPF)	The housing provision in Australia is govern by a multi-level governance. However, the existence of a strong and sustained leadership both for implementation and ongoing delivery of an affordable housing strategy prove to be effective Measures to address the multi-level governance: 1. To ensure a whole government approach, ideally a single entity also at a political level is an ideal arrangement 2. Getting the support of financial (treasurer) ; this is essential as a resilient strategy (should there be any change of government) 3. Close consultation with private sector and relevant areas of government. This is to ensure all stakeholders are on board. 4. Flexible and innovative implementing agency 5. Land release – to ensure available land for affordable housing development

Based on the study carried out by AHURI, the effectiveness of recent government approaches in addressing affordable housing needs is hindered by the pattern of conflicting roles, fragmentation of responsibilities and a lack of authoritative leadership and expertise in the housing domain (AHURI, 2018) The experience from Australia has shown the issues in affordable housing provision is very much similar with what we are facing in Malaysia. Therefore, it can be summarised that among the strength of having a single authority are :

1. The authority to control matters relating to the acquisition of land for housing
2. The ability to provide a centralised data for housing demand and supply

3. To have better coordination with the private sector

5.2 Proposed Institutional Improvement.

An in-depth interview was carried out to establish proposed measures by the respondents to improve the institutional framework of affordable housing provision in Johor Bahru. Their answers were analysed using thematic analysis. The results are indicated in Table 2. The excerpts from the media were also gathered and themed according to the approach in the in-depth interview as indicated in Table 3.

Table 2. Proposed improvement to the structure of affordable housing institutional framework in Johor Bahru – In depth Interview

Proposed Improvement	**Respondents**
	n = 14 (%) (*)
Single Authority	4
Financial Assistance	1
Simplified Procedure	1

Table 3. Proposed improvement to the structure of affordable housing institutional framework in Johor Bahru – Media Content

Proposed Improvement	**Respondents**
	n = 12 (%) (*)
Single Authority	5
Financial Assistance	2
Simplified Procedure	nil

Table 4. Analysis on proposed improvement in institutional framework of affordable housing provision

STRUCTURE		**IN-DEPTH INTERVIEW**	**EXPERTS & INDUSTRY PLAYERS**	**TOTAL**
1.	Single authority : #single integrated database #one stop affordable housing units #central repository to manage demand and supply of housing #single taskforce	4	5	9
2.	Financial assistance : #innovative financing #establishment of varying types of partnership	1	2	3
3.	Simplified procedure – e.g : selection of buyer: #reduce beaurocratic measures #use of technology to improve efficiency in planning approval process	1	0	1

Summary of proposed measures is indicated in Table 4. Both data from the in depth interview and excerpts from mass media resources were analysed using a thematic approach to derive to a conclusion. The proposed measures in the structure aspects includes the establishment of a single authority for housing, financial assistance and simplified procedure throughout the development process.

Establishment of a single authority was the most proposed measure to improve the institutional framework where Singapore was cited as an example of efficient administration.

"Something like Singapore? Definitely. If you have one board, or one body to govern it will be more efficient. "

(Respondent D9, 2018)

Issues on the separation of federal and state government is also highlighted by respondent. The separation sees allocation and quota for affordable housing is under state government jurisdiction. Furthermore, land matter is under respective state as in the provision in Malaysia constitution [5]

"It will be easier if it is under one organization. Because under current legislation land is under state. There are a lot of issues and it is confusing".

(Respondent D12, 2018)

"A single body will promote effective arrangement – if there are no issues. Maybe we could establish a committee to facilitate affordable housing between state and federal".

(Respondent G4, 2018)

"One single authority that act as a monitoring body. Everything will be coordinated by this entity. This will be the best. It will be the working committee or working entity. Currently, developer does all this on their own

(Respondent D11, 2018)

6. Findings

6.1 Why A Single Authority?

A single authority would be the ideal arrangement to provide for housing. This is because in terms of coordination and standardization of requirements, establishment of a single authority will potentially make these achievable. Furthermore, it is easier to streamline the provision of affordable housing especially the selling price, specifications and other physical or technical requirement.

6.2 What are the Potential?

Discussion on potential to establish a single authority for housing provision must be preceded by identification of the challenges in establishing the authority. These challenges can be categorised into two (2) . The separation of jurisdiction between federal and state government. The separation can be observed in terms of the housing policies where in Malaysia the Federal government provides policy frameworks in general terms. But the policies will be translated into a more detailed and strategized manner at state level. At the state level the policies are expressed in the structure and strategies plans for each state either in the socio-economic plans as in Malaysia 5 years plan and physical development plans. Finally, at the local government levels the prepared plans are made more detailed with specific requirements elaborations.

As for the overlapping of interests and responsibilities, development of affordable housing is being done by multiple agencies that have different roles and responsibilities. This is because each agency for example PRIMA, SPNB was established to provide for different types of housing catered for specific segment of population. In addition to that, the existence of legislative power for PRIMA Corporation has created some jurisdiction issues.

7. Conclusion

Although a single authority is the most ideal arrangement to ensure a more systematic and efficient affordable housing provision, some challenges can be observed. However, the establishment of a single

authority is much applauded by the main players. This is a very strong justification that indicate the significance of single authority to oversee matters related to affordable housing provision.

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An Overview of Service Quality of Public Transport Studies using Bibliometric Analysis

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Abstract. The quality of services delivered by public transport operators is used to assess the level of service provided to passengers and users. Improved public transportation quality of service (QOS) will attract new customers to switch from private automobiles to the public transportation system. This evaluation of public transportation service quality is an important tool for transportation operators and planners in attracting and retaining customers, setting strategic goals, and making funding choices. Several studies on the quality of public transport service have been published. However, extensive, and quantitative research are lacking. Furthermore, just eleven reviews on the quality of public transport services have been published in the Scopus database. The current review was carried out to provide scholars and practitioners with the update of public transport quality publications through the last 10 years (2012-2022) to fulfil their concerns and answer their public transport service quality question. This paper contains a literature review of quality of public transport service. A bibliometric analysis was performed using VOSviewer software analysis the service quality of public transportation publications obtained from the Scopus database to enable researchers to trace the historical and annual records of publications related to service quality covering the leading countries, institutions, journals, most frequently used keywords, authors, citation network analysis and the most cited publication. The study given indicates a discernible improvement in the research on service quality of public transportation, as shown by the examination of 783 papers from the Scopus database.

1. Introduction

Service quality was one of the most widely discussed topics in business a decade ago [1]. The discrepancy between consumers' expectations of the service provided and their perceptions of the level of service delivered has been postulated and defined as service quality [2]. As a result, service quality has been identified as a critical strategic retailing tool, particularly in the development of defensive marketing tactics. The assessment emphasis that represents the customer's view of a certain service dimension was characterized as reliability, responsiveness, assurance, empathy, and tangibles. This focus was mostly driven by marketing sciences, with the goal of better understanding how to better cater to the demands of customers using management procedures. This knowledge has contributed as a solution to a significant problem in formulating policies to promote customer happiness and retention, as well as in implementing tactics to produce a competitive advantage in service delivery. Enhancements in the provision of service quality have the potential to lead to an augmentation in ridership, hence potentially enhancing the financial performance of a transit agency in several instances [3].

Quality criteria are essentially parameters that assist people in deciding which public transportation service to choose. A higher level of specific criteria is indicative of superior service quality, hence demonstrating a stronger dedication to the provision of services by public municipal transport. The importance of quality criteria varies across different public transit clients. A particular group of individuals can articulate the significance of criteria, although they lack the ability to select from a range of public transport and private vehicle options.

An additional group of passengers is presented with a choice between two alternatives. These individuals serve as representatives of both the importance of the system and the quality of service it provides. The assessment of public passenger transportation's overall quality is determined upon a multitude of elements. As a result, researchers face difficulties in determining the specific orientations that their efforts should focus on. in order to contribute to the development of the inquiry of this subject. This paper aims to provide a comprehensive summary of the discoveries and trends in exploration by categorizing the research field into clusters, which will guide researchers towards the most impactful works, outcomes, and areas that need additional investigation. This study does a bibliometric analysis and a strategic analysis of service quality in the public transportation sector. The objective of this bibliometric study is to elucidate the notion of transportation quality, underscore the dearth of research in this area, and provide a comprehensive overview of the nations, journals, and institutions that have been most prolific in publishing studies on transportation quality.

This analysis seeks to facilitate future research endeavors and foster collaboration in this field. The objectives of this study were to: (1) analyze the temporal distribution patterns of service quality in public transportation journal articles; (2) highlight the contributions made by prominent authors, countries, and academic institutions; (3) assess the dominance of countries in terms of major applications; and (4) offer insights into potential areas for further research. This study will provide valuable insights for scholars, politicians, and citizens interested in examining the research patterns pertaining to service quality in public transportation. It aims to facilitate discussions on the existing state of research and explore potential avenues for future studies.

2. Literature Review

2.1 Service Quality Review Research

In the realm of service literature and marketing, scholars tend to prioritize the characterization of service quality based on the viewpoint of individual consumers, sometimes referred to as user-based [4]. The growing amount of competition can be attributed to the notable rise in the number of operators and the diversification of services provided. Consequently, the significance of marketing has grown significantly. In this particular scenario, the majority of operators perceive service quality as the primary driver and assign it a high position on any service quality assessment. The requirement for a very high degree of service has been identified as vital to maintaining a flourishing business and competing with other organizations.

There are several contentious discussions over the conceptualization and quantification of service quality [5]. The absence of well-defined and quantifiable criteria for evaluating the quality of service is the root cause of this issue [6]. The tight relationship between the potential to enhance public transport performance and the measurement thereof is well acknowledged, making it a topic of significant interest for both planners and transport operators [7].

The best-known and most widely applied conceptual technique is the SERVQUAL scale [7]. It is a general measure for assessing service quality across industries. In transportation research, a variety of SERVQUAL scale modifications have been developed to be industry specific.

A comprehensive set of quality standards has been created to address the issue of public transport service quality. The EN 13816:2002 standard was formulated to establish a comprehensive framework of quality criteria, which are classified into eight distinct categories. The initial two categories, namely availability and accessibility, encompass a broader perspective on the provision of public transportation. Subsequently, the following five categories delve into the intricate aspects of service quality. Lastly, the concluding category focuses on elucidating the environmental repercussions on the community. The

performance of railway operators is measured according to the guidelines set out in EN 13816, which outlines eight measurement criteria, 29 sub-criteria, and 193 Key Performance Indicators (KPIs) [8]. These criteria are first proposed to guide future efforts in setting quality standards for public transit in underdeveloped nations. These criteria may be applicable to the perspective of the user, the transport operator, or the transport authorities. The user's perspective reflects their subjective evaluation of the service they have received. The viewpoint of a transportation operator encompasses the evaluation of public transit's efficacy under customary operational circumstances. Nevertheless, several firms choose to assess service quality based on their own criteria, resulting in variations in performance assessment standards across various operators [8]. Service quality concepts play a pivotal role in the overall performance of a business since they have a significant impact on customer decision-making. In light of the remarkable growth of the service industry, extant literature on service quality reveals significant variations in the definitions and perceptions of service quality [6,9].

3. Methodology

3.1. Bibliometric Analysis

In order to formulate this critique and accomplish its objectives, bibliometric analysis was used. The practice of bibliometric analysis, which originated in the 1950s, involves the quantitative evaluation of bibliometric data, including publications and citations [10]. Bibliometric analysis is a valuable methodology for discerning the attributes of scholarly publications and assessing scientific outcomes in a systematic way [11, 12]. As cited in reference [11], bibliometrics is defined as the use of mathematical and statistical techniques in the analysis of books and other forms of communication. Bibliometric analysis is a widely used and comprehensive method for scrutinizing and clarifying vast quantities of scientific data. This enables us to analyze the evolutionary intricacies of a certain subject while also providing valuable perspectives on the developing areas within the field [10]. Bibliometrics is a statistical analytical approach used in the field of publishing that provides quantitative insights into academic publications [14,15]. As mentioned in a previous study [16], bibliometric analysis provides valuable insights into the growth of scholarly literature and the dissemination of knowledge within a certain field. This analysis involves reviewing data extracted from databases, including citations, authors, keywords, and article use statistics, to get a comprehensive understanding of the subject's development through time. Bibliometrics encompasses many methodologies, such as citation analysis, co-citation analysis, bibliographic linking quotation, and co-word analysis for keywords, depending on the dataset used in the research [17]. The methodology used involves the utilization of quantitative analytic techniques to examine empirical data derived from published literature, with the aim of investigating the patterns of publishing within a certain academic discipline. This study relies on a bibliometric analysis and strategic assessment of the contributions pertaining to service quality and customer happiness. The inclusion of sociological literature in these interdisciplinary data collections confers a significant advantage. The study started with a bibliometric analysis aimed at identifying the overall distribution of publications by year, the frequency of citations by year, the most frequently cited authors, and the productive countries. The following list comprises the top 10 distributions with the highest citation counts. The present research used the program Scopus to conduct a logical planning analysis, enabling the creation of logical maps and a more comprehensive understanding of the progress within a scientific field. Scopus offers a range of modules designed to assist researchers in conducting scientific planning activities. These modules include a dedicated segment for managing the database and its components, a module responsible for conducting scientific planning analysis, and a module for visualizing the generated results and maps.

Historically, classification and processing of bibliometric material were rather difficult, but bibliometric analysis has become much easier owing to a variety of tools (e.g., Gephi, VOSviewer, CiteSpace, BibExcel, and Bibliometrix). VOSviewer is a bibliometric analysis and bibliographic map expert program. The program was used to extract and summarize the relevant information from the gathered papers, which helped identify current research trends connected to transport quality and gave researchers with a clear vision to support them in future study and collaboration. The study also presents

an assessment framework for the topic of service quality, drawing on rigorous research and highlighting its importance in the examined contexts.

Since literature reviews lack a quantitative component, there is a possibility of researcher bias in the research findings. Thus, bibliometric analysis distinguishes itself by its capacity to analyze a large number of studies, significantly boosting the analytical rigor and trustworthiness of the conclusions and it eliminates researcher subjectivity. Another useful feature of this analysis is that it depicts a study field's structure, existing linkages, and popular themes [18]. Thus, bibliometrics enables us to rapidly capture the dynamics of publications in specific scientific domains and examine research gaps over time [19].

3.2. Data Collection

The bibliographic data for this research was obtained from the service quality of public transport Citation Index, accessed via the Scopus bibliographic database provided by Elsevier. According to the database introduced in 2004, Scopus has a comprehensive collection of roughly 36,377 titles from around 11,678 publishers. Among these titles, 34,346 are esteemed peer-reviewed journals that span across prominent topic areas such as biological sciences, social sciences, physical sciences, and health sciences [21]. For the purpose of this research, a total of 10 journals were chosen from a database. These journals were carefully picked, comprising of seven prominent business journals and three esteemed marketing journals. Aggregating findings from other business journal-ranking studies.

Data mining was carried out using the Scopus database in August 2022. The main theme of this research was a review article in the title and abstract that included "Service Quality*". The oldest and most recent dates of publication Returning to 2012, the latest one is from 2022.

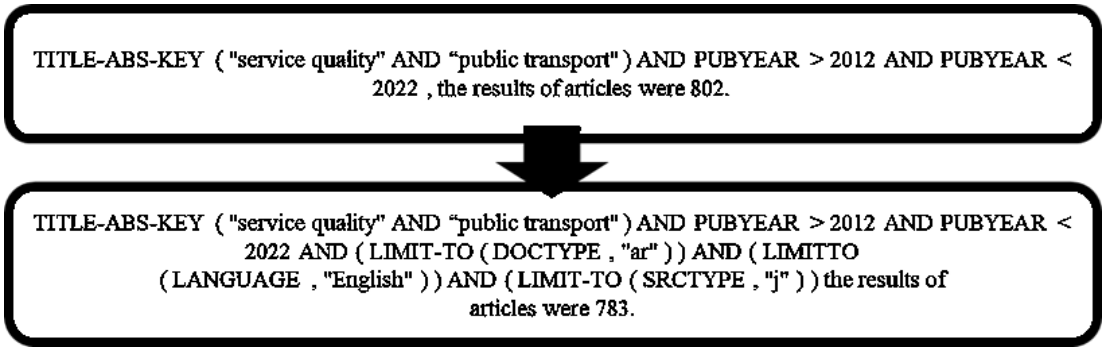

Figure 1. The procedure of data mining.

A total of 783 articles' citation, bibliography, and author keywords were exported to VOSviewer (version 1.6.7, Center for Science and Technology Studies, Leiden University, The Netherlands), which is a software tool used for bibliometric mapping and visualization. The outputs created by VOSviewer may be located and shown on maps. The objects of interest in this analysis are the items, while the author's keywords or nations serve as the focal points. A potential correlation or association might exist between any two entities, indicating a connection or relationship between them. Each relationship has a degree of strength, denoting a positive numerical value. There is a notable increase in the number of articles at the start of 2018, which reflects a significant interest in researching the service quality of public transport. The number of annual publications has shown a consistent upward trend, resulting in a notable rise in the overall quantity of articles generated. Hence, it is anticipated that the yearly publishing would persist in increasing. Nevertheless, a significant proportion of these articles are not readily available to users and need a financial transaction to get access to the valuable information they include.

The examination of co-authorship involves the participation of thirty-six writers from fifty-six nations. The nations engaged in this study may be categorized into ten clusters, each of which is represented by a significant country of co-authorship. These large countries include the United States,

the United Kingdom, Australia, Taiwan, South Korea, China, Hong Kong, Iran, Germany, Malaysia, India, and Italy.

The chosen overlay visualization technique for presenting the yearly average frequency of publication occurrences and the intensity of keyword connections via color reflects the normal year of publication for the associated document in which the keyword appears. VOSviewer has the capability to analyze a minimum of five keyword occurrences.

3.3. Data Analysis

The analysis conducted on Scopus resulted in a total of 783 publications pertaining to the assessment of service quality in public transportation. The distribution process started in 2012 and had exponential growth, culminating in its zenith in 2021. Given that the study was conducted in the mid-2022, it should be noted that the information pertaining to the year 2022 is not yet complete. However, based on the observed trend, it is hypothesized that there was a positive growth rate in the previous year, as seen in Figure 2.

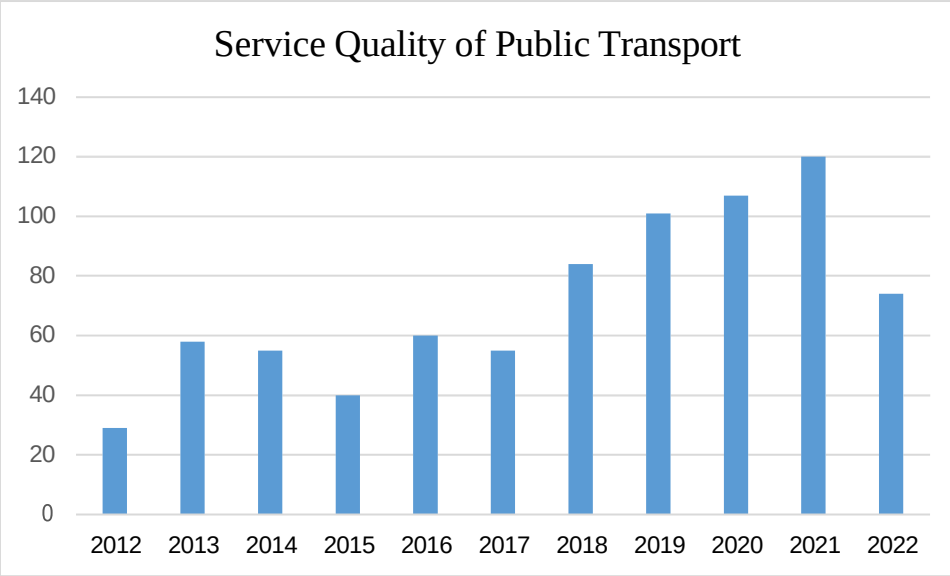

Figure 2. Service quality of public transport research studies.

Many researchers around the world work on service quality of public transport. This study affirms that service quality of public transport studies focuses mainly on 783 articles in the past ten years that revolved around public transport.

Table 1 presented above displays the top ten most often cited scholarly publications pertaining to service quality in the domain of public transportation. Through an analysis of these papers, it is possible to identify the key research topics in the literature pertaining to service quality. Based on the data, it is evident that the top 10 most competitive journals are owned by five distinct publishers, as seen in Table 1. Among the various publishers, Elsevier Ltd has released a total of five journals. One of their prominent publications is the respected magazine titled "Transportation Research, Part A: Policy and Practice," with a collection of 187 papers published in serials publications. Additionally, Elsevier Ltd has published "Transport Policy," which has produced 206 articles, and "Sustainability Switzerland," which boasts a substantial collection of 8,379 articles. Subsequently, Transportation Research Procedia and Transportation Research Record exhibited a total of 703 and 413 papers, respectively.

Table 1. Top 10 of the most productive journals on service quality of public transportation with the most cited article.

Journal Name	TP (%)	TC	Cite Score 2022	The most cited article (reference)	Times Cited	Publisher
Transportation Research, Part A: Policy and Practice	187	10,706	10.4	Early adopters of new transportation technologies: Attitudes of Russia's population towards car sharing, the electric car and autonomous driving	6	Elsevier Ltd
Transport Policy	206	7,063	8.7	Assessment of environmental and social sustainability performance of the freight transportation industry: An index-based approach	22	Elsevier Ltd
Sustainability Switzerland	8,379	198,292	5.0	The Impact of Financial Development and FDI on Renewable Energy in the UAE: A Path towards Sustainable Development	26	MDPI
Transportation Research Procedia	703	6,514	2.5	Impact of Teleworking on Travel Behaviour During the COVID-19 Era: The Case of Sicily, Italy	3	Elsevier B. V
Transportation Research Record	413	6,525	2.8	Characteristics of Heavy Vehicle Discretionary Lane Changing Based on Trajectory Data	4	SAGE Publications Ltd
Transportation	108	3,235	8.5	Exploring activity-travel behaviour changes during the beginning of COVID-19 pandemic in Indonesia	19	Springer
Public Transport International	30	560	5.5	Zero bunching solution for a local public transport system with multiple-origins bus operation	1	Springer Science and Business Media Deutschland GmbH
Research in Transportation Economics	56	1,603	5.2	Life cycle assessment of electric vehicles and internal combustion engine vehicles: A case study of Hong Kong	19	Emerald Group Holdings Ltd
Transportation Research Part C: Emerging Technologies	245	15,256	12.2	Decision making of autonomous vehicles in lane change scenarios: Deep reinforcement learning approaches with risk awareness	9	Elsevier Ltd
Case Studies on Transport Policy	160	1,823	3.4	Transport preferences and dilemmas in the post-lockdown (COVID-19) period: Findings from a qualitative study of young commuters in Dhaka, Bangladesh	5	Elsevier Ltd

3.4. Leading Countries, Organizations, and International Institutions

Figure 3 shown below illustrates the nations that have achieved notable achievement in driving the expansion of research activities pertaining to the quality of services in public transportation. China is in the forefront in terms of the number of publications generated, with a total of 93 journals accounting for 11% of worldwide publications. This significant contribution indicates that China has a pivotal position in driving the improvement of service quality in public transportation. According to the research findings, Spain ranked second in terms of productivity, with a total of 59 studies generated. The academic ranking of Huazhong University of Science and Technology (TPI) is somewhat lower than that of Hua University in Taiwan. This suggests that making a straight comparison among the fifteen nations with academic institutions might introduce bias.

This study aims to investigate the trends and advancements observed in the field of service quality of public transport research between the years 2012 and 2022. The paper systematically compiled the keywords from the review papers in order to investigate the usage of keywords and co-words as shown in Figure 5. This process was conducted in two distinct stages. In each sub-period, the development of co-word networks was undertaken to illustrate the relationships within visualised co-word networks in each respective subject, focusing on the keywords involved. To gain a deeper comprehension of the evolution of research interests, the study employed a classification method to identify recurring keywords across seven distinct thematic categories.

Out of 1727 keywords, only 53 met the threshold. A total of 53 author keywords were used. For each of the 53 keywords, the total strength of co-occurrence links with other keywords will be calculated. Since re- Interchangeable marking Single terms and congeneric phrases, 8 keywords for VOSviewer mapping reached a minimum requirement of 5 occurrences. The bubble width reflects the keyword frequency count, while the row thickness shows the keyword cooccurrence magnitude.

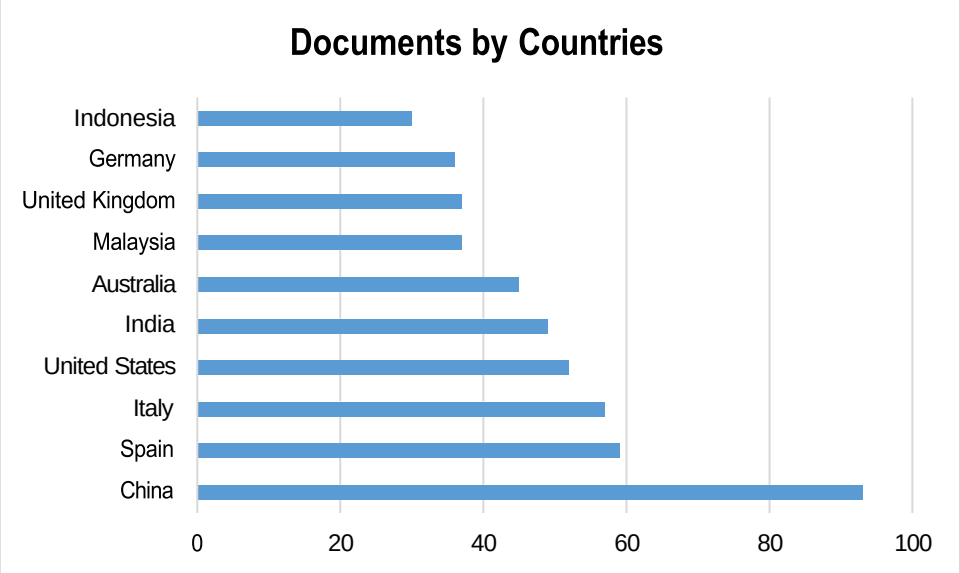

Figure 3. Nations involved in the case study.

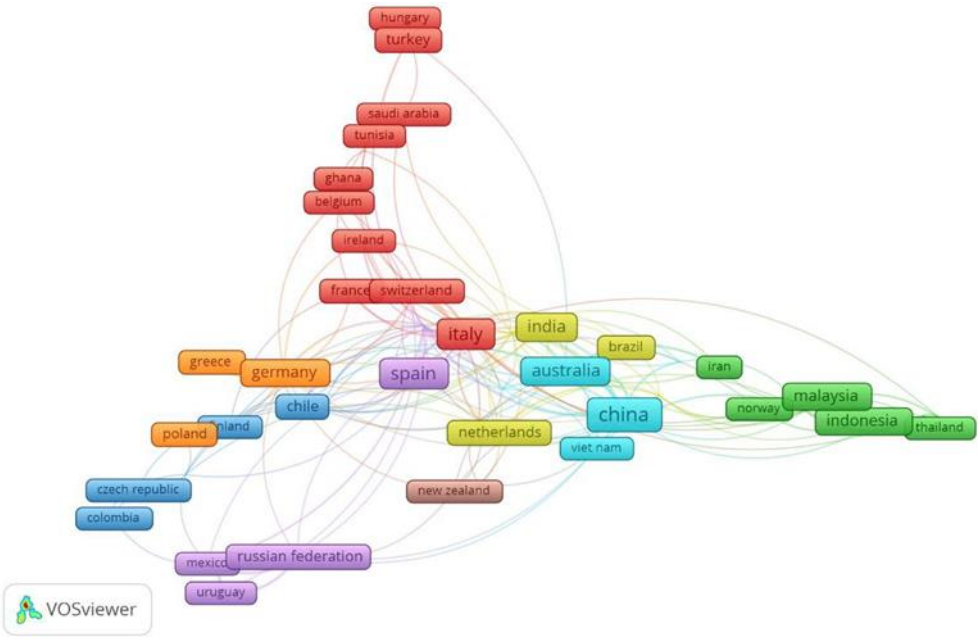

Figure 4. Visualization of the countries on service quality of public transport.

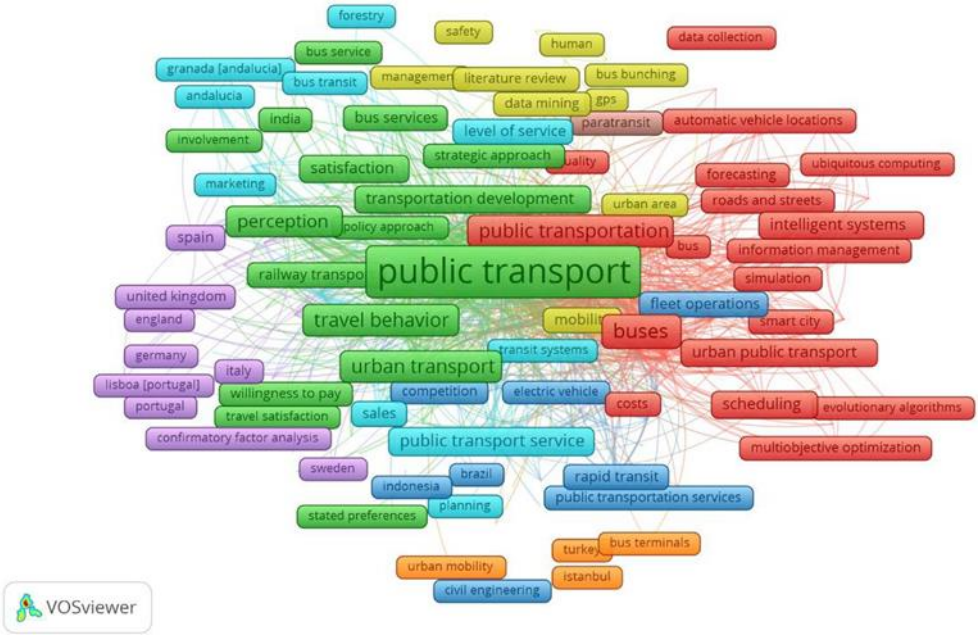

Figure 5. Keywords used in the study

3.5. Leading Authors

The list of the ten most prominent authors in service quality and customer satisfaction is displayed in Table 2 with the first publication ranging from 1998-2022. Table 2 lists the 15 most prominent authors in service quality of transport studies, as follows: Italy (2 authors), Spain (2 authors), Oman (1 author), Chile (1 author), Germany (1 author), Malaysia (1 author), Australia (1 author) and Sweden (1 author).

Mazzulla, Gabriella from Italy has led a record number of 81 documents, 30 *h-index* and 3,479 citations. Mazulla and Eboli, the second leading author are affiliated with the same current university which is Università della Calabria. Third and fourth leading authors, Juan and Rocio de Oña respectively have the same last names and are associated with the same university which is Universidad de Granada.

It should be noted that that authors do not necessarily appear in Table 2 for the most frequently cited papers listed in Table 1.

Table 2. Leading authors for service quality of public transport studies

Author	Scopus ID	Year of 1st Publication	TP	h-index	TC	Current Affiliation	Country
Mazzulla, Gabriella	6506549346	2001	77	27	3027	Università della Calabria	Italy
Eboli, Laura	24921250100	2006	68	27	2996	Università della Calabria	Italy
de Oña, Juan	12241140900	2002	85	24	2580	Universidad de Granada	Spain
de Oña, Rocio	36875908400	2010	41	20	1553	Universidad de Granada	Spain
Javid, M. A.	56514248400	2012	34	8	216	University of Nizwa	Oman
Muñoz ,Juan Carĺos	35368813300	1998	130	25	2565	Pontificia Universidad Católica de Chile, Santiago	Chile
Antoniou, Constanti-n os	7004031914	2002	240	34	4079	Technical University of Munich	Germany
Borhan, Muhama-d Nazri	23033010200	2007	65	13	554	Universiti Kebangsaan Malaysia, Bangi	Malaysia
De Gruyter , Chris	56256478600	2005	72	17	716	RMIT University, Melbourne	Australia
Friman, Margareta	6602671754	2001	93	35	4259	Karlstads Universitet, Karlstad	Sweden

4. Discussion

One of the primary concerns for transport planners is the promotion of sustainable modes of transportation to address the issues arising from the overreliance on private automobiles in urban areas.

Hence, managers of public transport services aim to reduce the reliance on private vehicles via the promotion of a consumer-oriented public transport system and continuous improvement in quality, ultimately resulting in increased customer satisfaction. Enhancing the caliber and efficacy of public transportation is essential in order to ameliorate individuals' everyday transportation practices.

Hence, in order to enhance the caliber and efficacy of public transportation, it is important to get a comprehensive understanding of the pre-existing methods for evaluating service quality. Service quality is a construct that encompasses a range of criteria that are used to characterize the public transportation service. Planning authorities and service providers have the ability to alter these qualities. The empirical evidence from developed countries indicates that in order to effectively compete with private transportation, public transit must continually enhance its quality and range of services [18].

Service quality studies provide valuable insights for policymakers in comprehending public views about the promotion of sustainable transportation modes. These insights may aid in the effective execution of the ambitious Malaysian National Transport Policy (2019-2030). These research aim to enhance the comprehension of users' perspective, which is crucial for policymakers to implement policies that may alter unfavorable views and attitudes towards public transportation while decreasing reliance on automobiles [4]. Research on service quality plays a crucial role in advancing the methods used to evaluate the effectiveness of public transportation services. It enables a thorough examination of the quality of service provided by public transportation systems. The provision of valuable information will enable operators to strategically develop services that cater to distinct user types and future consumers of public transportation.

The evaluation of a public transportation system encompasses several elements, including those pertaining to safety, comfort, responsiveness, capacity, tangibility, and dependability [1]. The comprehension of the behavior, requirements, and expectations of public transportation consumers has significant importance in the establishment of quality standards. Both transportation operators and regulators need to determine the key features that are most important to current and future customers.

With 53 keywords, findings showed that service quality in public transport's most frequently identified keyword was service quality which has 226 link strength. This can be seen in figure 5. The next frequently identified keyword is public transport with 186 occurrences and 196 link strength. Different research areas have been described and presented in the two statistics. During the period 2012 to 2022, service quality in public transport has been focusing on bus services and uncovering service quality attributes. This suggests further research in other modes of public transport. As stated by the source cited in reference [22], the information has been published and documented. Two distinct categories may be recognized for the measurement of service quality and customer satisfaction.

Based on the extant literature, there exists a consistent if modest body of research pertaining to the domain of service quality within the realm of public transportation. This bibliometric study aims to demonstrate the significance of service quality in public transportation. This document aims to provide information by presenting prominent writers and the important terms associated with the service quality of public transportation. Additionally, this study delves into the nations and organizations involved in the realm of public transportation service quality.

5. Conclusion

The study given indicates a discernible improvement in the research on service quality of public transportation, as shown by the examination of 783 papers from the Scopus database. Over the last decade, there has been a notable surge in the growth of publications, with expectations of further expansion in the future. A significant quantity of articles and robust international cooperation have been identified across several nations. Institutions have the potential to provide incentives to academics hailing from nations such as the United Kingdom and Australia, therefore facilitating the expansion of research cooperation. Various subjects have been extensively studied, with a particular focus on service quality and social sciences, which are considered significant areas of study. Various emerging study fields related to service quality have also been the subject of scholarly discourse.

There are also other limitations or drawbacks. The primary focus of the research is not immediately apparent, and a cohesive group of authors has yet to establish itself. The limited contact between research institutions and writers poses challenges in fully leveraging the benefits of collaborative gatherings. The current state of service quality in public transport necessitates more exploration. It is imperative for scholars worldwide to develop novel ideas pertaining to public transport's service quality. There have

been many studies on service quality in various fields. However, service quality research in public transport is still lacking. This can be seen from the results of the analysis using VOSviewer software. This article employed bibliometric analysis to identify the main topic areas in any research that has been carried out over a certain period and to identify trending topic areas related to the research to provide renewal opportunities for conducting further research in the future.

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The Implementation of Smart Contract as A Solution for Solving Legal Controversies in The Construction Industry - A Bibliometric Analysis and Critical Review

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Abstract. The flaws in contract interpretation and its lengthy process have caused several legal controversies in the construction industry: construction disputes, mechanic liens, timeline dispute and construction defects globally. For the past two decades the construction industry has been swaying towards a digital culture, coupled with the digital technologies associated with the 4.0 revolution principles. Smart contract is foreseen to provide solutions to the various legal issues faced by the built environment. Smart Contract can be viewed as a steppingstone in endorsing various digital tools in the construction culture. There is rich literature focusing on the adoption and implementation of many new technologies across the construction arena, whereas administering smart contracts as a legal solution has often been marginalised. This study demonstrates key findings from a bibliometric analysis and critical review of 465 published journals between 2017 and 2023. After thoroughly reviewing the abstracts, 36 published articles; all focusing on smart contract to address the afore-mentioned legal controversies were used for a Bibliometric Analysis. The Visualization of Similarities (VoS) Viewer application was used to graphically map the articles. The findings revealed that United Kingdom and China are the two countries where the topic was mostly researched. Furthermore, 36% of the articles have global co-authorship Findings from the literature review determine that smart contracts are advanced beyond contract administration and payment provision. It encompasses logistic handling, decentralised application, business management and automated payment. Additionally, it is observed that smart contracts adoption incorporates semi-automated consensus mechanisms for payments and encourages transparent symbolic methods. This study delves into using smart contracts as an adaptative solution to deal with legal construction difficulties.

1. Introduction

Time, cost and quality are the three main constrictive factors in determining the success or failure of projects. Issues like contractual disputes, delays, overruns, contractual claims are commonly triggered through these factors on construction projects. McKinsey Institute [1] study stated that contract procedures defined in construction projects are sources of those issues [1]. Contracts play paramount roles in the successful completion of construction projects globally. It is observed that traditional paper

contracts as a means of contractual arrangement for construction projects face several legal controversies [2].

The supply chain involved in major construction projects relates to many organisations and generates oodles of project information. Innovative evolution in technology has created management tools to handle heap project information as well as solving controversies simultaneously [3]. The last couple of decades, this industry has been hit by the wave of digitalization and it has introduced various prospects for the construction precinct. One of the most recent revolutionary applications that the construction industry is observing is the adoption of smart contracts. By definition, a smart contract are self-executing contracts that are automatedly and automatically fulfilled when specific pre-determined conditions are successfully executed [4] Smart Contracts are digitally programmed developed through the blockchain technology and has the capability of streamlining the contractual process, lowering transaction cost, enabling transparency and trust among construction stakeholders [5] However, the application of smart contract has the potential to solve the legal controversies spotted when using traditional written contracts by the construction industry [6]

Therefore, the study of the application of Smart Contract is essential because it can prove to be more effective and efficient compared to traditional contract [7]. Smart Contract is a peculiar digital tool that has a new approach to look at payment system [8]. Furthermore, Smart Contract provides advantages to clients, contractors, subcontractors, consultants, suppliers and others through the construction supply chain [9]. Smart Contract is becoming more and more popular in the construction arena and there are several reviews which have contributed to the state of the art and still more needs to be added and complemented. Defacto, there is still an insufficient detailed studies related to smart contracts in resolving construction contractual issues. Therefore, the objectives of this research are: RQ1. What trend for yearly publications of smart contracts in the construction industry? RQ2. In which countries most studies on smart contracts as a solution to legal controversies are conducted? RQ3. Explore the evaluation of research on smart contracts in resolving construction contractual issues.

The defined gap was resolved by using a Bibliometric Analysis and a Systematic review to answer the stated research questions in favour of augmenting and contributing knowledge in literature on smart contract application for academia and industry stakeholders. As smart contracts are gaining broader construction market development among construction practitioners, this study enlarges the scope of advancement and subsequent orientation of smart contracts for the construction sector.

2. Background & Literature Review

Any nation's economy around the globe has a dependency on the building industry. The same industry has always been criticized for its vulnerability due to late or non-payments issues [10]. Payment delays, absence of payment assurance, refusals, and rejections of payments and other disputes are major contributing factors affecting the normal course of the construction industry and have a significant influence on the stakeholders involved in construction initiatives [11],[12]. The effect of these issues results in cashflow difficulties, time delays and insolvency [13]. Contrasting to other industries like automotive, hospitality, medical and logistics, the construction industry is slow in adopting and implementing modern digital tools to cater for the contractual issues facing the industry [7]

Instead of relying on the time-consuming, ineffective, and inefficient human operated work processes [3], it is high time that the construction industry adheres to innovative techniques that are cost effective with increasing quality and time performance to reduce the contractual issues effect. Smart contracts are labelled as a particular kind of digital tool that might substantially assist the industry in its difficulties.

2.1. Smart Contract

Smart contracts' application in the building sector presents a prospective initiative to mitigate payments and disputes in contracts. Smart contracts have the competence to programmatically distribute money on a predetermined date without delay, thus reducing the possibility of effecting late payment. This industry requires a secure legal environment to reduce contractual controversies throughout the building process, smart contracts are welcome to positively contribute as an innovative tool to influence the

industry [12]. Unfortunately, this particular industry is reputed for its resistance to adopting novel digital technologies [14]

Henceforth, smart contracts are suggested as the novel technology to deal with long lasting time contract processes. Nick Szabo first proposed the smart contract as a computerized protocol in 1994 for the execution of the terms and conditions of a contract through codes [15]. Smart contracts are defined from Blockchain technology, which organizes the execution of established and pre-agreed legal obligations based on decentralized network coding [16],[17]. Digital contracts and intelligent contracts are used to refer to smart contracts, all these terms share similar meanings. As per Ahmadisheykhsarmast & Sonmez, [12], smart contracts guarantee a trustworthy interaction and payment among project stakeholders which in turn reduced the cost of third-party intermediaries. It also has the potential to minimize time and cost overruns. Therefore, it uses is of paramount significance for the construction industry to go ahead with digitalisation.

2.2. The Construction Process and Smart Contracts

There is potential for smart contracts to be customized to support solving a number of expanding issues in the construction industry like, payment concerns and contract disputes and further can be used to encourage the implementation of building information modelling (BIM) [18]. Furthermore, research conducted by Agapiou, [6] stated that with smart contracts, specified criteria can cause automatic actions to be taken. The use of smart contracts on the construction projects is summarized but not limited to, payment escrow, payment tracking, quality assurance, contract administration, dispute resolutions, supply chain management, warranty management and insurances. With the goal of increasing efficiency, lowering costs, and fostering trust in contractual relationships, the construction sector can use smart contracts to computerize key processes in the methods already indicated. However, it should be highlighted, though, that the usage of smart contracts is still in its infancy and that ongoing legal and regulatory changes could have an impact on how they are applied in the construction sector. [19].

3. Research Methodology

The "mixed-systematic review method," which combines a qualitative approach (such as bibliometric analysis) with a qualitative approach (such as systematic review), was used to achieve the objectives of this study: Figure 1, depicts the methodology's theoretical foundation.

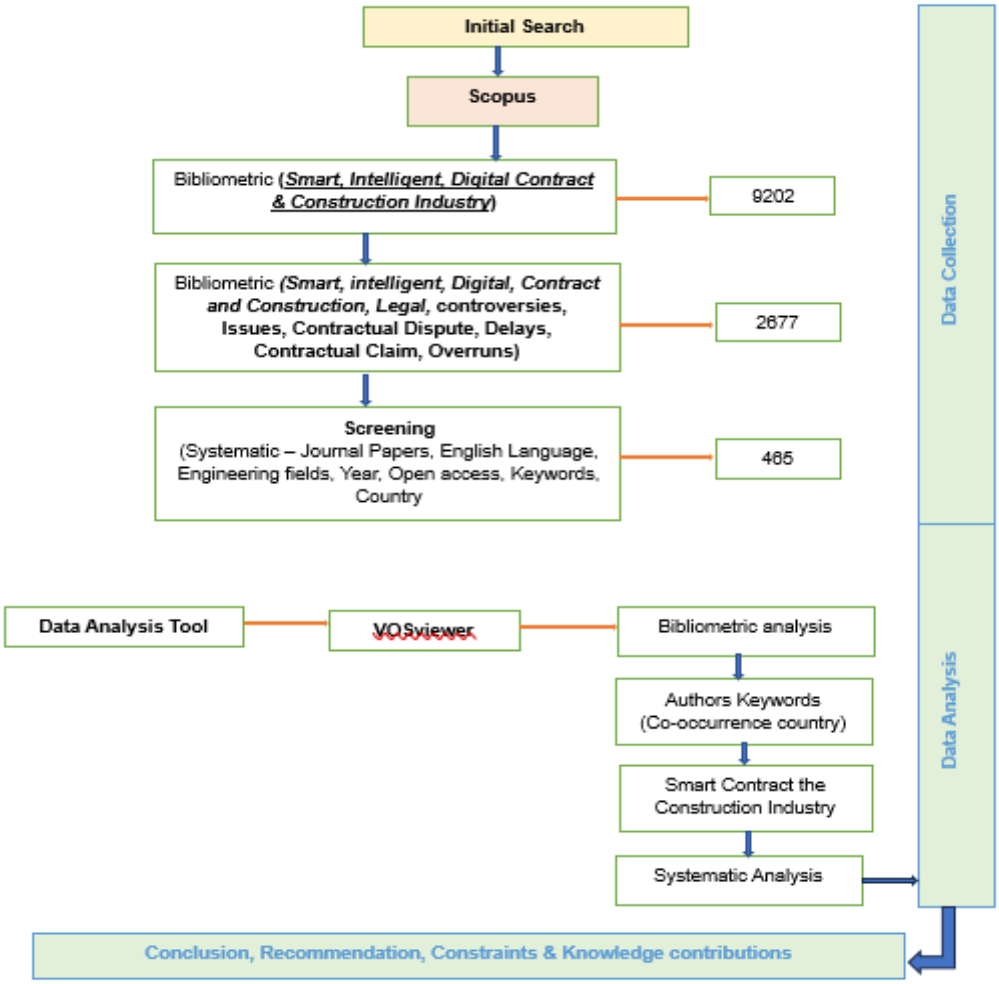

Figure 1. Research Theoretical Framework.

3.1. Method of Mixed-Systematic Review

For this study, a mixed-systematic review methodology was used. Utilizing both the strength of qualitative and quantitative methodologies, the mixed method approach seeks to lessen the discomfort. [20]. The bibliometric technique is used in this study because it is a valuable tool for illustrating the scope of the information and the connections between articles, journals, conference articles and other sources of information [21]. Bibliometric mapping is embraced as a tool to clasify the knowledge domains and the study models for smart contract and the legal contraoversies from established literatures. Systematic analysis currently defines a holistic perspective of various research to unveal what has not yet been researched and to profile future research directions [22]

3.2. Data Collection

The Scopus database was consulted to find data for the research because of its wider range of scientific publications relative to other database [23], its capacity of indexing mechanisms that provide access to most recent publication [24],[25] and for providng a non-replication of publications from various databases [26]. The eventual approches adopted for the data collection were bibliometric analysis and systematic analysis respectively. Stated by Donthu, et al. [27] the bilbliometric analysis approach focuses on interpreting and recording the Smart contracts' evolutionary nuances and scientific basis by rigourously assessing massive amounts of unstructured data in the construction industry between 2017

to 2023. This chosen period reflects the maturity of the research domain. The Bibliometric analysis offers strategies to access selected data inline with smart contract and the construction industry. Figure demonstrate the search engine of the literature. The first row and the second row were combined to define literatures related to smart contract in the consruction industry domain. “Smart" OR "Intelligent" OR "Digital" OR "Contract AND Construction" AND "Legal" OR "Controversies" OR "Issues" OR "Contractual Dispute" OR "Delays" OR "Contractual Claim" AND "Overruns.

The search process using keywords search combination “Smart" OR "Intelligent" OR "Digital" OR "Contract AND Construction" in the Scopus database generated up to 9202 publications up to May 2023. The keyword search was set to retrieve publications using title/abstract/keywords. Furthermore the legal aspects were added in the search string and the total records from Scopus obtained were 2677. A screening application was then conducted through a systematic review where only publications related to source types Journals, English Language, Engineering fields, Year, Open Access, Country and it reduces to 465 Scopus records.

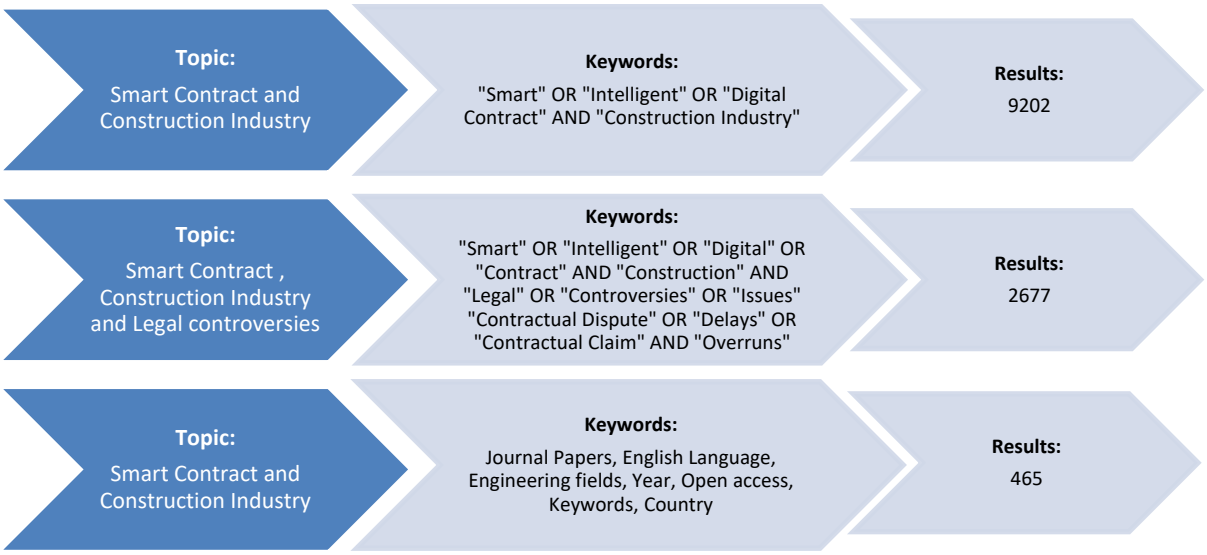

Figure 2. Literature Search Strategies.

3.3. Bibliometric Analysis Tools

For this study the network results of the Systematic Literature Review were visually displayed using the VOSviewer tool. Tools for various bibliometric analyses such as Gepsi, Cite Space, Sci2, HistCite are also available and each of them they have their own strength and functionality. VOSviewer has the potential and ability for visualising and exploring bibliometric networks [28]. Recently, many researches have used VOSviewer tool to undergo studies on BIM literature and Smart Contract literature as it is the most distinctive and influential knowledge graph analysis tool [29]. As examples Ding et al., [30] used VOSviewer for a Bibliometric review of the Integration of BIM and Chinese Architectural Heritage. Lately, Rathnayake et al. [31] used VOSviewer tool for bibliometric analysis and review of Smart Contract in the constrution industry.

4. Analysis and Discussion of the Data

4.1. Descriptive analysis

4.1.1. Annual Publications Trends on Smart Contract in the Construction Industry. Publications on Smart Contract in the construction industry as shown in Figure 3. ***The annual publications trend between 2017 and 2023***shows an increasing trend between 2017 and 2023. In 2017 a total amount of 39

publications are related to Smart contract in the construction industry and in 2022 the total amount of publications associated to smart contract in the construction industry is 103. In 2023, by the time the analysis was conducted it was observed that 56 publications were already been established henceforth, we can see as a prediction that the trend is on an ascending dimensions. The emerging concept of Smart Contract is gaining amplitude in the construction industry. Additionally, the rise in publications about smart contracts in the building sector suggests that the technology is a predictably useful tool as a new research agenda in the construction field. From 2019 the publications on smart contract have increased signifigantly which expalins the increasing awareness in the application of smart contract by the construction stakeholders. Besides, the scalability of smart contract is a plus point for its adoption in the construction arena. Based on the actual data it is perceived that the contribution to research on smart contract in the construction industry is going to be a branch of research in the very near future.

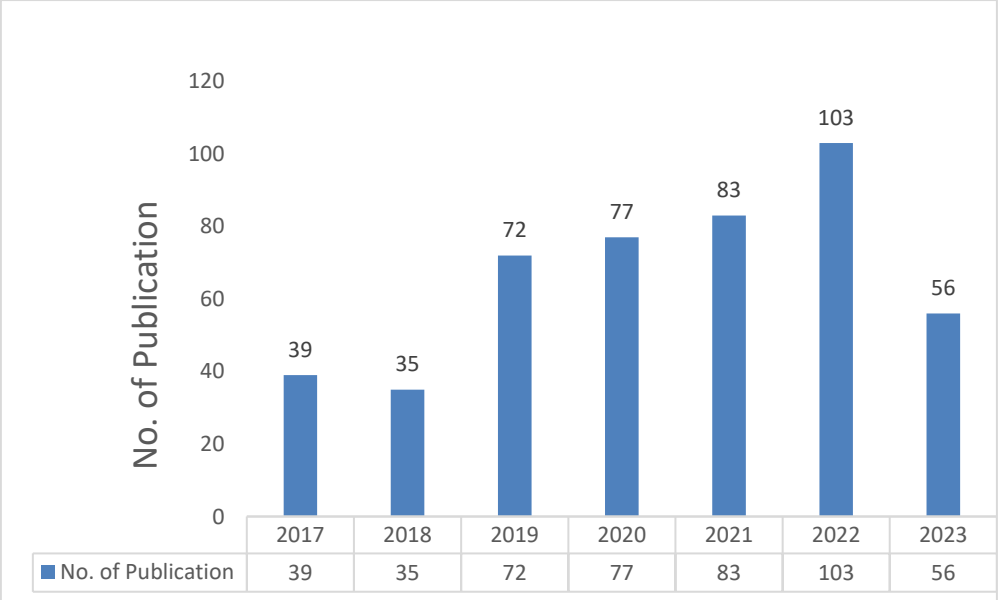

Figure 3. The annual publications trend between 2017 and 2023**.**

4.1.2. Journal contribution on Construction Industry Smart Contracts. Academic journals are one of the pillars of research where academicians can refer for information in any field of science [25], similarly for smart contracts this holds true. Figure 4 below shows that *Automation in Construction* has the highest contribution of publications in the field of smart contracts in the construction industry. It also, reveals that *Buildings from MPDI* influences the publications on smart contract related to construction and the *Journal of Construction Engineering and Management* also plays an important part in the publication in the same area. This is a very good point to be referred to by researchers and students who are and wish to study smart contracts in the construction industry, their focus should be geared toward *Automation in Construction*. It has a significant contribution on Smart Contract applied to the construction arena and it includes information about a wide range of topics of digital solicitation to the construction industry. It is a positive point to be noted from Table 4 below that there is a large number of different journals that are contributing to research pertaining to smart contracts applications to the construction field. Figure 4 below displays a comprehensive journal contribution on the application of smart contracts to the construction sector..

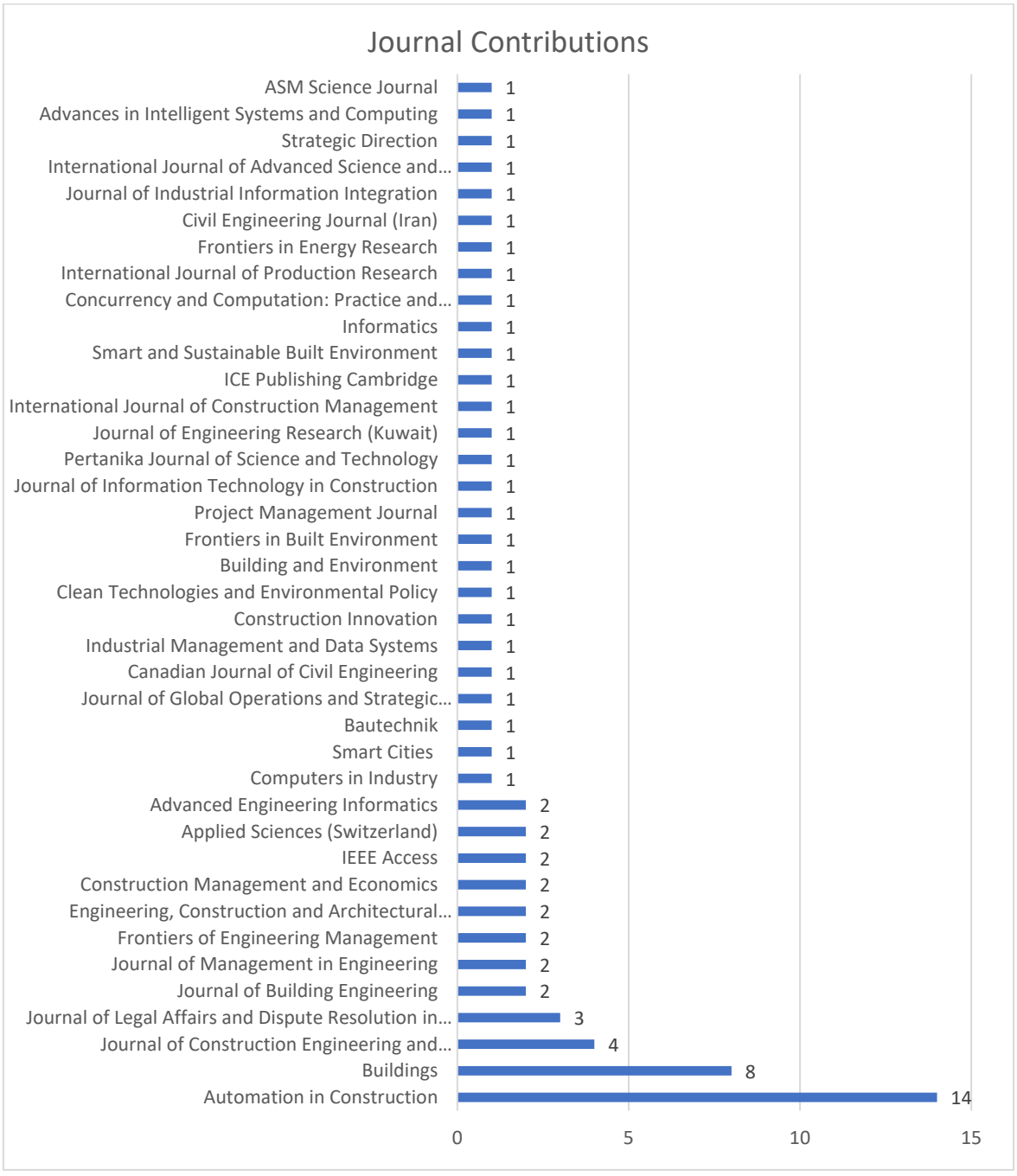

Figure 4. Journal Contributions.

4.2. Bibliometric Analysis

4.2.1. Geospatial distribution of academic articles about smart contracts in the building sector. The second research question was defined by using the global network of nations in the area of scientific collabaoration particularly researching the smart contract application in the field of construction. VOSviewer network was accustomed to develop the geospatial distribution and collaboration. The "Co-authorship" type of analysis and "Countries" unit of analysis have been applied to establish a detailed vizualisation of the countries collabaration network as shown in Figure 5.

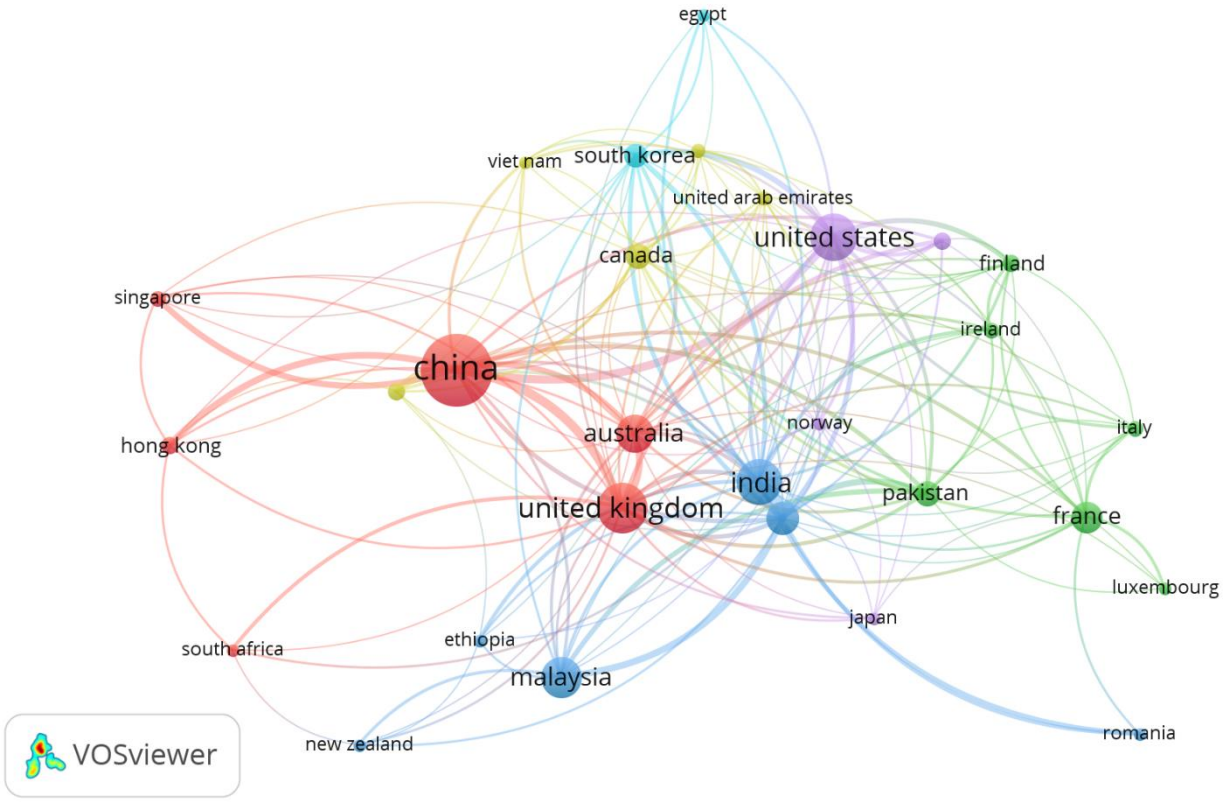

Figure 5. The geospatial cooperation network on smart contract research.

To demonstrate most effective network, the "minimum number of documents of a country" and the "minimum number of citations of a country" have been set to 10. It is observed form the geospatial network that China and United Kingdom have a solid relationship with each other and they are the most rated nations researching in the area of smart contracts related to the construction industry. Australia and United State are the next two countries which have a glaring link with China in the same field of study. China is enthusiastically collaborating in research in the field of Smart Contract with Singapore, Hong Kong, Pakistan, France Vietnam and Malaysia. The [Table 1] below demonstrates the ranking of the the geographic distribution of publications on smart contracts that have been published in the construction industry. In terms of citations, China (3851 citations), United State (2374 citations), United Kingdom (1338 citations) and Australia (1023 citations) publications in the field of smart contract are most cited. The least cited country is Hong Kong with 195 citations. The country's impact was measured and demonstrated by their typical number of publications and citations for each article, the results demonstrated that Taiwan is the highest among the 15 countries showing interest in the study of smart contract within their construction industry with an average citation per publication value of 60.5.

Table 1. Geospatial distribution of published articles on Smart Contract in the Construction Industry.

S. No.	Country	Documents	Citations	Citations' Rank	Average Citation/ Publication
1	China	171	3851	1	22.52046784
2	United Kingdom	84	1338	3	15.92857143
3	United States	72	2374	2	32.97222222
4	India	66	948	5	14.36363636
5	Malaysia	54	376	10	6.962962963
6	Australia	46	1023	4	22.23913043
7	Saudi Arabia	36	508	9	14.11111111
8	France	33	210	13	6.363636364
9	Pakistan	21	205	14	9.761904762
10	Canada	21	690	7	32.85714286
11	South Korea	19	733	6	38.57894737
12	Sweden	11	343	11	31.18181818
13	Finland	11	236	12	21.45454545
14	Hong Kong	11	195	15	17.72727273
15	Taiwan	10	605	8	60.5

4.3. Author contribution

A research paper's significance is mostly determined by the caliber of the research it contains. The quantity of writers in a research article is not a criterion for judging the study's quality, but it gives an indication of the level of collaboration to the research work. As per the systematic literature review, 6% of the research papers in this study had sole author and the rest had multiple authors. Figure specifies the authors' contributions for the selected papers for the systematic Literature Review.

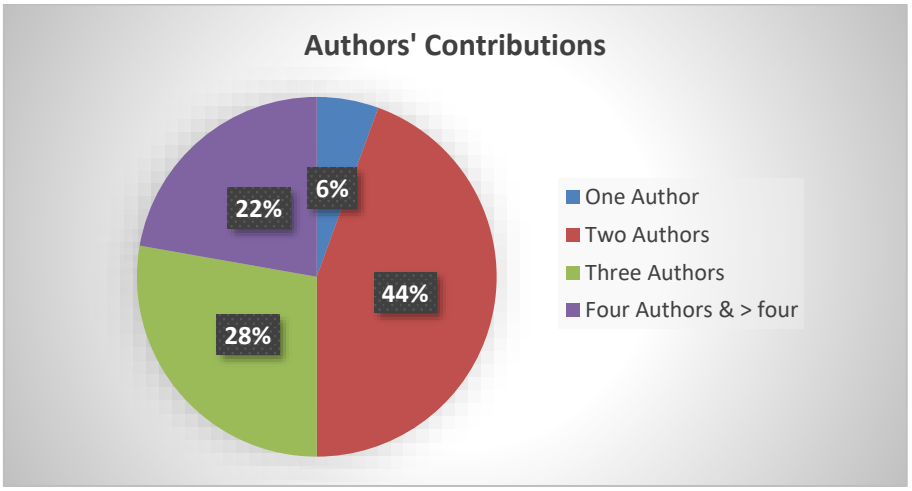

Figure 6. Contributions made by Authors.

The analysis of international involvement by considering country of author's institutions is shown in Figure . Accordingly, 36% of the research publications have international co-authorship and 64% of the publications were composed by natioanl authors (authors of the same nation). This proves that there is ample possibility for more co-author relationship among various researchers from different nationalities to augement the research intensity relating to the building industry's use of smart contracts.

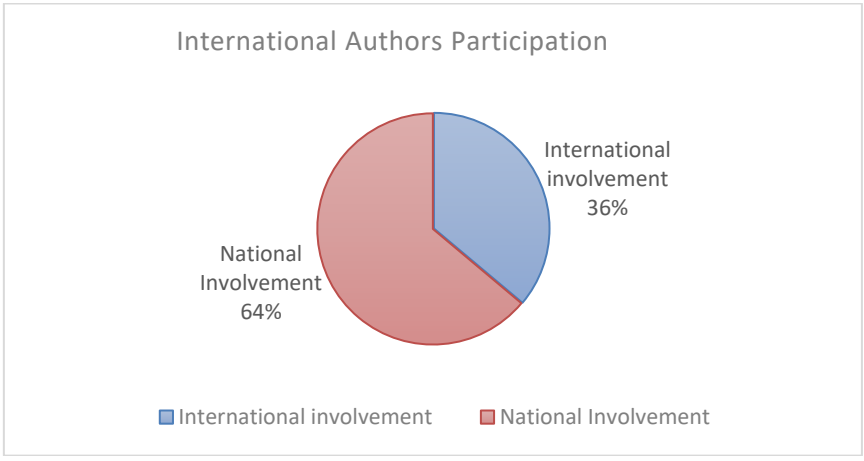

Figure 7. International Authors Participation.

4.4. Keywords Analysis

Keywords are essential parameters, as a research tool, to recognize the area of research topic [31]. Figure shows the most popular search terms chosen for the study. Based on the 465 papers, it was found that blockchain is mostly researched followed by smart contracts. This implies that even though the current study focuses on smart contracts, "blockchain" displays a strong interrelationship with the use of smart contracts in the building arena. It is also observed that construction, disputes and disputes resolution are keywords most frequently cited in their research as author keyword occurrence. This proves that the chosen articles are pertinent to the current investigation. It also reveals that there is a potential for new research in relation to FIDIC and smart contract.

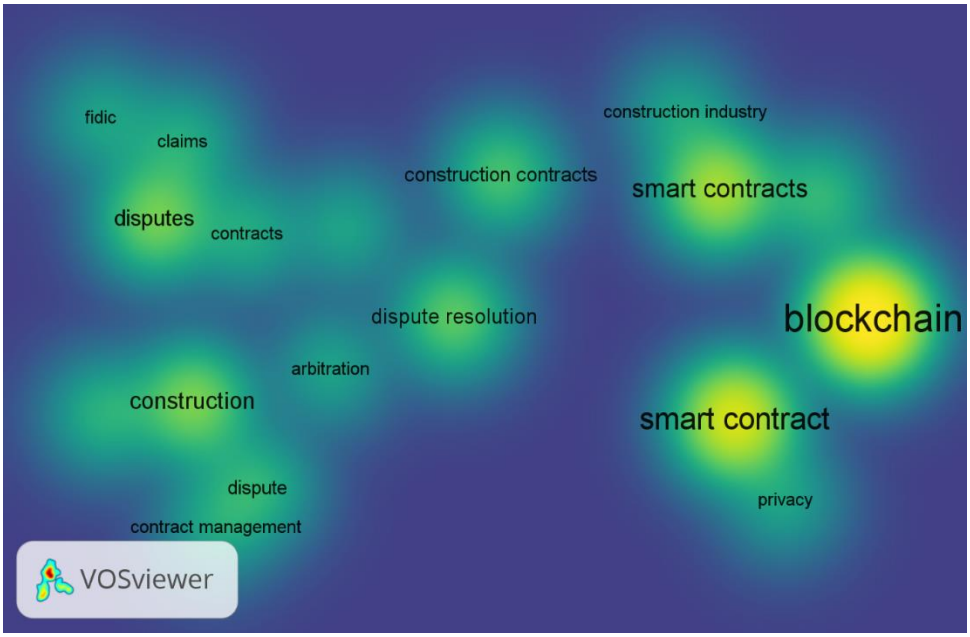

Figure 8. Co-occurrence of Keywords.

4.5. Evaluation of smart contract in resolving construction contractual issues

Figure 9 illustrates how the third goal of this study was determined through a systematic literature evaluation. The use of smart contracts was broken down into three phases, including: Phase 1 - Planning and design phase, Phase 2 - Construction phase and Phase 3 - Operation refer to Figure [32]. The [Table 2] shows the distribution of each phase, the legal controversies associated with each one and Sub-legal issues affiliated to them during a construction project's life cycle. The sub-legal issues contribute in specifying the solutions applicable by smart contract in resolving contractual matters in specific areas of the construction industry.

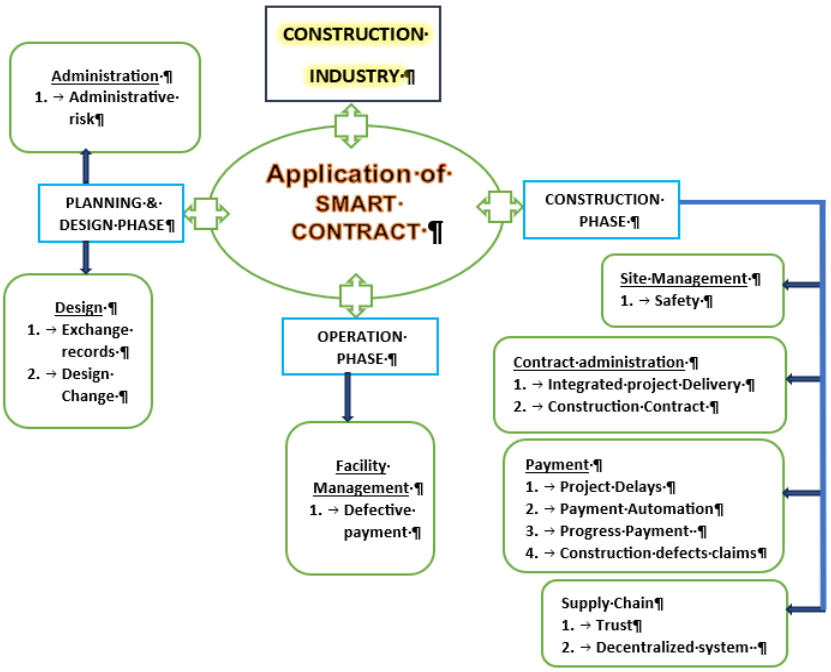

Figure 9. Phases of the application of smart contract.

4.6. Contractual controversies associated with the life cycle phases of construction projects

The construction sector has embrased on many evolutionary technological improvements in the past two decades. Construction projects are still unable to settle numerous legal controversies in their life cycle stages despite substantial scientific research and enhanced management strategies. [33]. The observed legal controversies at each life cycle phase are seggregated during the design and planning phase as Admistration and Design, in the construction phase as Site Management, Contract Adminstration, Payment and Supply Chain and at operational phase as Facility Management.

Table 2. Phases and contractual legal controversies.

Serial No.	Phase	Construction legal controversies	Sub- Legal Issues	Source
1	Planning and Design	Contract Disputes	Administrative Risk	[9],[32],[33],[34],[35]
		Design negligence	Design defects	
			Changes at design stage	
2	Consruction Phase	Site Management	Safety	[32],[45],[46],[47],[48],[49]
			Scaffolding	
		Contract Administration	Integrated Project Delivery	[18],[32],[50],[52],[53],[54]
			Construction Contract	
		Payment	Project Delays	[10],[12],[19],[31],[32],[35], [55],[56],[58],[59],[60],[61],[62]
			Payment automation	
			Progress Payment	
			Construction defects claims	
		Supply Chain	Trust	[63],[64],[65],[66]
			Decentralised system	
3	Operation Phase	Facility Management	Defective payment	[67],[68]

4.7. Planning and Design Phase

4.7.1.Contractual dispute/Adminstrative risk. At the planning and design phase the contractual dispute was related to adminstrative risk [9], [32], [34] and it was noted that smart contract studies had not given any particular solution regarding administrative risk issues throughout the building projects' life cycle. The relevant publications spoke rather on the factors like drivers and risks of smart contracts adoption in the construction sector. A through study done by Badi et al. [35] on United Kingdom data reveals that four determinants that have a vital impact on the adoption of smart contarct are observability, high level management support, competitive pressure and supply chain stress. Furthermore, Koc & Gurgun, [36] defined the best five drivers required to implement Smart Contract are easy-to-read layout, lowering of client risks, absolute responsibility, risk allocation and simplicity of understanding by different stakeholders and conflict and dispute resolution. A research conducted by Gurgun, & Koc, [34]; Faraji, [9] stated that the five adminstrative risks quoted as barriers in the implementaion of smart contract are, change in regulations, lack of will power, overlook planning strategies, legal arrangements not clearly define, no proper disbute resolution methods available. Shen & Pena-Mora, [37] talked about using

smart contracts togetehr with blockchain on contract management for decision-making. Therefore, Smart Contract has the potential to be applied at the planning and design phase of construction projects to overcome legal controversies at administrative risk level.

4.7.2.Design negligence.

With digitisation, design information can be better handle and exchanged through BIM- enabled information management but little attention is paid to their administrative contract in terms of design liability [32]. A study was done by Erri Pradeep et al. [38] identified a method, using the Ethereum public blockchain, to strengthen the regulation of design liability for participating stakeholders and the exchange records' ability to be audited.They also concluded that smart contract was the key element in the system that guarantees design security. The verification was enabled by using a safe login for identifications that are stored on the blockchain. This implies that smart contract provides security to design informtion at various levels as the system is controlled by the credentials of the user. In a study done by Dounas et al. [39] Dounas et al. [40], elaborated on the principles of a smart contract linked with various BIM tools that helps in the decentralisation at architectural design phase with the idea of a successful collaborative philosophy for designers. Another study embrased by Tao et al. [41] shows that the applicationof smart contract with BIM enabled collaborative design to enhance security and decentralisation of transactions among stakeholders. They elaborated on a smart contract principle to discuss and ask about design adjustments. In line with the above design negligence can be eliminitaed as collaborativeness among stakeholder is ensured. Srećković et al. [42], through a conceptual framework at design phase defined approvals and certification of workflow at various stages during design phase. Furthermore, Liu et al. [43] investigated smart contracts use to facilitate BIM for viable management of building design information. To show how design negligence can be controlled by smart contract, Dounas et al. [44]described a managing BIM change records with smart contracts in the practice of architectural design. Supporting Dounas's study, Xue & Lu [18] envisioned a new smart contract logic to lessen information overlap between clients and architects by solely controlling and storing BIM change information at design phase. Conclusively, design negligence can be managed and controlled by the application of smart contract during the planning and design stage of a project's life cycle, and at the same time collabation among stakeholdes is ensured.

4.8.Construction Phase

4.8.1 Site Management.

Construction site management information is a very tedious and complex task to be managed under the traditional method. Engineering data manipulation is just one of several fraudulent behaviours that plague the real-world application of construction site information management, substantially impeding the monitoring of engineering projects' safety. [32]. Digitalisation has brought a new breath to the structure through smart contracts. Smart building sites can increase the security and traceability of multi-nature engineering data by implementing creative digital management. This implies the advantages provided in terms of authenticity and security of engineering information reduces the risk of legal issues in the long term. Smart contacts can also prevent fraud, tampering, and breach of contract, as the blockchain ensures that every transaction is verified, recorded, and immutable.

It is noted that under the construction phase, studies on smart contracts reveal that smart contracts are used to bring solutions to safety issues and workers management. Kochovski & Stankovski [45] utilized smart contracts for management team access to AI models to meet data security and privacy norms, resulting in a secure and intelligent construction site. As smart contract creating a safe and knowledgeable construction site, the risks of legal controversies and dispute are limited. In a study accomplished by Pinna et al. [46] established a management system for construction workers where they defined two main smart contracts, the "OSPManager" and "JobManager". These two contracts serve the purpose of meeting security criteria by utilizing "contract diagrams," which are diagrams that represent the on-chain components of solidity-based smart contracts.

Further use of smart contracts in solving contractual issues on site work is found in the supply and erecting of scaffolding on site. Scaffolding work has always generated contractual issues on construction site which is considered as a hindrance in the final completion of construction projects.[47] A study defined by Baek et al. [48] used smart contracts to examine adequacy of on-site scaffolding. The system developed allows the input of information on ordering and procurement by both main contractor and supplier. The traceability of information was prompt and accurate using a distributed ledger store technology through a smart contract process. This in turn reduces the risk of non-supply of scaffolding on time and prevents contractual dispute for inaccurate information. It is also proved to promote better business relationships as they can protect the privacy and identity of the parties, as well as the sensitive and proprietary information contained in the contracts, by using encryption and digital signatures. For the installation of scaffolding on site, Li et al. [49] study showed the application of smart contract with BIM to provide a simulation for the installation work. This technology is seen to reduce contractual conflicts during the construction process and it enhances the workflow for proper completion of work on time scheduled.

4.8.2.Contract Management.

The goal of the contract management protocol is to coordinate the formation, implementation, and analysis of contracts at the organizational level in order to maximize both operational and financial performance. The objective is to reducing financial risk which is most likely difficult with construction projects due to the uniqueness of each project [18]. Contract management in the construction industry deals with information processing. The flaw with the current prevailing traditional paper based contracts directs to complications in tracking changes and recording implementation. This leads to irregular behaviour and low contract enforcemnet. As a result of the benefits that smart contracts provide, immutability can be guaranteed while all modifications are securely documented [32]. As contract management is an information process based, Various types of information can be applied to smart contracts, like construction documents, [50] delivery information [51] and BIM change data [18]. These applications can solve many disputes and contractual issues during the process as information can be effortlessly traced and firmly recorded. A research executed by Das et al. [50] showed how smart contract is used to develop a document management system for construction projects. The process involves two elements known as a process orchestrator and a sub-process executor where the former process arranges the functions according the workflow and the latter executes individual function like document creation and endorsement, updates and feedback.

Construction projects require compliance checking to warrant the correctness of various information like execution order, payment, and BIM model. Methodically analyzed obstacles to automated compliance checking was conducted by Beach et al [52], the study reveals that lack of open standards regulatory clauses and regulatory protocols for BIM make the contractual enforceability a diificult process when using the design and built delivery method. Following the difficulties forecasted by Beach et al [52], Hunhevicz et al. [53] came up with a contractual solution utilizing clever control logic to regulate the order of work execution for various construction participants. Furthermore, Nawari [54] proposed a smart contract framework to verify the BIM model compliance over a project's whole life cycle. Those methods investigated ensure the reduction of contarctual conflits throughout the conntract management process.

Hence, conclusively smart contracts can enhance contract security by developing the confidentiality, integrity, and availability of contract data and transactions. Furthermore, smart contracts can increase the resilience and reliability of contract execution, as the samrt contract uses a blockchain platform, which is distributed and decentralized, implies that neither a single point of failure nor an attack can compromise the network. This ensures that contractual controversies can be eliminated.

4.8.3. Payment.

Payments are assisted in a construction contract via the supply chain and logistics by combining stakeholders activities during the construction period. They relied also on the terms and conditions such as obligations, permisions, and prohibitions [55]. Construction payment administration is a laborious operation when using the conventional way. Furthermore, it is more complicated because many stakeholders are subject to various contracts at various phases and levels of the project's structure. The payment procedures are also impacted by the lack of clear definitions of the obligations, liabilities, and liabilities of stakeholders in building contracts.This increases disputes and originates delays in payments which are the root reasons of extra spending, cash flow issues, and a lack of confidence. The reviewed publications for this research showed results that smart contracts in construction field is a novel method or technique [32], [56].

There is a positive view of most reviewed publications on the use of smart contract for payment. They also, proposed that smart contract can be seen as an alternative to counter payment contractual problems on construction projects. In Badi's et al. [35], research, they stated that smart contracts allow that payout time can be reduced. Futhremore, smart contract can lower transaction cost and provide secured payments. Additionally, smart contracts decrease the likelihood of conflicts, boost party confidence, and satisfy organizational needs for contract management. One solution was proposed by Mason [57] that once the specified conditions were met and the work was finished, automated payment could be implemented using smart contracts. In the same line, Palachuk [58] research reveals that smart contracts can facilitate the development and management of construction agreements, which reduces stakeholder conflicts. Pattini et al. [59], showed that design, commissioning, construction, and asset management execution stages can all be automated thanks to the usage of BIM and smart contracts in the construction industry. This implies that many contractual issues like late payments, defective payment, construction delays, are easily managed at different levels during the development of a building project. McNamara, [19] established that smart contract can improve administration efficiency, communication, collaboration, and trust. It has been observed that smart contracts can manage dispute resolution in any form since they can automate the effects of each contract and offer a tamper-proof record. [60]

It was observed from the reviewed publications that smart contarcts providing solutions regarding payment security which is considered as a gist for dispute, are highly discussed. Wang, [61] stated that in Australia, smart contracts, a type of performance security, improve the safety of the payment infrastructure. For ensuring the payment of building contracts, a smart contract system utilizing DApp with a blocked procedure was proposed by Ahmadisheykhsarmast & Sonmez [12]. to execute payment when required as per the agreement. This is a way to reduce payment dispute as the conditions are clearly stated between both parties in contract. The construction supply chain's use of secured payment automation was covered by Hamledari & Fischer, [10] and portrayed a result through decentralised smart contracts linked with robotic. Reinforcing the latter study, Luo et al. [55]; Das et al. [62] stated in their study that terms and conditions are checked using an automated system at various stages for payments (Interim payment) during different period of time during a construction.

Smart contracts are electronic papers that can automatically and independently carry out their intended actions based on predetermined criteria. One of the numerous advantages of smart contracts is the high level of trust, security, and transparency they offer. This also means that because smart contracts are not slowed down by manual review or bank intervention, they expedite the payment processing process. It is also observed that contractual payment controversies can be easilly monitored and reduced by using smart contracts for a number of reasons namely consitency, self-sufficient, sustainable, economic, secure and accurate. Smart contracts facilitate speedier payment to users.. The investigated areas under which smart contract are properly researched and applied are project delays, automated payment, progress payment and construction defects claims.

4.8.4. Supply Chain.

Supply chain is portrayed as a high volume of engagement with multiple parties. Implies that contracts are multiple and are prone to contractual issues [63]. Thus, the use of smart contracts in supply chain management has been noted as a solution to overcome legal controversies. In their study on smart contracts for the building supply chain, [64] found that the main stakeholder viewpoints were quality, confidence, fairness, protection, transparency, accountability, enforcement, and uniformity. These factors are essential to reduce legal risks in the supply chain process. Therefore, the application of smart contarct contibutes in the elimination of legal controversies in the chain of supply construction process. Tezel et al. [65]study demonstrated the importance of background checks, contract management, data ownership, and redefining trust. Trust shifting in the construction supply chain was studied by Qian & Papadonikolaki [66] and they found that smart conatrct can be used in contracting and cashflow transfers. From those literatures it is observed that utilizing smart contracts can lessen the requirement for trust among contrcution supply chain contributors.

Allocation of information across the constrution suppy chain is paramount as it encourages decision-making, quicken the timeline, lower expenses, and boost the project's final quality. As smart contract uses a blockchain platform, the traceable, immutable, and secure characteristics of blockchain-based smart contracts can promote a more cooperative, open working environment between project stakeholders and contractors, reducing commercial disputes and promoting greater project stakeholder alignment.

4.9. Operation Phase

4.9.1.Facility Management. Facilities management deals with a range of assets, incorporating physical assets such as equipment, furniture, and buildings, as well as digital assets such as documents and data. Facilities management uses smart contract to automate many of its processes like lease agreements, maintenance contracts, and service level agreements. These smart contracts are programmed to automate execution when conditions are met, such as releasing payment for a service when a maintenance task is completed genuinely. Even those merits, the adoption of smart contracts at operational and maintenace phase has been slow and rare. One study conducted by Tiwari & Batra [67] demonstrate how a smart contract is used to provide an immediate payment after a problem is fixed. Another study achieved by [68], develop a framework to assemble asset information and involving owner, consultant, contrator and supplier to trace out data at different point from any location during the buiding's life cycle.

The automated renting out of commercial buildings or complexes is possible with smart contracts. The programmed automated contract can inevitably execute the lease agreement once the tenant upload the essential necessary documents and payment, and at termination of agreement the system releases the security deposit. This example is a show case where smart contract can help in reducing legal controversies on payment and lease agreement. Another show case of the use of smart contract in the facilities management is at managing maintenace contract. When a maintenance task scheduled in accordance with a performance matrix is successfully done, the service provider may be automatically paid via a smart contract. It is know that facilities management supply chains is complex involving multiple stakeholders at procurement, delivery, and maintenance processes. Smart contratcs can help to provide a transperent and secured system which is tamper-proof. The risk of having fraudulous, errors and delays in the facilities management supply chains is reduced as parties involved are held acountable for their action. Hence, reduces the eventuality of any legal controversies at that level of management.

Utilizing a smart contract platform makes it possible to configure and validate contractual restrictions, handle warnings and reports automatically, and integrate the planning of interventions and services to facilitate customers usage of various facilities.

5. Conclusion

In any construction process, fulfillment of contracts plays a vital role in successfully completing a project without any dispute. The flaws in the contract document often led to legal controversies. There is sufficient room for introducing new and cutting-edge digital solutions to handle the persistent concerns that the construction industry faces, particularly when it comes to legal matters. The construction industry needs digitalization which is now considered as a significant priority for the industry. The next step in the process of turning conventional contracts into code-based contracts is the adoption of smart contracts in the construction sector. This study aims to define whether the application of smart contracts can resolve the construction legal issues during the life cycle of a project. The contribution of this study was achieved by reviewing 36 studies on pertinent applications from 2017 to 2023. The work adds to the body of knowledge by conducting a cutting-edge systematic literature review on smart contracts and how they might be used to resolve contractual disputes across the life cycle of construction projects. By analyzing bibliographical data from the Scopus journal articles, a systematic literature analysis was conducted to identify the various applications of smart contracts to settle legal conflicts in the planning and design phase, construction phase, and operation and maintenance phase. The contribution to knowledge derived from the review delves into using smart contracts as an adaptive solution to deal with legal construction difficulties.

The findings of this study were first divided into three phases: planning and design; construction; and operation and maintenance. Each phase's contractual issues were then identified and analyzed by a thorough assessment of the literature. The results show that 2022 had the most smart contract-related publications, with 103 journals in the construction industry. The distribution of the publications among various countries, smart contracts have been mostly studied in China and United Kingdom. China represents the Asian continent and the United Kingdom the European continent. Additionally, the results of the keyword analysis show that the terms "blockchain" and "smart contracts" came in first and second place, respectively. The journal contributions also demonstrate that the construction industry's biggest contribution to publications on smart contracts is made by *Automation in Construction*. As a result of the use of smart contracts, various legal solutions have also been defined and acknowledged under the three stages in the life cycle of construction projects. Contract disputes, design negligence, site management, contract Administration, Payment, Supply chain and Facility Management were highlighted as contractual legal controversies in the construction industry. Automated payments, contract management, transparency, dispute resolution, traceability, trust, decentralized application, semi-automated consensus mechanisms for payment, interim payment were discussed and the use of smart contracts in the construction industry is proposed as a way to resolve legal disputes.

The filtering of contributions and reporting of various legal issue solutions by applying smart contracts to the construction business in this study enhance knowledge contribution, although some limitations are similarly noted. Articles that were not peer-reviewed were not included in the analysis. Grey sources such as websites, expert reports and social network post were excluded in the systematic literature review. Those sources may not be evidence-based and their inclusion in a Scientific literature review may not be credible. Based on the selection criteria there may be articles on smart contracts applied to construction industry which have been excluded. The reason may be the information related to smart contracts are not mentioned in their titles, keywords or abstract. Also, it is noted that manual screening may cause publication bias and sample selection bias. Furthermore, implication and conclusions are limited since future research smart contracts application to the construction industry are still theoretical. Future study in the same field is advised to examine how smart contracts can be used in conjunction with other cutting-edge concepts like BIM and other digital tools to successfully implement digital technology in the construction sector is recommended.

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Additional Development Cost Components for Smart Living Housing Development

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Abstract. The demand for Smart Living houses has grown among socially conscious consumers. As the distinct Smart Living features are convinced to provide extended convenience independence for one's well-being. However, Malaysia remains infancy in coping with the global revolution of Smart housing market. Main challenge is derived from the uncertainty regarding the development cost components for Smart Living housing development. It has been informed for conventional housing development to require huge capital as they need to fulfil the local authorities' demands. As of now, no specific requirements outlined by the local authorities for Smart Living. Hence, it is anticipated to bring additional cost for developing Smart Living houses. Thus, this paper is to establish an anticipated list of Smart Living features, identified as the additional development cost components for Smart Living housing development. This quantitative research started by summarising 46 anticipated features from 32 articles through literature review. Then, an open-ended questionnaire survey developed from initial finding with 5-points Likert scaling was distributed through the purposive and subsequently snowballing sampling. Due to the passive nature of Smart development market, this is to target the experts for the identification of practical Smart Living features. Finally, responses from 40 were received. The following features were ranked by Relative Importance Index (RII). Findings deduced an anticipated 32 Smart Living features to be the additional development cost components and 5 existed cost components. These development cost components are further categorised in hard cost and soft cost items as it is unprecedented cost components yet significantly influence the inflating Gross Development Cost (GDC). As the finding hopes to portray the additional cost components for Smart Living housing development. Thus, this study provides a valuable reference on the development cost components in Smart Living housing development feasibility studies for now and future advance adoption.

1. Introduction

In response to the ecological and social damages caused by modernization, the idea of sustainable has been fused with one of the economically stimulating sector – the construction industry [51]. This sector has proven to carry exceptional impacts on global economic development as it provides adequate buildings and infrastructures to ensure progressive social development, industrialization, and urbanization [45, 51]. In consequence, the fusion leads to an innovative concept on shelter. It started with the Green building/houses that concerns on environmental impact of construction sector, then improvises to the Smart Living houses. Unlike the Green concept, the priority of Smart Living covers all three pillars of sustainable concept in building a township known as Smart City [10,12].

Ample studies from the developed countries have proven the workability of the Smart Living through the Smart City initiative, as it focuses on catering residents' well-being and offers benefits for convenient independence [4, 7, 11]. For instance, the idea of Smart Living houses has been proposed to cater the national subjects like Ageing Population [4, 7, 11, 19, 22, 49]. As it provides an environment that will fit the inhabitants' preference and requirements [5, 11, 22] as the distinct Smart Living features can enrich the sensing, actuation, interaction, and computational capabilities to help occupants for convenient independence. To compare with conventional houses, Smart houses is justified to deliver more than just a shelter, but meet the occupants' security, comfort, happiness, and health simultaneously [2, 15].

However, literature reviews Smart Living housing development in Malaysia remains infancy as compared to neighborhood countries who shares similar geography and cultural backgrounds [3, 6, 8, 15, 18,48]. Thus, to catch up with the global housing revolution, more support and action research are needed to acknowledge the factors and potential research gap that limits the development.

Since 2012, the factors that contributed to the local laybacks in overall sustainable concept housing development have been consistent. Mainly are the lack of skill and capacity, overlapping of roles among the government agencies causing gap between policing and enforcing, the passiveness of industry in keeping up with government programs, lack of research and innovation, and cost versus benefits in terms of implementation technology [3, 4, 6, 10, 30]. This lacking present visible pattern of decision-making, particularly on the risk of development activities against the cost benefits.

Besides, the progression of Smart Living related research remains on the surface, saturating around the market perspective, barriers, and expectation [5, 27, 36, 50], theoretical suggestion and implementation, technicality on Smart features (e.g., software and hardware for Internet of Things) [7, 11, 22, 23, 37, 44] comparison between the Green to the Smart concept [8, 16, 22, 47] and conceptual touch on design solutions [34, 37, 40]. Moreover, since the first publication of Malaysian Smart City Framework in 2019, the execution plans remain ambiguous. The abstract nature of those guidelines remains in the form of blueprints and action plans [32]. These situations reinforced the missing bridge between planning and exact implementation. Thus, stakeholders are required to implement Smart Living development while taking up the financial risk upon features implementation. Towards the end, it eventually influences the inflating project Gross Development Cost (GDC). All in all, these appear to be a practical-knowledge gap between policing and enforcing [31].

According to the literature reviews, there is a lack of rigorous research in the risk of development activities against the cost benefits. Some of these ambiguous requirements produced by policy makers on features implementation appear to be lacking in terms of standards, levels, and cost implication study. The purpose of cost implication study is to bridge the risk between development activities and cost benefits. Besides, the field of cost implication study has been justified from many backgrounds to improve decision-making for execution. Many of the prior studies merely focus on the theoretical, technical, and conceptual aspects of Smart Living building or houses. However, there are very few practical studies or action research in the field of project cost feasibility study. This is an important and worthy of investigation. As the study of cost implication upon features implementation provides transparency within development planning and viability before considering for future advance and market growth. The hypothesis presents - the identification of additional development cost components as a kick start to the whole cost implication study allow for efficient decision-making during investment-decision moment that will promotes the market growth [31].

2. Literature Review on Smart Living Development within Smart City

Smart City is a whole concept of sustainable town planning. It is made up of six elements - Smart Governance, Smart Infrastructure, Smart Mobility, Smart Environment, Smart People and Smart Living. Each element carries respective roles, whereas Smart Living is the crucial part from the whole as it focuses on the major residential needs in accommodate occupants [6, 9].

For Smart Living development, it is viewed from the spectrum of housing development and Smart Living features implementation. In which, the implementation of those distinct features is scaled into

township, and the next is building (internal and external). By considering the typical housing developments, these distinct features must be considered as the additional development cost components. This is because the addition of features, are the additional development cost components, that will directly influence the inflating GDC [2, 4].

Conventionally, the GDC of a typical housing development can be broken down into hard cost items and soft cost items. The hard cost items are the cost components to build a physical house which normally occupy 45% of the whole GDC [2, 4]. While soft cost items are the cost components typically took up 20% over total development cost, it is a series partially hidden and visible yet essential costs that are related to administration to make the whole development possible [2,4]. Due to the practical-knowledge gap [31] presented, there is no outline from the authorities regarding this area of Smart Living housing development. In fact, there is no guidance in terms of the hard cost items and soft cost items for Smart Living housing development.

In conclusion, to enable progressive Smart Living housing development growth, information about Smart Living features implementation and the additional development cost components that imposed must be guided as per conventional housing. Figure 1 illustrate the relationship of Smart City with Smart Living, the sample of Smart Living features, and the scale of features implementation according to typical housing development cost components.

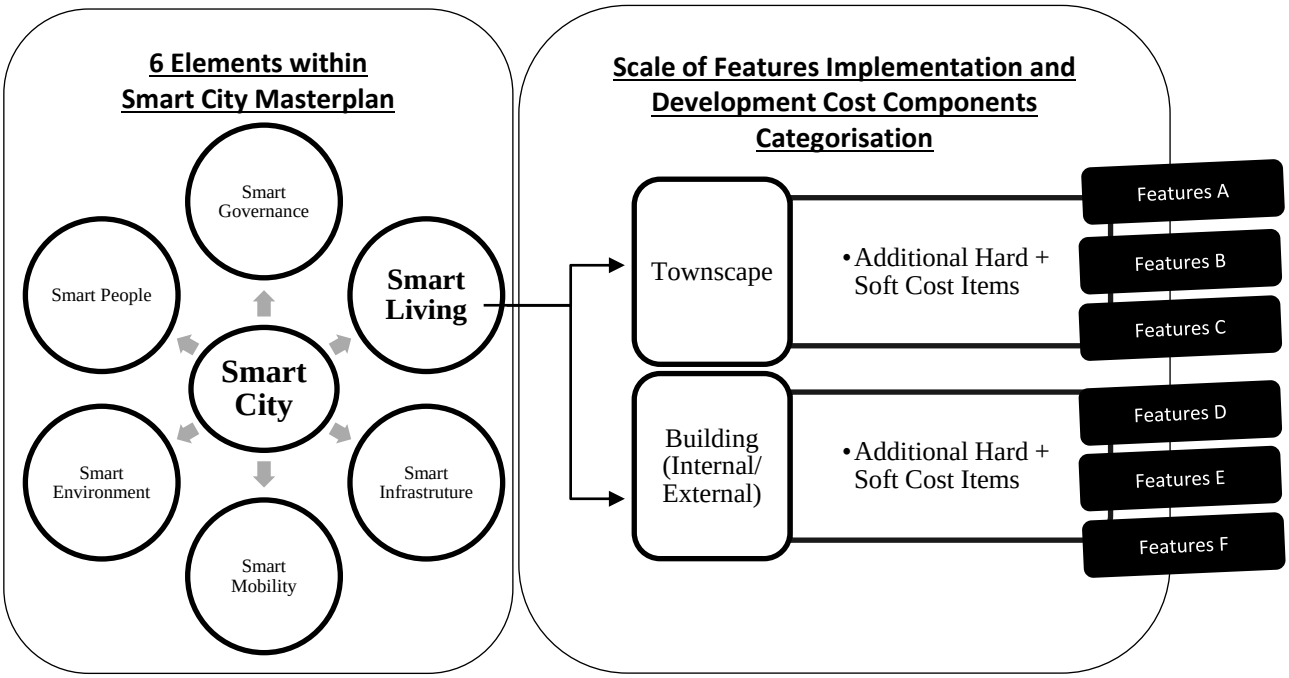

Figure 1. Illustration of Smart Living Features Implementation & Development Cost Components Categorization.

2.1 Gross Development Cost (GDC) for Smart Living Housing Development

As above said, the conceptualization of Smart Living housing is distinct compared to conventional housing. Thus, it exhibits the additional development cost components upon features implementation. However, procuring those features with additional development cost components [13, 20] has not been readily appreciated by conventional stakeholders which leads to uncertainty in decision-making during feasibility studies. As shown in Figures 2 and 3 illustrate the general breakdown of anticipated development cost components for Smart Living housing development GDC.

Conventional Housing Development Cost Breakdown:

Housing Development (Hard cost + Soft cost + Land Cost + Profit)

Figure 2. Typical housing development cost components breakdown [2, 4].

Smart Living Housing Development Cost Breakdown:

Housing Development (Hard cost + Soft cost + Land Cost + Profit)
+
Smart Living Features (Additional Hard Cost + Additional Soft Cost)

Figure 3. Simulation of Smart Living housing development cost components breakdown.

For conventional housing development, there are established models (e.g., Elemental Cost Analysis (ECA), As Completed Detailed Abstract (ACDA)) showcasing standardized development cost components to assist with cost implication simulation during the feasibility studies [2, 4]. Similarly, Smart Living features should comply with conventional development cost components categories and management. This is significance, as the anticipated development cost components for Smart Living features can provide cost implication simulation during the feasibility studies [45,46].

2.2. Literature Review on Smart Living Features from Abroad and Local Practices

This research focuses on establishing the anticipated additional development cost components as a kick start to the whole cost implication study for Smart Living housing development. A quantitative survey begins by identifying a list of Smart Living features from abroad and local practices to determine the salient features through extensive literature review [35].

The articles selection is set to be parallel with the keywords as shown in Table 1. It covers the category of 'Process' with the keywords - adoption, development, and implementation. For the 'Body of Knowledge' category, it covers the keywords - Smart Living concept, Smart Living features, additional development cost components, and market perception. Regarding the 'Field Area' category, it covers the keywords - Smart Living housing development and the Green building development as Green practice was the preceding of Smart concept. Lastly, the 'Context' category covers the keywords on both the developers and policy makers, within the construction industry and specifically on housing project.

Table 1. Categories of Search with Keywords for Relevant Articles Identification on Salient Smart Living Features.

Process	Body of Knowledge	Field Area	Context
• **Adoption** • **Development** • **Implementation**	• Smart Living Concept • Smart Living Features • Additional Development Cost Components • Market Perception	• Sustainable Construction • Smart Living Development • Green Building Development	• Developers/Policy Makers • Construction Industry • Housing Project

Table 1 shows the categories of search for keywords with four categories – Process, Body of Knowledge, Field Area, and Context. As shown, there are 3 keywords for 'Process', 4 keywords for 'Body of Knowledge', 3 keywords for 'Field Area' and 3 keywords in 'Context'. Subsequently, there

are 161 articles filtered through the initial 'Process' category with keywords of adoption, development, and implementation. Next, the 'Body of Knowledge' category that covers the keywords Smart Living concept, Smart Living features, additional development cost components, and market perception, narrows the numbers of articles to 43. Following by the 'Field Area' category that covers the keywords Smart Living housing development and Green building development pull the number of articles down to 35. Lastly, the 'Context' category covers on both the developers and policy makers, within the construction industry and specifically on housing project set the remaining number of articles to 32.

From the 32 articles, 46 features are identified. For comprehensive measures, the Smart Living features is grouped under the 3 pillars of sustainable concerns – social, economical, and environmental. This is to ensure that all features fit the whole sustainable concept. Firstly, the features that fall under social will serve a purpose to fit occupants' well-being and independent convenience. For example, pedestrian friendly street and cycling track. Secondly, the features that belong in economical aspect, they serve to provide good values or return in relation to the money, time, or effort expended. Like dual flush toilet, solar panel, and faucet aerator. Lastly, the environmental concept features are relating to the natural world and the impact of human activity on its condition, like disaster risk management, hill slope structure and private farming proximity. In summary, the features proposed will truly fit the concept of Smart houses and form the distinct additional Smart Living housing development cost components. Interestingly, there several features that overlap with conventional housing.

The following Table 2 summarised all the Smart Living features and categorised into (i) the 3 pillars of sustainable aspects – social, economical, and environmental; (ii) categorisation to the development cost components – hard cost items or soft cost items; (iii) the scale of features implementation – township (additional and existed) or building scale (additional and existed)

Table 2. List of 46 Smart Living Features Identified from 32 Articles.

3 Pillars of Sustainable	Development Cost Components	Smart Living Features Implementation			
		Townscape		Building (Internally/Externally)	
		Additional features/cost components	**Existed features/cost components**	**Additional features/cost components**	**Existed features/cost components**
Social	Hard Cost Items	- Public Transport Facilities [19] - Pedestrian Friendly Street [19, 20] - Cycling Friendly Street [19, 20] - Sport Facilities [19] - School & Education Centre [19] - Smart Pole with Panic Button [20, 32] - Recreational Facilities & Ancillaries [19, 20, 32, 44] - Retail Facilities [19] - Health & Medical Centre [19,20,44]	- Road & Paving - Vehicular Circulation [20] - Road Furniture & Speed Limit Sign [20] - Entrance Landscape [20] - Security Provision - Gated Guarded Community [20]	- Internet Connectivity [19, 20] - Smart Security Lock System [23, 34, 40] - Smart Wall Pad [23, 30, 40] - Robotic-based Appliances [19, 30, 40] - Video Monitoring System [44, 49]	
	Soft Cost Items	- Parking Service at Public Area [20, 32]			
Economical	Hard Cost Items	- Flood Mitigation Structure [44] - Rainwater Harvesting System [19, 20, 44] - District Cooling System [44]	- Grey Water System [19, 20, 44]	- Light-emitting Diode (LED) [19] - Solar Panel [19, 20, 34, 44] - Occupancy, Motion & Sensory based Appliances System [19, 30, 40] - Remote Control & Connectivity [19, 30, 40] - Water Closet Items - Faucet Aerator, Dual Flush Toilet [19, 20] - Smart Sensor Cloth Dryer [30, 40] - Smart Meter at Parking Area [32] - Solid Waster Management System [20, 30] - Home Energy Management System [16, 23]	
	Soft Cost Items	- Cashless Payment Facilities [32] - E-Governance Structure [32]			
Environmental	Hard Cost Items	- Farming/Tree Cover/Tree Inventory [20, 32] - Hill Slope Structure [20] - Drone/Unmanned Aerial Vehicle [19, 32]	- Garden Works & Landscaping [20, 32]	- Private Farming Proximity [20, 32] - Acoustical Environmental Structure [32] - Smart Ventilation Control [23, 34, 40]	- Refuse Disposal - Garbage & Recycling Bin/Chute [19, 20, 23,32]
	Soft Cost Items	- Disaster Risk Management (Risk Management Consultation) [20] - Daylight-oriented Structure (OTTV Consultation) [20]			

As shown in Table 2, there are 19 features from the social aspect, 17 features from the economical aspect, and 10 features from the environmental aspect. The identification of Smart Living features as additional development cost components is compulsory because Smart Living houses demand special materials, expertise, regulation, and specialized equipment that typical man powers or conventional work methods cannot procure [12]. Besides, the addition of Smart Living features is onto the housing development master plan, respective phases and building elements. These additions do bring more barriers in the form of development cost components per said that were anticipated to subsequently increase the inflating gross development cost. As listed, there are more considered hard cost items as compared to soft cost items.

3. Research Methodology

3.1 Research Approach and Sampling

Following the initial findings from literature review, a quantitative approach is adopted to validate the practicality of all the feature. This involved an open-ended questionnaire survey that is developed from the preceding content analysis to identify the salient Smart Living features for Malaysian Smart living housing development. The refined list of Smart Living features forms a solid foundation for this survey instrument. Furthermore, a Reliability Importance Index (RII) valuation is conducted on this survey findings. This is to measure the practicality of respective features in Malaysian market before engaging them as the salient additional development cost components [46]. As stated in equation (1), the formula for Relative Importance Index (RII) [46].

$$\mathbf{RII = \Sigma W / (A*N)} \quad (1)$$

W = Weightage Given
A = Highest Point (e.g. Likert scale 0-5, so the A value is 5)
N = Total Nr of Respondents

Considering the passive Smart Living market, the sampling approach begins with purposive and follow up with snowballing sampling. The purposive sampling is to target the industry experts by a series of established criteria during the first batch of questionnaire distribution [1]. The respondent's profile shall cover stakeholders with bachelor's degree or higher; with at least five years of professional experience in the construction industry and sustainable project; anyone with the position of professor or researcher at an accredited higher education institution or government agency. Examples are the sustainability director, heads of departments or manager in a Malaysia Smart City planning institution (e.g., PLAN Malaysia), member or chair of a sustainability-related committee, primary or secondary author of at least two peer-reviewed journal articles on any of the sustainable construction, and author or editor of a book or book chapter related to sustainability topics. Subsequently from the first batch, the sampling approach snowballs to reach more respondents per recommendation from the initial batch [39].

4. Responses, Findings and Data Analysis

4.1 Respondents' Profile

In total 40 respondents accumulatively answered the survey. There are 29 from the private sector and 11 representing the policy makers. All have had more than 5 to 10 years of experience in the construction industry, as well as involvement in Green and Smart concept development. The background consists of mainly Project Manager, then Director, Head of Department, Consultant Principal, Architect, Green Engineer, and Site Officer. The response from every background and range of experiences covers this finding sufficiently to suit the new nature of Smart Living housing development. Following Figure 4 shows the respondent's profile distribution.

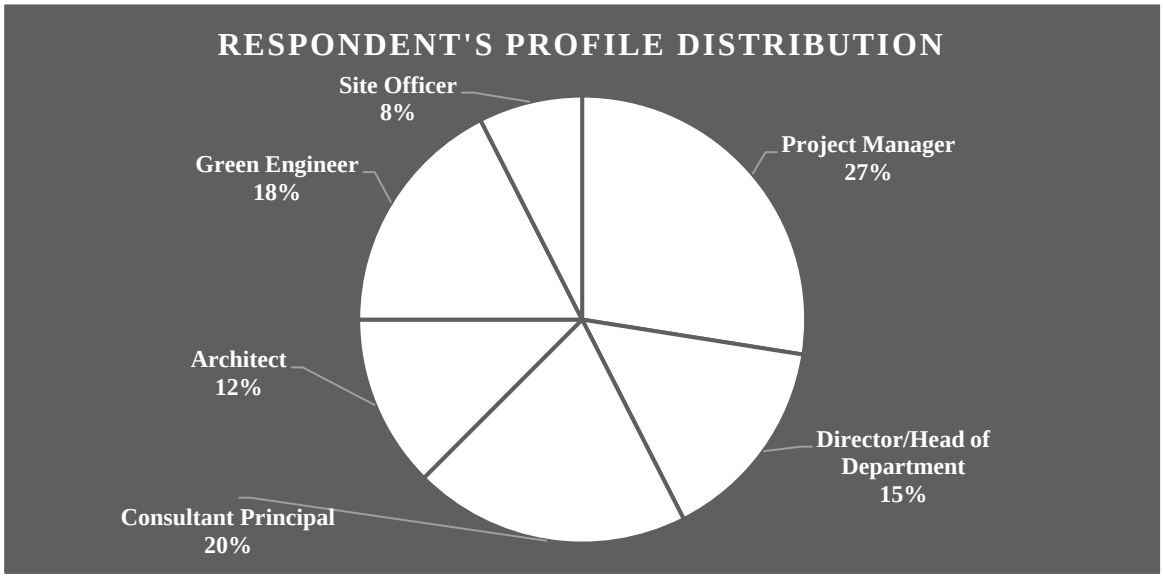

Figure 4. Respondents' Profile Distribution.

4.2 Data Analysis and Discussion

After the survey, this section presents the analysis and discussion on the remaining 41 Smart Living features that are the anticipated development cost components for Smart Living housing development. Findings are as shown in Table 3, 4 and 5. The Smart Living features are categorised (i) the 3 pillars of sustainable aspects – social, economical, and environmental; (ii) categorisation to the development cost components – hard cost items or soft cost items; (iii) the features are then ranked using the Relative Importance Index (RII) as in following sub-section 4.2.1.

4.2.1 Ranking of Smart Living Features Practicality in Malaysia

The aggregated ranking is derived based on the relative importance index (RII) using a 5-points Likert Scale which the indicators are: 1-Irrelevent, 2-Less Likely, 3-Neutral, 4-Likely, 5-Very Likely. The rule of valuation index implies range between 1.00 to 0.80 is the 'most likely' practical feature for Malaysian Smart Living market [21]. While the range between 0.79 to 0.31 is at the acceptable level indicating 'likely' to 'neutral' but the range that is similar to and less than 0.30 show the 'less likely' and 'irrelevant' features to be included into the list of anticipated development cost components [21].

Table 3. Practical Smart Living Features on Environmental Aspect from Questionnaire Survey.

Smart Living Features - Environmental Aspect

Nr.	Features	Development Cost Item	RII Value
1	Disaster Risk Management (Risk Management Consultation)	Soft Cost	0.900
2	Farming/Tree Cover/Tree Inventory	Hard Cost	0.760
3	Hill Slope Structure	Hard Cost	0.650
4	Garden Works & Landscaping	Hard Cost	0.640
5	Private Farming Proximity	Hard Cost	0.640
6	Daylight-oriented Structure (OTTV Consultation)	Soft Cost	0.600
7	Acoustical Environmental Structure	Hard Cost	0.450
8	Refuse Disposal - Garbage & Recycling Bin/Chute	Hard Cost	0.440
9	Smart Ventilation Control	Hard Cost	0.300
10	Drone/Unmanned Aerial Vehicle	Hard Cost	0.220

There are 10 Smart Living features from the environmental aspect, but only 8 features are considered practical according to experts. The 'most' likely feature is Disaster Risk Management. Follow up with Farming/Tree Cover/Tree Inventory, Hill Slope Structure, Garden Work & Landscaping, Private Farming Proximity, Daylight-oriented Structure, Acoustic Environmental Structure, and Refuse Disposal – Garbage/Recycling Bin/Chute. Lastly, is the Smart Ventilation Control and Drone/Unmanned Aerial Vehicle that are ranked the lowest in RII indicating the 'less likely' and 'irrelevant' features in Malaysian Smart Living housing market. Besides, there are 2 soft cost items and 8 hard cost items from the whole Environmental aspect features.

Table 4. Practical Smart Living Features on Social Aspect from Questionnaire Survey.

Smart Living Features - Social Aspect			
Nr.	Features	Development Cost Item	RII Value
1	Security Provision - Gated Guarded Community	Hard Cost	1.000
2	Public Transport Facilities	Hard Cost	1.000
3	Internet Connectivity	Hard Cost	1.000
4	Pedestrian Friendly Street	Hard Cost	1.000
5	Cycling Friendly Street	Hard Cost	1.000
6	Sport Facilities	Hard Cost	0.900
7	School & Education Centre	Hard Cost	0.850
8	Smart Pole with Panic Button	Hard Cost	0.800
9	Smart Security Lock System	Hard Cost	0.800
10	Smart Wall Pad	Hard Cost	0.800
11	Road & Paving - Vehicular Circulation	Hard Cost	0.800
12	Robotic-based Appliances	Hard Cost	0.760
13	Health & Medical Centre	Hard Cost	0.700
14	Road Furniture & Speed Limit Sign	Hard Cost	0.600
15	Recreational Facilities & Ancillaries	Hard Cost	0.570
16	Retail Facilities	Hard Cost	0.550
17	Video Monitoring System	Hard Cost	0.450
18	Entrance Landscape	Hard Cost	0.420
19	Parking Services at Public Area	Soft Cost	0.300

Next, there are 19 Smart Living features from the social aspect, and 18 features deemed to be practical for Malaysian Smart Living housing market. The 'most' likely feature is the Security Provision - Gated Guarded Community, Public Transport Facilities (e.g., bus stop), Internet Connectivity, Pedestrian Friendly Street, Cycling Friendly Street, Sport Facilities, School and Education Centre, Smart Pole with Panic Button, Smart Security Lock System, Smart Wall Pad, and Road Paving for Vehicular Circulation. Follow up with Robotic-based Appliances, Health & Medical Centre, Road Furniture with Speed Limit Sign, Recreational Facilities, Indoor Video Monitoring System, and Entrance Landscape. Lastly, is the Parking Services at Public Area that are ranked the lowest in RII indicating the 'less likely' and 'irrelevant' features in Malaysian Smart Living housing. There are only 1 soft cost item with 18 hard cost items from the whole Smart features from the social aspect.

Table 5. Practical Smart Living Features on Economical Aspect from Questionnaire Survey.

Smart Living Features - Economical Aspect			
Nr.	Features	Development Cost Item	RII Value
1	Flood Mitigation Structure	Hard Cost	1.000
2	Light-emitting Diode (LED) type Lighting System	Hard Cost	1.000
3	Solar Panel	Hard Cost	1.000
4	Occupancy, Motion & Sensory based Appliances System	Hard Cost	1.000
5	Rainwater Harvesting System	Hard Cost	0.900
6	Remote Control & Connectivity	Hard Cost	0.800
7	Grey Water System	Hard Cost	0.800
8	Smart Tourism Area	Soft Cost	0.800
9	Water Closet Items - Faucet Aerator, Dual Flush Toilet	Hard Cost	0.720
10	Smart Sensor Cloth Dryer	Hard Cost	0.600
11	Smart Meter at Parking Area	Hard Cost	0.600
12	District Cooling System	Hard Cost	0.600
13	Solid Waster Management System	Hard Cost	0.550
14	Home Energy Management System	Hard Cost	0.520
15	Thermal Comfort Mechanism	Soft Cost	0.340
16	Cashless Payment Facilities	Soft Cost	0.300
17	E-Governance Structure	Soft Cost	0.150

Lastly, there are 17 Smart Living features from the economical aspect, and 15 features deem to be practical for Malaysian Smart Living market. The 'most' likely feature is the Flood Mitigation Structure, Light-emitting Diode (LED) type Lighting System, Solar Panel, Occupancy, Motion & Sensory based Appliances System, Rainwater Harvesting System, Remote Control & Connectivity, Grey Water System, and Smart Tourism Area. Follow up with Water Closet Items - Faucet Aerator, Dual Flush Toilet, Smart Sensor Cloth Dryer, Smart Meter at Parking Area, District Cooling System, Solid Waste Management System, Home Energy Management System, and Thermal Comfort Mechanism. Lastly, is the Cashless Payment Facilities and E-Governance Structure that are ranked the lowest in RII indicating the 'less likely' and 'irrelevant' features in Malaysian Smart Living housing. There are 4 soft cost items and 13 hard cost items from the Economical aspect of Smart features.

In conclusion, there are 46 Smart Living features that are summarised as the anticipated development cost components for Smart Living housing development. After the questionnaire survey and RII valuation, there are 41 remaining features out of 46 that are deemed to be practical for Malaysian Smart Living housing development according to the industry experts. For environmental aspect, there are 8 features left viable as the drone/unmanned aerial vehicle and smart ventilation control have been excluded. For social aspect, there are 18 features remain as the parking services is considered irrelevant. Lastly, cashless payment facilities and e-governance structure are excluded from the economical aspects to leave only 15 features. Table 6 categorised the finalized 41 salient Smart Living features similarly to Table 2 into: (i) the 3 pillars of sustainable aspects – social, economical, and environmental; (ii) categorization to the development cost components – hard cost items or soft cost items; (iii) the scale of features implementation – township (additional and existed) or building (additional and existed) scale.

Table 6. List of 41 Salient Smart Living Features for Malaysian Smart Living Housing Development.

3 Pillars of Sustainable	Development Cost Components	Smart Living Features Implementation			
		Townscape		Building (Internally/Externally)	
		Additional features/cost components	**Existed features/cost components**	**Additional features/cost components**	**Existed features/cost components**
Social	Hard Cost Items	- Public Transport Facilities [19] - Pedestrian Friendly Street [19, 20] - Cycling Friendly Street [19, 20] - Sport Facilities [19] - School & Education Centre [19] - Smart Pole with Panic Button [20, 32] - Recreational Facilities & Ancillaries [19, 20, 32, 44] - Retail Facilities [19] - Health & Medical Centre [19,20,44]	- Road & Paving - Vehicular Circulation [20] - Road Furniture & Speed Limit Sign [20] - Entrance Landscape [20] - Security Provision - Gated Guarded Community [20]	- Internet Connectivity [19, 20] - Smart Security Lock System [23, 34, 40] - Smart Wall Pad [23, 30, 40] - Robotic-based Appliances [19, 30, 40] - Video Monitoring System [44, 49]	
	Soft Cost Items				
Economical	Hard Cost Items	- Flood Mitigation Structure [44] - Rainwater Harvesting System [19, 20, 44] - District Cooling System [44]	- Grey Water System [19, 20, 44]	- Light-emitting Diode (LED) [19] - Solar Panel [19, 20, 34, 44] - Occupancy, Motion & Sensory based Appliances System [19, 30, 40] - Remote Control & Connectivity [19, 30, 40] - Water Closet Items - Faucet Aerator, Dual Flush Toilet [19, 20] - Smart Sensor Cloth Dryer [30, 40] - Smart Meter at Parking Area [32] - Solid Waster Management System [20, 30] - Home Energy Management System [16, 23]	
	Soft Cost Items				
Environmental	Hard Cost Items	- Farming/Tree Cover/Tree Inventory [20, 32] - Hill Slope Structure [20]	- Garden Works & Landscaping [20, 32]	- Private Farming Proximity [20, 32] - Acoustical Environmental Structure [32]	- Refuse Disposal - Garbage & Recycling Bin/Chute [19, 20, 23,32]
	Soft Cost Items	- Disaster Risk Management (Risk Management Consultation) [20] - Daylight-oriented Structure (OTTV Consultation) [20]			

According to the survey, there are no additional Smart Living features proposed. Industry experts agreed with the anticipated list of Smart Living features as extracted from the 32 articles. Furthermore, the survey went through purposive and snowballing sampling eventually refined the list from 46 features to 41 features with minimal exclusion of 5 features.

However, to consider the features that overlap with conventional housing, what is left are 14 features for social aspect, 12 features for economical aspect and 6 features for environmental aspects. Thus, there are only 32 Smart Living features to be the anticipated additional development cost. All 26 features for social and economic aspects are hard cost items. While there are 4 hard cost items and 2 soft cost items for features from environmental aspect. In short, there are an additional 30 hard cost items and 2 soft cost items for Smart Living housing development.

Besides, feedback given revolves around the theme of Smart Living market passiveness and overall conventional project procuring reluctant for changes. However, with the present of 32 features as the additional development cost components for Smart Living housing development, a solid cost implication study can be conducted. By establishing the additional development cost components, conventional stakeholders will have better understanding on development activities to measure with their cost benefits.

In conclusion, findings met the practical-knowledge gap mentioned. As it manages to bridge the gap between policing and enforcing by identifying and determining the salient Smart Living features and additional development cost component for Smart Living housing development GDC. The identification of additional cost components can assist in actual project development execution and lead conventional stakeholders to acknowledge the 'extra-work' that comes along upon features implementation which allow them to be more certain in the GDC estimating, planning and simulation.

All in all, the transparency regarding the development cost components is important for stakeholders now, just to know what and where to price for cost estimating, planning and feasibility study. In that case, it may reduce the risk of decision-making, particularly on the risk of development activities against the cost benefits.

5. Conclusion

This paper presented the 32 Smart Living features as the anticipated additional development cost components for the Smart Living housing development. It is a part of the whole initiatives in managing the uncertainty during decision-making on the matter of development cost component in feasibility studies as it is influencing the Gross Development Cost (GDC).

According to the prior research, there is a lack of rigorous research in the risk of development activities against the cost benefits. Some of these ambiguous requirements from policy makers regarding the type and level of features implementation appear to be lacking in the practice of cost implication study. The purpose of cost implication study is to bridge the risk between development activities and cost benefits. By doing so, the hypothesis is applicable as the identification of additional development cost components as a kick start to the whole cost implication study allow for efficient decision-making that promotes an efficient development strategy for the local Smart Living market.

Development strategy is important, as it can be known as a strategic form of risk management because it allows conscious and transparent decisions. The clarity obtained will enable the stakeholders to make the most from the value offered by the Smart Living concept. Towards the end, the outcome will reflect a holistic approach to the cost implication in accordance with the choices of features implemented that will allow a new understanding horizon for stakeholders who are developing the Smart Living concept houses. Besides, prolong asymmetric information about Smart Living features and uncertain additional development cost components that are not mandatorily imposed onto the industry will enable the opportunistic behavior of irresponsible parties.

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Safety Management Practices Model for Micro, Small and Medium Companies in Saudi Arabia

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Abstract. Micro, small, and medium companies (MSMCs) dominate approximately 95.18% of all construction enterprises in Saudi Arabia. Unfortunately, when compared to other industries in the country, this sector has the greatest risk of accidents. Accidents are frequently blamed on insufficient training, poor safety practices, a lack of knowledge, and a lack of worker/management commitment. Given this concerning trend, quick action is required to strengthen health and safety practices in the construction industry and assure worker safety. To address this issue, a study will be conducted to identify existing safety management practices in MSMCs, define the challenges these companies face when implementing safety management, propose a strategy to improve safety management practices, and develop a safety management practices model for MSMCs in Saudi Arabia. The importance of this study stems from its potential to improve the safety and working conditions of MSMCs in the construction industry, which can contribute to higher productivity and economic growth. The study's findings are expected to provide insights that may be used to inform the creation of policies and initiatives to improve safety management practices in the industry and promote a safer work environment for all employees.

1. Introduction

The construction sector is an industry that includes all entities that are related to the design, development, operation, and maintenance of buildings, including suppliers, manufacturers, contractors, subcontractors, professionals, advisers, clients, and organizations [1]. Saudi Arabia's construction industry contributes significantly to the growth and support of the country's productive infrastructure and other economic sectors. The importance of the country's construction sector, which is one of the biggest and most dynamic economic drivers and provides work for millions of people, cannot be understated [2]. Most organizations place a lot of emphasis on achieving high levels of workplace safety. In addition, in this study, we will compare safety management practices in Hong Kong and the United Kingdom with Saudi Arabia.

In order to implement the provisions of the Directive into domestic law, the United Kingdom passed the Construction (Design and Management) Regulations 1994 (CDM 1994) in 1994. To ensure the health and safety of construction employees, these guidelines require that all parties involved in a project, including clients, architects, and builders, fulfill their respective legal responsibilities. In addition, responsibility for the smooth operation of the PCPC and CPC have been delegated to the Planning Supervisor and the Principal Contractor, respectively. In response to worries about the coordination of health and safety measures before construction, the British government's Health and

Safety Executive (HSE) has made two statements. The Preconstruction Phase Plan Coordination (PCPC) has been revised by the Health and Safety Executive (HSE) in both cases. Almost a decade after it was first signed into law, the Construction (Design and Management) Legislation 1994 (CDM 1994) was revised and reenacted in 2007. Because the former Planning Supervisor was elevated to CDM Coordinator, the aforementioned shift occurred. The 2007 implementation date marked the beginning of the aforementioned constraints.

The Construction (Design and Management) Act of 2015, or CDM 2015 for short, replaced the older CDM 2007 law after nearly seven and a half years. The position of CDM Coordinator was changed to that of Principal Designer (PD) for a number of reasons. These factors necessitated revising the nomenclature once employed to characterize the role. The preconstruction coordinating function should have been studied more thoroughly before being modified. The unintended consequences and root causes of the issues that have arisen as a result of these shifts are thus elusive to understand. Despite the fact that CDM 2015 has been in operation for nearly six years, there is surprisingly little research that explores the function of PD within this framework, as evidenced by a comprehensive review of the literature. In the following lines, I'll spend some time dissecting this finding. The unanticipated result of the investigation was uncovered as a result of the research. Research into the Construction (Design and Management) Regulations 2015 and its application to the pre-construction phases of building projects has been conducted to address the identified knowledge gap. The study was conducted to help scientists learn more about the role of interest.

Studies on construction management were carried out from the vantage points of the client's comprehensive health and safety protocols, the coordination of project supply chain participants with a focus on health and safety, the management of pre-construction information, the development of a construction phase plan (CPP), the creation of a Health and Safety File (HSF), and the implementation of collaborative risk management. This study's findings provide a high-level explanation of the difficulties experienced by those attempting to put PD functionality into practice. The information can be broken down into several groups using roughly seven distinct types. The investigation is summarized in detail and in its entirety in the book's introduction. The following paragraphs provide a concise overview of the research that formed the basis for this publication. The roles and responsibilities of the Principal Designer (PD) are laid out in great detail in Part 3 of the Construction (Design and Management) Regulations 2015 (CDM 2015). In this study's fourth section, we detail the specific methodologies and processes we used to collect the data presented here. The study's findings are reported in Part V, and their implications are elaborated upon in Part VI. The report concludes with a discussion of the study's findings and interpretations, along with some important qualifications.

2. Literature Review

Several authorities [3] have emphasized that the primary contractor and any subcontractors working under them have primary responsibility for health and safety on construction sites. The Prevention through Design (PtD) principle is diametrically opposed to this approach because it maintains that the project's characteristics—including the materials, sizes, and locations of project elements, as well as the possible construction techniques needed to carry out the project—are determined by the choices made by designers. In contrast, the traditional approach waits until the works are complete before deciding whether or not the materials, size, or locations were appropriate. According to [4] the inherent attributes of a design put everyone involved in the building's construction, usage, upkeep, and eventual demolition at danger. This assertion is supported by the findings of [5]. Health and safety dangers should be addressed throughout the preconstruction phase of project development, according to some [5] and [6] who argue that failing to do so would run counter to the existing principles of efficiently managing health and safety risks in construction projects.

According to [7] the Construction (Design and Management) Regulations 2015 (CDM 2015) in the United Kingdom gives "Prevention through Design" (PtD) significant weight in the realm of reducing

health and safety incidents that occur within construction projects. This is because the Construction (Design and Management) Regulations 2015 implemented the TMCS Directive. Since this method is required by both regulatory frameworks, its value is far larger than that of the Prevention through Design (PtD) strategy. Procurement choices made during the planning and preconstruction phases will have their possible long-term effects taken into account by the regulatory framework. [8] state that the PD's role is to aid the client in creating an environment conducive to collaboration, coordination, and open lines of communication, all of which are crucial to the project's success. Health and safety, the concept and practice of Prevention through Design (PtD), and the Construction (Design and Management) Regulations (CDM) were the primary foci of the literature review conducted for the purposes of this study due to the interconnectedness of these topics. In prior work, [9] studied and rated the Health and Safety (H&S) Regulations and the Construction (Design and Management) Regulations.

This research is restricted to looking into PtD practices in the past. Over the past three decades, the construction industry has exhibited a steady interest in Prevention through Design (PtD) studies. Hardison and Hallowell [10] organized the prior literature into three categories based on their findings. The authors supported their claim that the Prevention through Design (PtD) approach is effective by providing case studies of actual projects (C2). The researchers also probed more into the methods employed to implement this concept. Finally, the panel discussed potential proactive risk reduction techniques that may be implemented during the project's design and construction phases. All three of these factors together form the backbone of their case. In this investigation, we looked at how categories 2 and 3 from Hardison and Hallowell's original concept interact with one another. This study's broad focus allowed for the exploration of a potential link between the two. Since this is the case, we can conclude that these two forms of aid can be combined into a third. Subcategories of this exhaustive taxonomy of supplementary resources include (C3) constructability review, (C4) construction hazard assessment implication review, (C5) norms and regulations, (C6) qualitative tools, and (C7) technology. Furthermore, in the early stages of a project's development, qualitative tools heavily rely on the judgment of industry professionals in order to determine how to best tackle health and safety issues. Using tools like building information modeling (BIM) and virtual reality (VR), designers may get an unbiased look at any potential health and safety risks that may be built into the structure.

Expertise in creating virtual environments for computers allows for this. The subsequent analysis confirmed the growing emphasis on multidisciplinary research that emphasizes PtD-specific abilities. This study dissects capabilities (C8), knowledge (C9), experience (C10), organizational capacity (C11), mindset (C12), behavior (C13), and formal education and training (C14). The evaluation's findings are; a rundown of the evaluation's subcategories, from C1 to C14. The demonstrates widespread consensus amongst academics that the PtD work was fruitful, leading to widespread support for the project. [9] research demonstrated that investigation of PtD application tools had been going on for about two decades prior to the publication of this review. This was confirmed by the study. However, PtD competency had received little attention from researchers until recently.

Consequently, a number of researchers have advocated for a focus on this element [12],[13] and [14]. [15] Conducted a literature review on PtD, and their findings are consistent with those presented here. Consistent with the aforementioned review, it delves into the major issues that have piqued the interest of academics in the field of building health and safety. [16] and [17] found that designers can be broken down into three distinct groups after conducting a thorough analysis. These groups were established according to participants' preconceived notions, their familiarity with health and safety (H&S) issues, and their attitudes and actions during the design process.

3. Saudi Arabia's Safety Management Practice for Micro, Small, and Medium Companies (MSMCs)

Safety management involves the systematic process of identifying potential health and safety risks, implementing measures to mitigate those risks, and minimizing the potential consequences of such risks within a given project or context [18]. This comprehensive approach encompasses various elements such as processes, programs, procedures, and policies, all under the oversight of relevant authorities responsible for their administration and implementation in Saudi Arabia [19]. The structured components of safety management are typically documented and disseminated as official materials that outline roles, responsibilities, and functions concerning safety. However, Micro, Small, and Medium Companies in Saudi Arabia (MSMCs) often encounter specific challenges in managing safety due to resource limitations and a lack of expertise in occupational health and safety. Despite these challenges, MSMCs in Saudi Arabia must prioritize safety management not only to safeguard their employees' wellbeing but also to adhere to legal and regulatory requirements [20]. Through effective safety management, MSMCs in Saudi Arabia can establish safer work environments, reduce accident risks, enhance productivity, and foster profitability [21] (Wang et al., 2018).

Safety practices in Saudi Arabia encompass a series of protocols, actions, and policies designed to ensure the well-being of individuals, property, and the environment [22]. Implemented across diverse settings such as workplaces, homes, schools, and public spaces, these practices focus on identifying and mitigating potential hazards to prevent accidents, injuries, and illnesses [23]. In Saudi Arabia adopting safety practices assumes paramount importance in cultivating safe and healthy environments for both individuals and communities. By adhering to these practices, individuals can effectively reduce the risks of harm and ensure the safety of themselves and others [24]. MSMCs in Saudi Arabia, integral to global economies, contribute significantly to job creation, innovation, and economic growth for the country. However, these enterprises in Saudi Arabia grapple with challenges linked to resource constraints and limited capacity, which can hinder their ability to enact robust safety practices [25].

3.1. Safety Management Practice for MSMCs in the United Kingdom and Hong Kong

The United Kingdom (UK) and Hong Kong (HK) both take very serious and unique approaches to safety management in the workplace. The Micro, Small, and Medium Companies (MSMC) sector in Hong Kong is shaped by the city's highly urbanised and technologically evolved surroundings [26]. Consistent application of rigorous regulatory standards, implementation of cutting-edge technical solutions, and use of proactive risk assessment methodology all attest to the region's dedication to protecting its employees. In the meanwhile, the health and safety at labour law provides the backbone of the United Kingdom's legislative framework for safety management [27]. A culture of shared responsibility for safety practises permeates the corporate environment, and MSMCs reflect this by placing an emphasis on risk assessment, stakeholder cooperation, and continuous improvement.

4. Methodology

We conclude from a survey of the current literature that there is a dearth of studies examining the actual application of the Construction (Design and Management) Regulations 2015 (CDM 2015) throughout the preconstruction stage of building projects. This is especially true when it comes to the Principal Designer's (PD) responsibility for overseeing potential threats to workers' health and safety. The authors advocate for a qualitative research approach that records the participants' actual thoughts and feelings during the study. Such an approach is particularly useful for studying societal problems that have received less scholarly attention in the past [28], [29]. From the beginning of a project's planning phase, health and safety management were included. In order to collect the necessary information, a total of 14 FGDs were conducted. Including human viewpoints and personal encounters was a driving factor in selecting this method of data collection [30]. In their study, [31] discovered that designers fell into three

distinct categories with respect to their knowledge and outlooks on health and safety (H&S) issues in the design process. The aforementioned results provide more backing for the reasoning behind selecting a certain method under the given conditions.

Purposive sampling was used to choose research participants, with assistance and facilitation from construction industry professional groups and other key organizations. Focus Group Discussions (FGDs) were advertised through the use of event management services like Eventbrite and online professional networking sites like LinkedIn. Participants were given a consent form that explained in detail why the focus groups were being held in accordance to internationally recognized data protection systems. The participants were asked to share details about their background in H&S management, with a focus on the construction sector. They were also asked to affirm that they were willing to take part in the research. Focus group discussions (FGD) were scheduled in advance and a comprehensive timetable was supplied in the permission form. The researchers asked potential participants to indicate which sessions they would be most interested in attending. Permission forms were checked to ensure that they came from those who truly deserved to be invited to participate based on their extensive background knowledge and experience in the field. After that, everyone was put into their designated sessions. The research suggests that a good number of participants for a focus group is between four and twelve. [32] The pursuit of knowledge is advocated by several authorities.

The data was obtained from two distinct cohorts, each comprising four participants, and afterwards juxtaposed with a solitary cohort comprising eight persons. The method utilized to determine group composition involves the participation of two drivers. The primary impetus behind this program was from the need to foster a sense of shared experiences among the individuals involved, thereby facilitating open and real interactions characterized by a certain level of mutual understanding. The incorporation of diverse groups was also meant to foster the cultivation of critical discourse among the responsibility bearers of the Community-Driven Development (CDM) approach. The purpose of this discussion was to examine the common experiences of individuals in managing comparable difficulties, with the ultimate goal of validating shared norms and practices while identifying potential conflicts that may occur across diverse groups.

Two Focus Group Discussions (FGDs) were held with only clients, two FGDs were held with only professional designers (PDs), and two FGDs were held with a combination of designers and PDs. One FGD was held with individuals involved in CDM support services, one FGD was held with principal contractors (PCs), and one FGD was held with contractors alone. The total number of participants in the focus groups was 89. Many people attended multiple FGD sessions and contributed thoughtfully.

The participant profile, as illustrated in Table 1, was as follows: A considerable percentage of the participants, precisely 70%, had professional experience beyond five years in the field of CDM legislation. Furthermore, it is worth noting that a significant majority, reaching as high as 90%, retained links with the prevailing organizations and associations that are tasked with the supervision of professional conduct in the field of construction and the wider realm of health and safety. The aforementioned professionals have acquired professional expertise in several positions within the construction sector, encompassing responsibilities such as CDM clients, project managers, designers, client health and safety consultants, principle contractors, and contractors. The involvement of HM Inspectors and other experts from the Health and Safety Executive (HSE) in the focus group discussions (FGDs) yielded favorable outcomes.

Table 1. Demographic characteristics of participants in the FGDs

A. Professional background	Frequency (%)	B. Professional affiliation	Frequency (%)
Architect	1 (1.1)	APS	31 (21.1)
Quantity Surveyor	1 (1.1)	IOSH	64 (43.5)

Civil Engineer	10 (11.2)	CIOB	6 (4.1)
Health and Safety Practitioner	58 (65.2)	IFE	3 (2.0)
Project Manager	8 (9.0)	IIRSM	14 (9.5)
Structural Engineer	1 (1.1)	RIBA	1 (0.7)
Other*	10 (11.2)	ICE	10 (6.8)
		RICS	6 (4.1)
		IStructE	3 (2.0)
		ICM	2 (1.4)
		Other**	7 (4.8)
Total	89 (100)		47 (100)***
C. CDM role on projects	Frequency (%)	D. Years of CDM experience	Frequency (%)
Client	11 (12.4)	1-5	27 (30.3)
Principal Designer	27 (30.3)	6-10	15 (16.9)
Designer	4 (4.5)	11-15	11 (12.4)
Principal Contractor	12 (13.5)	16-20	17 (19.1)
Contractor	6 (6.7)	21-26	19 (21.3)
Other****	29 (32.6)		
Total	89 (100)		89 (100)

Notes: APS = Association for Project Safety; IOSH = Institution of Occupational Safety and Health; CIOB = Chartered Institute of Building; IFE = Institution of Fire Engineers; IIRSM = International Institute of Risk and Safety Management; RIBA = Royal Institute of British Architects; ICE = Institution of Civil Engineers; RICS = Royal Institution of Chartered Surveyors; IStructE = Institution of Structural Engineers; ICM = Institute of Construction Management

*Includes indication of CDM roles instead of professional background.

**Professional affiliation indicated as HM Inspector

***Total frequency in excess of the total number of participants due to multiple affiliations by participants.

****CDM roles indicated as CDM Advisors (22) and HM Inspector (7)

5. Review Analysis of Safety Management Practice in Saudi Arabia, United Kingdom and Hong Kong

Micro, small, and medium companies (MSMCs) in Saudi Arabia, Hong Kong, and the United Kingdom adopt varying approaches to ensure the occupational safety and health of their workforce. The landscape encountered by MSMCs in Saudi Arabia is characterised by a dynamic interplay between traditional and modern values. The approach to safety management of Saudi Arabian MSMCs is influenced by regulatory limits, cultural standards, and economic situations [18]. These organisations may have challenges in accessing occupational health and safety resources and expertise. Therefore, it is imperative for them to develop customised plans that consider local norms with the adoption of international standards. In contrast, Hong Kong is characterised by its high level of urbanisation and

technical advancement, creating an environment conducive to the flourishing of MSMCs. The region's safety management practises are characterised by adherence to stringent regulatory standards, utilisation of technological solutions, and implementation of proactive risk assessment approaches [26]. The MSMCs in the region prioritise the implementation of advanced safety measures, reflecting the overarching focus on security that accompanies Hong Kong's status as a prominent global financial hub.

In a comparable manner MSMCs in the United Kingdom are evidence of a commitment to safety management practises that are embedded in the country's extensive legislation. The health and safety workplace act provides organisations of all sizes with a legal framework for implementing safety policies and procedures [27]. MSMCs in the United Kingdom place a high value on risk assessment, stakeholder engagement, and continuous improvement, and have adopted a culture of shared responsibility to achieve these objectives. The implementation of safety management in the MSMC industry varies across these three regions due to regulatory guidance, technological adoption, and cultural differences [33]. By analysing these various approaches, we can learn how to implement safety management in micro, small, and medium companies (MSMCs) across a variety of industries and regions.

6. Conclusions

This research has successfully pinpointed three interconnected issues that the PD function faces in light of the CDM 2015 regulations for construction and management. There are three main issues that must be addressed and fixed in this setting. To begin, difficulties occur in ensuring that the CDM customer follows all applicable laws and regulations. The dispersed nature of the supply chain also creates difficulties in terms of how well everyone works together and stays in the loop. Finally, it's worth noting that the current project has its own unique problems with the way the PD job is being carried out. Despite being a cornerstone of the UK, Hong Kong and Saudi Arabia's legal framework for site safety, the internationally recognized directives have been the subject of relatively little study, as evidenced by an analysis of the body of existing literature. Therefore, the findings of this study not only add to our knowledge of PD adoption in these countries, but also highlight how health and safety collaboration can be better promoted in pre-construction activities within the international regulatory framework for PtD. The failure to adequately coordinate health and safety (H&S) concerns during construction's preliminary stages can be attributed to a number of factors. The observed problems include a lack of supervision in managing the more comprehensive health and safety operations and a lack of commitment on the part of the Construction Design and Management (CDM) customer to complete their health and safety responsibilities. It's not enough to appoint a program director with the necessary expertise and allocate sufficient time and money. The client should prioritize building a project team comprised of people who are capable of working together, coordinating their efforts, and communicating effectively. It is crucial that issues related to health and safety be properly managed throughout the pre-construction phase. Implementing an integrated project delivery methodology by the procurement team and developing insurance products that encourage and facilitate collaborative working techniques are the most effective strategies for building a cooperative atmosphere.

This study suggests that investigation is needed to determine strategies that help increase compliance behavior among CDM customers who take a fundamental approach to fulfilling their CDM responsibilities. Research into the challenges of coordinating health and safety risk management in the preconstruction phase of projects across these countries is needed. If we want to know how well the PtD concept is being coordinated and carried out outside of the UK and the HK and Saudi Arabia, we need to look at the data. This evaluation is necessary because similar degrees of coordination and practical application are needed for the PtD notion to be successfully used.

Statement on Availability of Data

Upon a reasonable request, the primary author will furnish the necessary data, models, or codes that substantiate the conclusions of this research.

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Exploring Land Use Change Influences Children's Travel Behavior on The Home-School Journey

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Abstract. In children's geographies of the hinterland area on the island, little is known about the geography of the travel behavior on home-school journeys. The study was conducted to investigate children's travel behavior in the hinterland area, particularly in relation to walking and boat travel. The study utilized a range of data collection methods, including participant go-along interviews and mapping to gather insights into the travel patterns of a sample of 43 respondents aged between 7 and 12, in Belakang Padang, Batam, Indonesia. were analyzed using GIS spatial mapping and descriptive statistics. The findings of this research highlight the importance of child-friendly land use planning that promotes active transportation to school and fosters a sense of familiarity. Hence, the *Kota Layak Anak* (KLA) program was implemented to evaluate child-friendly environments in Indonesia, it effectively addresses the unique challenges faced by children living in hinterland communities. Nonetheless, the program has yet to highlight a specific approach that accounts for geographical conditions and prioritizes the well-being of children and their travel experience in hinterland areas. In summary, the study emphasizes the significance of land use planning in shaping children's travel behavior and urges urban planners to consider the needs of children when designing child-friendly environments. Further attention to children's requirements in urban planning is crucial to ensure positive impacts on their physical, social, and cognitive attributes during their school journey.

1. Introduction

The influence of land use on children's travel behavior during school journeys was a significant focus and concern for urban planning and child development [1,2]. Commuting to school is a regular daily trip, while other trips are optional and not part of the routine [3]. How land is utilized in the areas surrounding residential neighborhoods and schools can significantly shape how children travel between these two locations [4]. The home-school journey is a significant aspect of children's daily lives, and various factors influence their travel behavior patterns during this journey. One crucial factor that has gained increasing attention in recent years is land use change. Previous studies evaluated children's ability to move around independently by examining land-use policies and strategies, transportation initiatives, and considerations of social fairness [5,6]. Land use change refers to transforming the land from one use to another, such as converting agricultural land into residential or commercial areas [7]. These changes can profoundly influence the built environment [8], transportation infrastructure [9], and children's travel behavior patterns [2]. Understanding children's travel behavior on the home-school journey helps identify potential challenges and develop practical solutions to improve the journey for all involved. The acquisition of knowledge is crucial in creating sustainable transportation strategies and

interventions that encourage healthy and active modes of travel, such as walking and cycling [10–12]. Studying the relationship between land use change and children's travel behavior helps design neighborhoods that are more accommodating for children and easier to access. Different factors, such as the built environment, influence children's travel behavior during their school journey [13]. However, most studies on home-school journeys were conducted in urban areas. Therefore, this research will be shown in the hinterland area due to different environmental and cultural factors. In addition, the physical setting of the place was found to be the main factor in child development. Therefore, different physical settings would influence children's performances in the home-school journey. Thus, this research should explore how land use change influences children's travel behavior on the home-school journey in the context of the hinterland area on the island. The land use change in the hinterland area, especially with boat transportation involved, significantly influences travel patterns. The availability and use of boat transportation and how the land is utilized and transformed in the hinterland area influence how children travel to and from school. Effective strategies and policies promoting safe and sustainable travel options require understanding how land use change and boat mode transportation affect children's travel behavior patterns. This paper delves into the connection between land use change in the hinterland area, boat mode transportation, and their influence on children's travel behavior patterns during the home-school journey. This study analyzes the correlation between the built environment and children's transportation preferences to identify ways to improve their mobility and overall health and wellness.

2. Literature Review

Land use pertains to the organization and allocation of vacant land for specific activities at a regional level, spanning national, regional, and local scopes [14]. How land is utilized is inherently linked to the pre-existing transportation system. The transport system encompasses a range of activities, including work, education, leisure pursuits, shopping, and socializing, all of which occur within designated land uses such as residential properties, schools, stores, and other establishments. To meet their needs, children in the hinterland area must travel between these land uses using various modes of transportation such as walking and boat. This resulted in the movement of human traffic, activities, and vehicles. The frequency and nature of journeys between land uses are ultimately determined by the needs of the children, which in turn influences travel behavior patterns and the number of children using the transport network system. The relationship between land use and children's activities is meaningful. The formation of land use for commuting to school is influenced by three key elements: children's activities, location, and interrelationships. As social agents, children show dynamic characteristics and carry out various activities that require adequate space provided by land use. The relationship between transportation and land use is reciprocal and constantly evolving. Alterations to transportation infrastructure result in changes to accessibility levels that influence land-use configurations. These land-use changes, in turn, influence activity and travel patterns, leading to further adjustments in transportation systems.

This study provides a framework for understanding how land use influences children's travel behavior to and from school. This framework includes the physical and design aspects of the surrounding area, such as land use patterns and transportation infrastructure, which influence a child's travel choices and behavior by thoroughly analyzing the four primary factors of distance and accessibility, safety and security, environmental quality, and social and cultural factors to understand how changes in land use influence children's travel behavior patterns (see Figure.1).

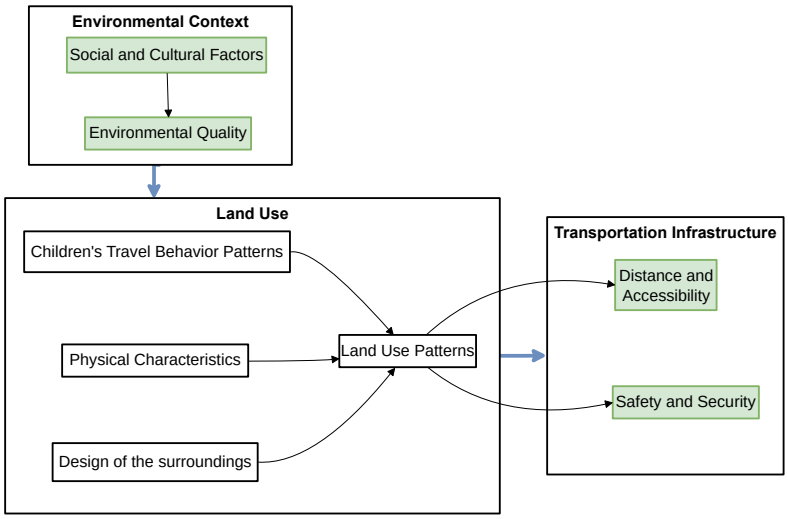

Figure 1. Theoretical framework land use influences children's travel behavior patterns on the home-school journey

2.1. Distance and accessibility

Walking to school is associated with improved overall physical activity, emphasizing the importance of proximity to the school in promoting active travel behaviors among children [14,15]. Children's activity spaces within their neighborhood, considering factors such as distance, accessibility, and land use patterns [17]. Land use changes prioritizing mixed-use developments and pedestrian-friendly infrastructure can further promote active travel options by reducing the reliance on motorized transport [17,18]. The relationship between neighborhood design, land use, and physical activity levels across different age groups, including children, creates environments that promote active travel behaviors and physical activity [20].

Additionally, improvements in accessibility to amenities, achieved through well-connected sidewalks, bike lanes, and safe pedestrian crossings, positively influence children's travel choices. These changes contribute to higher physical activity levels and influence parental decisions regarding their children's travel modes, creating a safer, more walkable environment that fosters independent mobility [21]. The importance of land use changes in shaping attitudes towards active transportation among different age groups [22]. Socioeconomic disparities in children's travel patterns can also be addressed through equitable land use changes that provide better accessibility to public transportation and community resources [23].

2.2. Safety and Security

Land use change is crucial in shaping children's travel behavior patterns concerning safety and security. Several studies have explored the influence of altered land use on how children travel within their neighborhoods. One key aspect is the built environment, where mixed-use developments and pedestrian-friendly infrastructures can promote active transportation like walking and biking to schools [24]. Changes in land use influence the mode of travel children choose when accessing destinations like schools. Such modifications directly influence the accessibility of these destinations [25]. However, safety perceptions and security concerns influence children's travel behavior. Changes in land use, such as increased traffic volume and speed, can lead to parents perceiving the environment as less safe, leading to a shift towards more car-dependent travel patterns for even short trips.

Moreover, social and cultural factors, including parental attitudes towards safety and peer influences, influence land use changes in children's travel behaviors [25, 26]. Active school travel is influenced by various factors, particularly the built environment, which acts as a mediator. In reality and perception,

this environment affects traffic, crime, and household transportation options. Consequently, parents' support for active school travel is influenced by how they perceive the built environment's influence [28]. The number of children walking or cycling to school has been declining globally due to concerns about traffic, neighborhood safety, and distance to school. Addressing these factors through built environment interventions, such as well-designed footpaths and lateral separation from motor vehicles, is crucial to promote active school travel [29]. Studies have also assessed neighborhood safety's influence on children's physical activity levels and the interplay of self-efficacy, socioeconomic factors, and environmental characteristics in children's active commuting to school [30].

2.3. Environment Quality

Environment quality and land use change significantly influence children's travel behavior patterns within neighborhoods. Creating green spaces and parks within residential areas encourages active transportation, such as walking and biking, among children [31]. Access to these recreational areas offers attractive destinations and promotes physical activity. Conversely, land use changes resulting in increased traffic or industrial activities can lead to poor air quality, negatively influencing parents' perceptions of safety [5]. Consequently, parents may prefer car travel over active modes for their children's commutes. The walkability and bike-ability of neighborhoods, achieved through pedestrian-friendly infrastructure and well-connected bike lanes, also play a crucial role in shaping children's school travel behaviors [31,32]. A walkable environment with easy access to schools and other destinations encourages children to walk or bike rather than relying on motorized transportation. Additionally, exposure to traffic-related pollution due to land use changes can affect children's health and well-being, reducing active travel. Noise pollution from traffic or other sources can create safety concerns for parents, limiting children's opportunities for independent travel. Finally, accessibility to key destinations, such as schools and recreational facilities, is vital in promoting active travel among children. Ensuring neighborhoods are designed with a focus on environmental quality can significantly influence children's travel behavior patterns.

2.4. Social and Cultural Factors

Children's neighborhoods' social and cultural context determines their mobility and active transportation choices. Research has indicated that an area's physical surroundings can impact people's attitudes toward travel and the tendency to disperse their activities. As such, the built environment can potentially influence travel behavior [34]. Neighborhoods with open, natural, and green spaces and urban design that encourage social interaction and safety are the primary factors that contribute to happiness [35]. Additionally, culturally sensitive land use changes can address diverse cultural practices and create spaces that resonate with children's backgrounds, promoting inclusivity and acceptance of active travel within different communities. Parents' perception of neighborhood safety affects children's physical activity and facility use. Children from less affluent families are less likely to use facilities, regardless of where they live, compared to wealthier children [36]. Furthermore, engaging community members, including children, in the land use planning process improves well-being in communities by fostering solidarity and encouraging community action. Culture can link the community to the development process and contribute to various local actions and development options [37].

3. Method

The study conducted in the Belakang Padang**,** Batam, Indonesia, covers an area of 581.55 km^2, with 512.43 km^2 of sea area, 69.12 km^2 of land area, and 166 islands (44 inhabited and 122 uninhabited) consisting of six districts Tanjung Sari, Sekanak, Pemping, Pecong, Kasu, dan Terung. Belakang Padang has a strategic location directly adjacent to Malaysia and Singapore. However, 22.439 people and 3870 children aged 7-12 attend primary school using walking and boats as part of their routine. This island was selected based on safety reasons and the presence of basic facilities of daily life, amenities, and a transportation network, as it can be accessed from the nearest jetty terminal in mainland Batam through a shuttle boat service within 15 min. In addition, Batam has the potential to set an example in creating

child-friendly environments on the island, which can be applied to other Indonesian islands such as Ambon Island and Selayar Island. The study analyzed 43 children aged 7-12 in the hinterland area, focusing on their home-school journey from two primary schools. The data was collected through go-along interviews and mapping.

Go-along interviews are an audio method and were used coherently to elicit the nature of children home-school journey in the hinterland area. During the data collection, it was identified that the children in this community go to school from 7.00 a.m. to 12.00 p.m. noon. The researcher accompanied the children during data collection and observes their behaviours and environment. The researcher can ask questions, make observations, and take notes to elicit the environment of children's school journey in the hinterland. A go-along interview is when the children lead a walking tour and move during their home-school journey. This research allows for brief engagement in familiar environments, making it a flexible technique for gathering data in a study focused on specific settings or places. Hence, various interview methods were used to minimise the possibility of missing any crucial information to ensure a comprehensive data collection on the children's perspectives and behaviors during their journey. In addition, these interviews are intended to be meaningful for the participant. Hence, Go-along interviews entail entering a research setting that is familiar and selected by the participant at a specific moment in time during the children's journey [38].

This analysis uses ArcGIS, namely ArcMap 10.8, The software can be obtained via the following page: https://desktop.arcgis.com/en/arcmap/. Method Landsat image data processing in ArcGIS uses guided supervised classification. This method classifies images based on reflectance values obtained from polygons representing sampled areas for different land cover types. These samples were collected manually, and the analyzed image was used to calculate the image classification. This method requires Spatial extension ArcToolbox includes composite, clip, pan-sharpened, and maximum likelihood classification. Data source administrative area boundaries from the official portal of the Geospatial Information Agency. The public can access it via the following page: https://tanahair.indonesia.go.id. It is necessary to determine the coordinate system to use. Determining the coordinate system is essential so that the input shapefile data into the ArcMap according to the actual position during go-along interviews can later be done in geometry calculations. Landsat images that have been composited and corrected for the coordinate system will be taken according to the area analysed, namely the Belakang Padang, Batam.

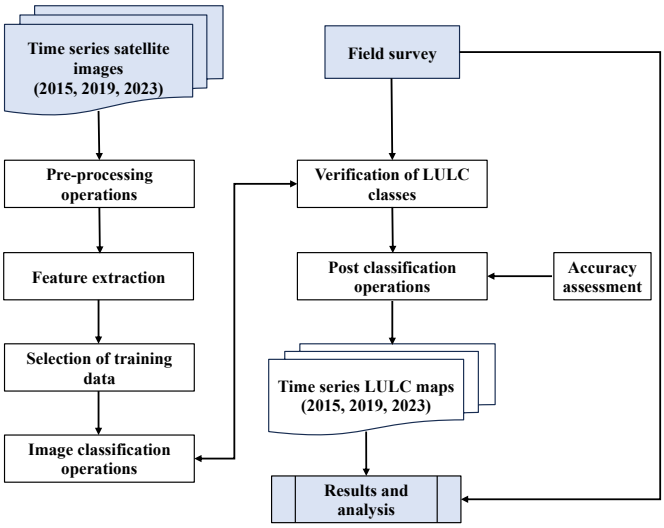

Figure 2. Land use cover analysis workflow

The provided statement suggests that a series of analyses have been conducted to improve the spatial mobility indicators for school children in the Batam hinterland. The analysis primarily centers on hinterland land use cover, explicitly focusing on built-up areas, open spaces, and green areas. The

temporal scope of the analysis spans from 2015 to 2023, allowing for a comprehensive understanding of the changes that have occurred over this period. The reason for choosing these three years includes the following. First, based on Laws of the Republic of Indonesia Number 32 of 2004 about Local Government about delegation of governmental authority by the Government to autonomous regions to regulate and manage government affairs in the system of the Unitary State of the Republic of Indonesia. Second, the end of Indonesia's recurring five-year national development plan allows us to compare the influence of the implementation of each phase of the plan on urban and hinterland development. Third, rapid development during the reign of the mayor of Batam for the 2011-2021 period. So, this year became a pivotal point to study the implementation of the development plan. Moreover, to investigate the trend of land-use changes, eight years were considered according to the limitations in selecting satellite images, and land use land cover maps were extracted for 2015, 2019, and 2023. The research pertains to land categories and their distribution changes, focusing on built-up areas, open spaces, and green areas. The significance of this study lies in its ability to shed light on spatial mobility indicators for school children. Built-up areas, comprising man-made structures such as buildings, roads, and infrastructure, directly impact transportation infrastructure, school accessibility, and overall mobility. Data analysis using ArcGIS and the land cover analysis workflow refer to Figure 2.

4. Results and Discussion

4.1. Land use change results

The availability of different types of land use can influence how school children travel to and from school. These analyses were gathered to enhance the spatial mobility indicators for school children in the Batam hinterland. The research focuses on land use cover, including built-up areas, open spaces, and green areas, from 2015-2023 (see Figure 2).

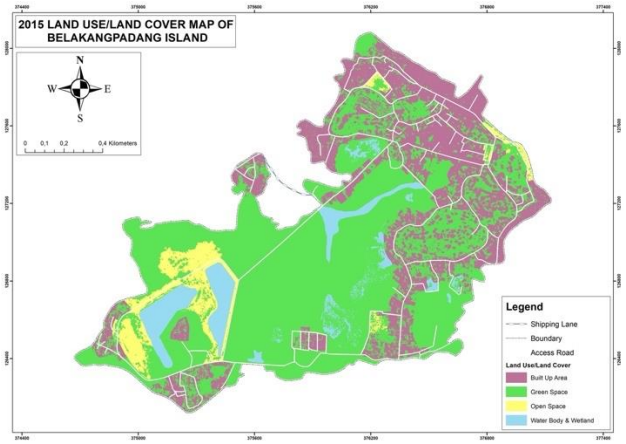

Figure 3. Land use change analysis from 2015

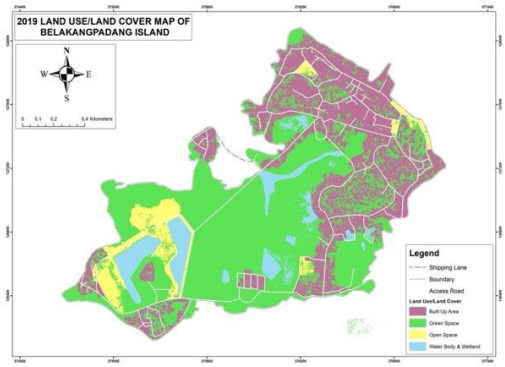

Figure 4. Land use change analysis from 2019

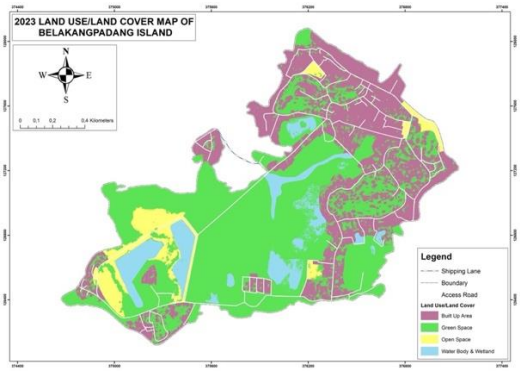

Figure 5. Land use change analysis from 2023

Based on the data provided on the built-up area, an analysis was conducted on the potential influence of land use changes on children's school journeys. The data showed a significant increase in the built-up area between 2015 and 2019, with a change of 9.58 units, representing a percentage change of 14.74%. The findings indicate significant urban development during this period. However, between 2019 and 2023, the rate of built-up area increase slowed, with only a 0.94-unit change, corresponding to a minor percentage change of 1.26%. Changes in the built-up area influence the proximity and accessibility to schools from home. Moreover, changes in transportation infrastructure influence the travel routes and transportation options available to children, influencing their school experiences, including the construction of new roads or improvements to existing networks.

Between 2015 and 2019, there was a significant decline in green spaces, with a decrease of -13.26 units and a -9.55% percentage change. This has resulted in a reduction in the availability of green areas. Between 2015 and 2019, the hinterland area experienced a positive trend in the increase of open spaces by 1.91 units, equivalent to a growth rate of 14.65%. From 2019 to 2023, there was a 1.54% increase in the upward trend, which amounted to a rise of 0.23 units. Unfortunately, there was also a -2.76% decrease in open space, reflecting a reduction of -3.46 units. This decline has harmed children's physical activity levels and overall happiness, as they have fewer opportunities to connect with nature and engage in outdoor activities during school trips. However, there is some good news. Parks, playgrounds, and recreational facilities have positively impacted children's physical activity levels and independent mobility, according to Carver et al.'s research in 2014. Additionally, the growth of water bodies and wetlands increased significantly during the same period, with an 11.59% increase, equivalent to an increase of 1.73 units. This positive trend in the expansion of natural features continued from 2019 to 2023, with a further addition of 2.57 units, corresponding to a percentage change of 15.45%. Expanding water bodies and wetlands provide crucial ecosystem services, including water regulation, animal habitat, and aesthetic value. Overall, the trend towards increasing natural features is a positive development that promotes physical activity and encourages children to engage with the environment. The study found that hinterland land use significantly influenced children's travel behavior patterns during their home-school journey. The analysis considered four factors: distance and accessibility, safety and security, environmental quality, and social and cultural factors. Distance and accessibility It is revealed that land use patterns in the hinterland areas, specifically on small islands, play a crucial role in determining the distance between homes and schools. Due to the limited land area on the islands, schools are strategically located near homes. As a result, children experience short travel distances when commuting to school. The emphasis on locating schools near homes demonstrates that land use planning on the island prioritizes the proximity of educational facilities to where children live. This deliberate decision aims to promote and encourage active modes of transportation, such as walking and using boats, as the preferred means of commuting to school. Children use active transportation by situating schools within walking distance or a short boat ride from home. Walking and using boats promote physical activity and contribute to sustainable travel behavior, minimizing reliance on motorized vehicles. This

aligns with Romero's previous study of land use planning with small islands' unique characteristics and constraints. With limited land area available, optimizing proximity between homes and schools becomes essential in ensuring convenient and accessible educational opportunities for children.

Additionally, the integration of boat transportation as part of the school journey highlights the importance of waterways in the transportation network. Boat travel was an alternative mode of transportation, particularly in the hinterland areas where bodies of water were prevalent [39]. The inclusion of boat travel in land use planning acknowledges the significance of water as a critical element in shaping travel behavior patterns on the islands.The decision-making process regarding hinterland land use considers community engagement, focusing on safety and security. The involvement of locals, parents, and teachers in the planning process allows for a more customized approach that reflects the unique needs and preferences of the community. This collaborative approach cultivates a sense of ownership and pride in the environment, making it more conducive to home-schooling children. By establishing a shared understanding of responsibility for the safety of children during their travels, community members can provide guidance, assistance, and supervision if needed during the home-school journey. This approach enhances children's security and promotes a more engaged and responsible community.

Land use decisions in hinterland areas profoundly impact the environmental quality experienced during home-school journeys. Green spaces, fields, and mangroves (see Figure.4) along the home-school route were among these land use considerations. Implementing such features establishes an attractive and engaging environment for children, ultimately enhancing their journey experience.

Figure 6. The children are playing with their friends in the field

Figure 7. The boys are getting ready to go home after swimming in the sea

Figure 8. The boys are walking and chatting with their friends

Figure 9. The boys are searching for a bird in the tree

Through the implementation of land use planning, the inclusion of green spaces along school routes has greatly enhanced environmental quality in hinterland areas. These areas, in turn, provide children with opportunities for activities, relaxation, and connection with nature. Greenery and vegetation have been shown to enhance neighborhood ties and a sense of community [38,39]. Additionally, access to green spaces has been found to increase the likelihood of children engaging in outdoor activities and active travel, ultimately making their journey to school more enjoyable and encouraging a healthier lifestyle. Land use decisions that prioritize preserving and incorporating natural areas such as mangrove forests, wetlands, or coastal habitats along school routes contribute to the environmental quality of the hinterland areas. By preserving these areas and ensuring their accessibility, children can experience and appreciate the natural environment during their school journey. Exposure to nature promotes a connection with the environment and positively influences children's psychological and cognitive well-being. Psychological well-being was negatively related to academic achievement, while cognitive well-being was positively associated with academic performance [42]. Exposure to the natural environment is the most compelling evidence for reducing stress and improving overall health [29]. Attractive green spaces and natural areas along the home-school journey encourage active travel among children.

"On our way home from school by boat, we saw waves, fish, and mangroves."

Walking through pleasant and engaging environments becomes more appealing than relying on motorized transportation (see Figure 5). Children in the hinterland area by walking, cycling, pedicab, and boat on the home-school journey. Land use decisions prioritizing the integration of green spaces and the natural area help create a conducive environment for reducing air pollution and noise, heat island effects, and increasing green space and physical [43].

Figure 10. Children walk with peers

Figure 11. A boy cycle back home

Figure 12. Pedicab waiting for children

Figure 13. The boys with the boat return home

Land use decisions that enhance the environmental quality along school routes also contribute to children's sense of place and identity in the hinterland areas. Incorporating natural elements and green spaces specific to the local setting helps foster a unique identity and connection to the surrounding environment. Children develop a sense of pride and attachment to their community, enhancing their engagement and commitment to preserving environmental quality.

"As we wrap up another day at school, our little group gathers at the Jembatan Turlan. The spot has become our favorite hangout because of the cool breeze and serene atmosphere. We delight in playing games and eating ice cream while enjoying the gentle wind blowing around us".

4.2. Travel Behavior Patterns

Children's travel behavior was closely linked to the land use of the route of children's school journey surrounding environment. Travel behavior for school children was a crucial factor in promoting active modes of transportation, mainly walking and boating. When school destinations were easily accessible through active transport, children engaged in regular physical activity as part of their daily routine. Figure 6 illustrates how routes in the Batam hinterland create environments that encourage active play and physical activity during children's school journeys. In the context of physical activity, the environment offers various affordances that facilitate engagement in physical activity. For example, a jetty or timber platform affords swimming, jumping, fishing, diving, floating, pouring, playing, touching, eating, catching, scooping, standing, and splashing. Shops afford opportunities for talking, observing, recognizing, choosing, manipulating, giving, queueing, and asking. Gates provide waiting, estimating, passing, identifying, and taking opportunities. The cemetary also offers for sitting, sweeping, and relaxing.

The school journey for children encompasses more than just traveling from home to school; it involves a complex process that influences their independent mobility and physical activity, providing them with

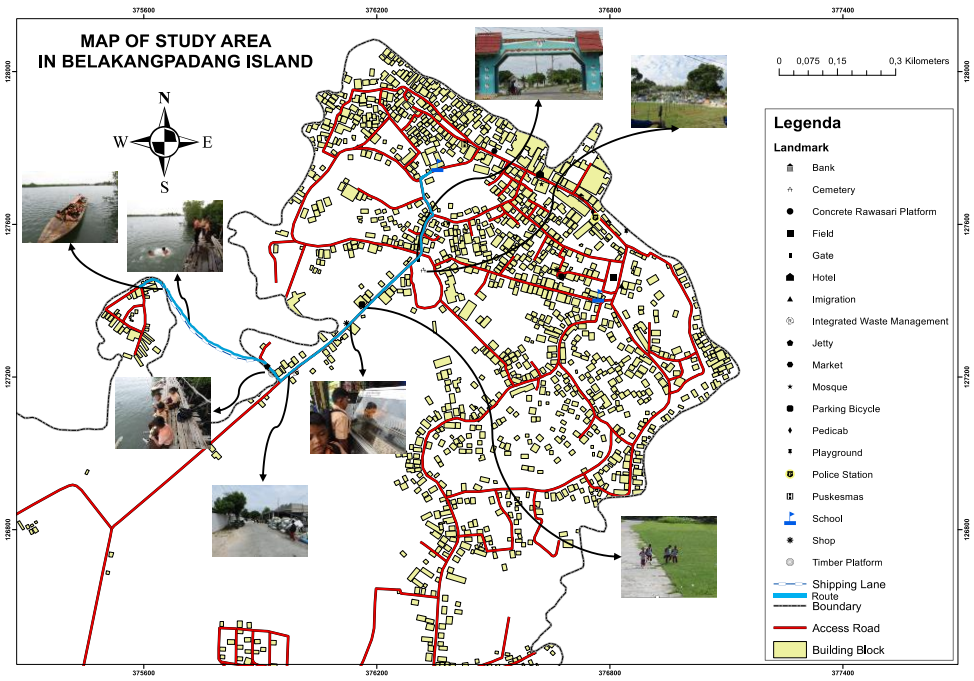

Figure 14. Children's travel behavior on the home-school journey in the hinterland

Various opportunities for growth and development. It is not merely a means of transportation but a significant aspect of their daily lives, impacting their overall well-being and autonomy. Considering the context of land use, planning is essential for urban planners to create a child-friendly environment. By

taking into account the specific needs and requirements of children in the planning process, such as safe and accessible routes to schools, green spaces for play and physical activity, and pedestrian-friendly infrastructure, urban planners foster an environment that encourages children's active lifestyles and promotes their overall health and happiness. Incorporating child-friendly features in land use planning can aid in children's social and emotional growth. Creating spaces where kids can interact with their peers, engage in creative activities, and feel a sense of belonging within their communities can foster this development. Urban areas can become more inclusive and livelier by prioritizing children's needs during the planning process. This benefits not only the younger population but also the entire community.

4.3. The Effect of Land Use Change and Travel Behaviour Pattern

This article is written to summon a thinking space that reconsiders the relationship among children, land use, and travel behavior patterns during home-school journeys. The discussions raised in this study speak more broadly to urban studies to shed light on how children's space serves as an entry point to understanding urbanity in the hinterland on the island. This study has also shown the complexities of hinterland areas and what. It means critically engaging with the embodied land use planning that pervades children's home-school experiences. This will only advance when the hinterland is imagined as part of children's spaces. It was breaking free from the thinking that children are liabilities and instead partners are a necessary response to land use planning in the hinterland area.

In Indonesia, ensuring a child-friendly environment is a priority, and this is evaluated through indicators and measures exemplified by the Kota Layak Anak (KLA) program. This program assesses various aspects, including education, leisure activities, and cultural engagement, explicitly focusing on schools providing specialized programs, facilities, and infrastructure for children's travel to and from school. Additionally, it emphasizes the availability of creative and recreational facilities accessible to all children. However, the main indications of the Batam Spatial Planning and Regional Planning 2021-2041 show significant development plans for the area of Belakang Padang, mainly related to sea transportation, construction of gas transmission networks, coastal protection, and tourism zones. Surprisingly, there was no specific mention of a program addressing the child-friendly environment, especially regarding children's travel behavior during the home-school journey. This is not to dismiss the previous efforts of child-friendly city initiatives but rather to build on these frameworks and modify them according to the needs of children in the hinterland area. Highlighting children's geographies in the hinterland area on the island opens narratives that an adult society may not see and only children can reveal. Adults may have forgotten to notice or comprehend certain things in their surroundings, but children have a unique perspective that allows them to perceive. Interrogating urban narratives in land use planning of children in the hinterland area helps reveal the ethical sides of urban design and policies in every day life in the hinterland area. Understanding the context of hthe ome-school journey in the hinterland area is relevant to children as they become increasingly complex individuals developing many other identities, which require processing spaces to explore and reflect their sense. Focusing on children's unique experiences in the hinterland offers the field of children's geographies rich opportunities to contribute to reimagining urban thinking.

Furthermore, the umbrella of the Kota Layak Anak (KLA) program is designed for all cities in Indonesia, without considering demographic conditions, particularly on islands like Batam. This raises concerns about the need for more tailored approaches to address the unique challenges faced by children in island communities when it comes to creating a child-friendly environment.

5. Conclusion

The study revealed that land use in the hinterland significantly influenced children's travel behavior patterns during their home-school journey. Four factors were considered: distance and accessibility, safety and security, environmental quality, and social and cultural factors. The land use patterns in the hinterland, particularly on small islands like Batam, played a crucial role in determining the distance between homes and schools. Schools strategically located near homes resulted in short travel distances

for children, encouraging active modes of transportation such as walking and boating. Integrating boat travel as part of the school journey recognized the importance of waterways in shaping travel behavior patterns on the islands. Community engagement in the decision-making process emphasized safety and security, fostering a sense of ownership and responsibility among community members for children's well-being during their travels. Land use decisions incorporating green spaces and natural areas along school routes enhanced the environmental quality, offering children opportunities for outdoor activities and a deeper connection with nature. This exposure to nature positively influenced children's psychological and cognitive well-being.

Children's school journeys in the hinterland area involved various active transportation modes, promoting physical activity and contributing to sustainable travel behavior. Child-friendly elements in land use planning, such as green spaces and unique local features, fostered a strong sense of place and identity among children, enhancing their engagement and commitment to preserving the environment. In conclusion, the study demonstrated the critical role of land use planning in shaping children's travel behavior during their home-school journey in the hinterland areas. Creating a child-friendly environment through thoughtful land use decisions can optimize children's well-being, physical activity, and overall connection to their surroundings. Implementing tailored approaches that consider the unique challenges of island communities can further enhance children's well-being and travel experiences in these areas.

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Systematic Literature Review of Harnessing Sustainability Strategies in Project Management of Construction Project

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Abstract. The UN 2030 Agenda for sustainable development offer opportunities for construction industry to redefine its sustainability focus. Spearheaded by projects, the construction industry is always seen as a non-sustainable sector as it uses more resources than what it produces. The purpose of this paper is to conduct a systematic literature review (SLR) of harnessing sustainability strategies in project management (PM) from the context of construction industry. The SLR employs the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement 2020 method which focuses on studies pertaining to the relationship between sustainability and project management as published in Scopus index from year 1996 to 2023. The SLR further limits the studies to be related to construction only. The result is synthesised based on the research questions, to determine how sustainability and project management integrates in a construction project and to highlight future research on sustainable project management (SPM) adoptions in construction. 677 articles have been screened from total of 7,127 identified, with most studies are classified into sustainability indicators, evaluation, and assessment tools category. Research in sustainability and project management is in increasing trend for almost 10 years, with an average of more than 50 studies per year from 2013. Nonetheless, few gaps or lack of studies have been identified for future studies e.g., in terms of sustainability integration with project management process groups, practical application/roadmap for the industry and studies concerning niche but impactful construction sub-sector such as power plant or industrial facilities construction.

1. Introduction

Sustainability is a crucial concept and approach that aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. It involves balancing economic, social, and environmental (the Triple Bottom Line or TBL) considerations to create a more equitable and resilient world. Embracing sustainability is essential for addressing global challenges such as climate change, resource depletion, loss of biodiversity, and social inequalities.

Sustainability, according to John Elkington, is a concept known as the "Triple Bottom Line" [1]. The Triple Bottom Line (TBL) framework assesses business performance based on three pillars:

a) Social: This aspect focuses on the social impact of a business activities. It considers factors such as the welfare of employees, community engagement, diversity and inclusion, human rights, and overall social well-being.

b) Environmental: The environmental pillar assesses the ecological impact of a business or project. It involves assessing resource consumption, greenhouse gas emissions, waste generation, pollution levels, and efforts to preserve natural ecosystems and biodiversity.
c) Economic: The economic pillar is concerned with financial performance and profitability. It looks at the traditional bottom line of financial success and considers factors like revenue, profit, cost efficiency, and return on investment.

The TBL approach suggests that sustainable success requires businesses and organizations to balance their activities across all three pillars. By considering not just financial bottom line, but also social justice and environmental quality impacts, business may continue to be profitable while becoming more socially responsible and environmentally conscious. TBL is therefore a holistic approach that promotes the idea that business and organizations should not only focus on short-term goal or profits, but also consider broader impact to the community and the planet at large.

The construction industry is a sector of the economy that encompasses the planning, designing, building, and maintenance of various structures and infrastructure. It is often considered as a key indicator of economic growth and development in a country as well as creating jobs where the industry often employs a diverse workforce, including architects, engineers, construction workers, project managers, and various skilled tradespeople. It involves the creation of buildings, roads, bridges, power plants, airports, dams, tunnels, and other physical structures that serve societal needs. A significant proportion of the gross domestic product of most countries is made up by the construction sector, where more than $3 trillion was spent all over the world for construction [2]. Spearheaded by projects, construction has always been regarded as a non-sustainable sector as it uses more resources than what it produces. It wastes 57% of resources as compared to 26% in other industries [3]. This is against the key aspects of sustainability which includes responsible consumption to minimize waste and resource depletion. It also one of the industries which emit significant amount of greenhouse gas such as CO_2. To illustrate, cement, a major material used in construction, alone contributes to 8% of CO_2 emission in the world [4].

As the main driver to construction industry, project is crucial to be managed properly. It is essential as proper PM is required to deliver project outcomes within its constraint, in effective and efficient manner. The term Project Management (PM) is used to describe the process of planning, organizing, and executing tasks and resources to achieve specific objectives within a defined scope, budget, and timeline (the iron triangle). It involves coordinating various elements of a project, such as people, materials, and technology, to successfully complete the project's goals and deliverables. PM processes commence with project initiation, followed by planning, execution, control and closing processes, as comprehensively detailed out in the Project Management Body of Knowledge (PMBOK) by the Project Management Institute (PMI). However traditional PM practices do not successfully address basic principles of sustainability as described in the Triple Bottom Line (TBL) considerations [5].

Sustainable project management is the consideration of sustainable practices throughout the project, asset and product lifecycle [6]. For project lifecycle, it involves consideration to environmental, social, and economic impacts, not only during project execution but also in the evaluation, planning and design phases. Sustainability practices is not only considered during the project alone, but also to the asset delivered by the project, as well as the product that the asset produces therein [6]. The objective is to achieve project's goals while minimizing negative effects on the environment and society as well as encouraging long-term feasibility and resilience. By integrating sustainability principles into PM practices or as some studies coined this as Sustainable Project Management (SPM), we can work towards a more sustainable and equitable future for both current and future generations. As proposed by some researchers that sustainability is a new school of thought in PM [5], studies also conclude that integrating sustainability into PM may support project success [7][8].

This SLR aims to provide answer to the research questions, to determine how sustainability and PM integrates in a construction project and to highlight future research on SPM adoptions in construction.

2. State of research

United Nation Special Commission, World Commission on Environment and Development released the Brundtland Report in 1987 titled "Our Common Future" which introduced the concept of sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." The report highlighted the connection between environmental, social, and economic issues and stressed the urgency of taking collective action to address environmental degradation, poverty, and social inequalities. It called for a more holistic and integrated approach to development that would balance the needs of the planet, people, and prosperity. Studies on sustainable development is important as it promotes responsible development, in a more equitable and sustainable manner. Natural resources, for example have been exploited to meet growing present demand. If such development is not monitored and controlled, the ability of future generation to meet their own demand will be compromised.

Various literatures have identified several benefits of incorporating sustainable business practices into a project [9], including moral imperative [10], organizational resilience [11], organization's economic prosperity [12], long-term performance [13] and improving technological performance [14].

Traditional construction project however often relates project success within the context of the iron triangle, i.e. with time, quality and budget. Nevertheless, a current study on relationship between SPM and project success has observed that project success is more than the iron triangle, where beyond that, variables related to project's deliverable and benefits of this deliverable enables are also recognized as a holistic set of project success' variables [8]. The study also noted that from available literatures, relationship between SPM and project success is mostly considered positively. Additionally, it has been observed that TBL is the concept used in most of sustainability studies with regards to SPM [6]. It can be concluded that in general, literatures have established that SPM is in fact relates to and contributes positively on project success.

With the knowledge that SPM does make a project to be successfully implemented, interestingly literatures also show that various interpretations on the role of sustainability has been identified, with regards to sustainability integration into PM. One of them has classified the sustainability interpretation utilizing a stage model that describes interpretations of sustainability role in PM, as illustrated in figure 1. The order of sustainability role in the stage model reflects the value ascribed to sustainability aspects in PM by each interpretation.

Figure 1. Stage model interpretations of the sustainability role in PM (sourced from [15]).

The stage model starts with sustainability value is not considered, as traditionally PM only considers the iron triangle in project implementation. When sustainability is introduced in PM, it usually regarded as something that hinders the actual project goal or as potential risks. Sustainability aspects come from the outside of the project, needs to be satisfied, as an extrinsic motivation and regarded in a negative connotation [15]. Another interpretation puts sustainability as an instrumental value. It regards sustainability as more to an instrument that supports the project goal. This leads to a more positive, supporting role of sustainability in PM, which helps to improve the project outcomes. The final interpretation is seeing sustainability as intrinsic value where all sustainability dimensions are ascribed to such high value that they are not as constraint or instrument, but rather as an equal goal of the project. As the previous stage 2 and stage 3 interpretations are regarded as close to the traditional PM, therefore the study suggested a review to the stage 4 definition of SPM, and propose new interpretation i.e. "SPM is a project management approach of ascribing intrinsic value to sustainability aspects by including all

sustainability dimensions as equal parts of project's success and therefore creating a business case for sustainability" [15].

Another study [16] highlights the relationship between sustainability and PM to be characterized in two interpretations based on existing literature. First is sustainability by the projects (SbP), where it reflects the sustainability of the deliverables or result of the project. For SbP, frameworks to define or assess the project content e.g. materials, specification, quality and success criteria are of concerns. Usually studies on the sustainability integration into PM utilizing this content-related perspective, focus on utilizing the TBL concepts by developing sets of indicators on different perspectives. Second interpretation as highlighted in the study is sustainability of the project (SoP), where it deals with the delivery and management processes of the project, rather than the project's content. This type of study argues on sustainability dimensions that are applied to the processes of project delivery, management and governance. SoP studies, in relation to SPM includes stakeholder engagement, procurement process, project monitoring, risks, project team and project communication, among others.

In terms of lifecycle orientation of SPM, study suggests that from sustainability perspective, PM should not only consider project life cycle, but the deliverables of the project i.e. the 'asset' lifecycle and the product that the 'asset' produces in its operation phase. Therefore, from the lifecycle view, considering sustainability in PM will require asset and product life cycles to be considered during the project life cycle [17] as well as these lifecycles interact and influence each other.

3. SLR Methodology

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement, published in 2009, was designed to help systematic reviewers transparently report why the review was done, what the authors did, and what they found [18]. Updated PRISMA Statement 2020, which replaced the PRISMA Statement 2009 is utilized in this SLR to include the advanced methods to identify and select studies. Search protocol used in identification and screening stage is summarized in table 1, and the SLR flow diagram according to PRISMA Statement 2020 is shown in figure 2.

Table 1. Parameter used in literatures identification stage.

Search Protocols	Description
Database	Scopus
Search keywords	Sustainable or sustainability and project management or project management process groups
Year	1996 to 2023 (28 years)
Keywords	Project management, sustainable development, sustainability, construction industry, decision making, construction, construction management, construction projects, sustainable construction
Subject areas	Environment sciences, business management and accounting, energy, social sciences
Document type	Articles and conference papers
Language	English
Source type	Journal
Publication type	Final
Access type	Open access

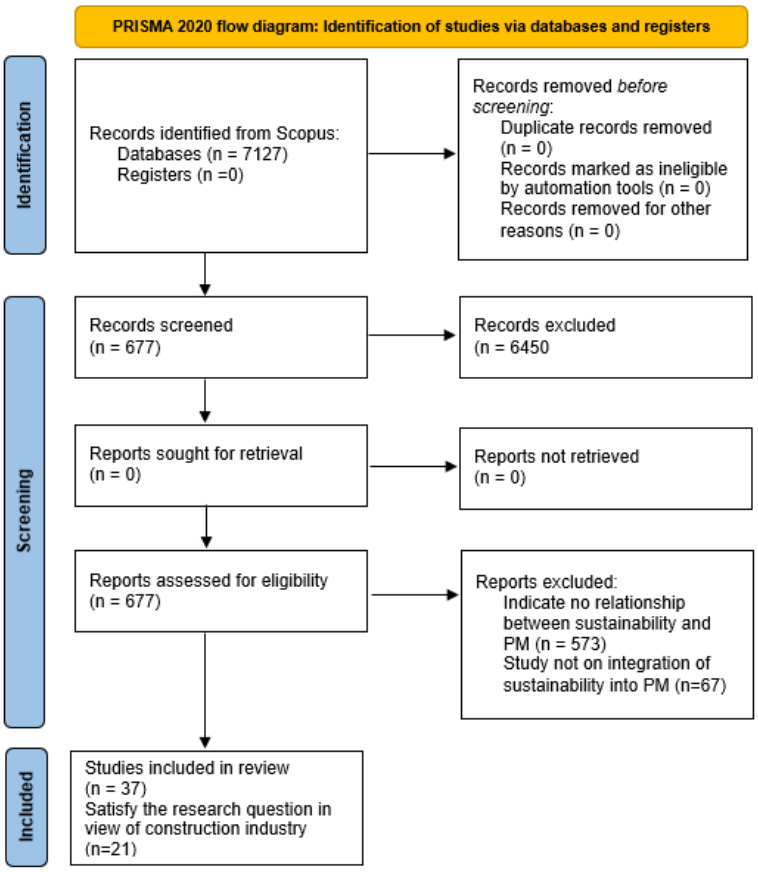

Figure 2. PRISMA 2020 flow diagram of the SLR ([18]).

3.1. Identification stage – search keywords

PRISMA Statement 2020 categorizes the process of literature review into three main stages. The identification stage uses pre-determined protocol or search strings of single, multiple or combination (Boolean) of words. Research questions are used to guide the word selection and selection criteria thereafter. The search protocol selected is to describe the relationship between two or more variables of concern.

Initial identification yields 7,127 results from Scopus database, based on the selected search keywords. No duplicates, or records excluded in this stage, and the result is further assessed in the second and third stage of the PRISMA Statement 2020.

3.2. Screening and study included stages

Publications selected from year 1996 to 2023 (28 years) based on argument that one of the most recognized and complete project management standards has been established by PMI in 1996, i.e. the first edition of PMBOK. Only final and open access articles are selected to provide the peer-reviewed only publications which are open and free to all. After applying the search protocols, the studies have been filtered to 677 studies. Thereafter eligibility assessment has been done based on the following criteria:

a) study that shows relationship between sustainability and PM; and
b) must be on integration of sustainability into PM.

Based on the criteria, and the focus on construction industry only as per the pre-determined research questions, the SLR has filtered the studies into 21 articles only. The findings from this study are expected

to discover existing literature in relation to the research questions and provide future studies direction with regards to the integration of sustainability and PM in construction industry.

3.3. Study sample characteristics

It is interesting to see the growth of sustainability and project management from 1996 to 2023. The sample characteristics of the articles are based on wider reach of 677 studies which we have filtered using the search protocols. This is to see general trend of sustainability and PM, where the increase in the trend of publication on sustainability and PM from 1996 to present year is very obvious. It peaked at 124 publications in 2021 and keep a good momentum of 114 articles in 2022, although a little bit of decrease from the previous year. In 2013, the trend picks up again after peaking in 2008, with 14 publications with average of 57 published articles every year from 2013 – 2022. The compound annual growth rate of the publications is at staggering 23% for that 10-year period. This confirms that the sustainability and project management issues are of concern in the academic field, as it is also picking up in the practitioner's field.

The studies' countries of origin also dispersed across the world with China being top country studied, and western countries from Europe and United States dominates the top ten list. Australia and South Korea tops the list for Asia-Pacific countries, ranked at 3rd and 10th respectively. Figure 3 shows yearly trend of studies publications and classification by country of the 677 studies.

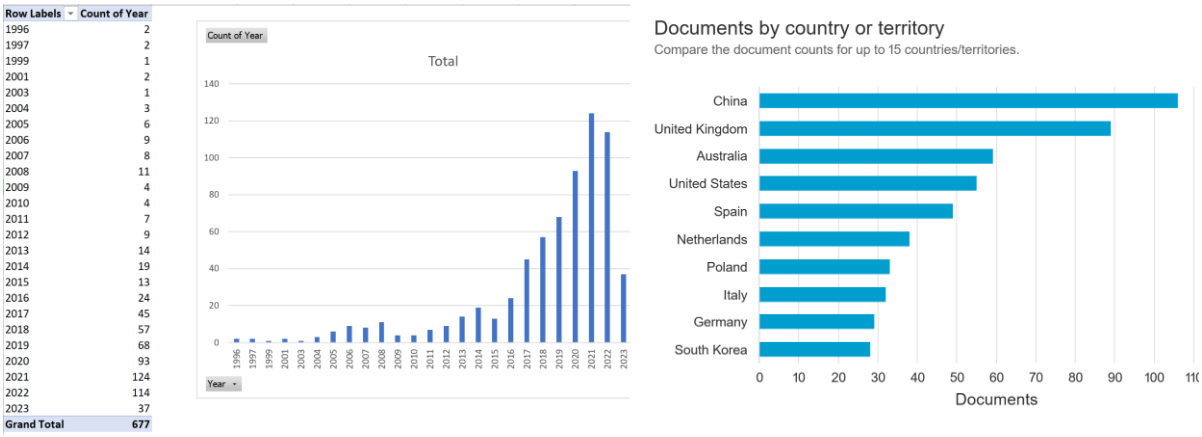

Figure 3. Yearly publication trends and documents by country.

4. Results and discussions

As this SLR aims to provide answer to the research questions on how sustainability and PM integrates in a construction project and to highlight future research on SPM adoptions in construction, the sustainability interpretation and relationship with PM as discussed in earlier chapters is used to provide insights based on findings of the 21 included literatures. The sustainability interpretations used are either sustainability values as in constraint, instrumental or intrinsic value [15], and also based on relationship of sustainability and PM, either sustainability by the projects or sustainability of the projects (SbP or SoP) [16]. Additionally, the studies' sub-industries, specific project phases and PM process groups are also highlighted, synthesized based on the 21 included literatures. The summarized result is tabulated in table 2.

Table 2. Summary of SLR findings on sustainability integration with PM in construction projects.

No	Authors	Country	Sub-industry	Focus	Values	SbP or SoP	Specific project phase	Specific PM process groups
1	Afzal F. et. al., 2023 [19]	Australia	Residential and Commercial	Organization Factor	Instrumental	SoP	n/a	n/a
2	Khan K. et. al., 2022 [20]	Gulf region	Infrastructure	Sustainability indicators	Instrumental	SbP	n/a	n/a
3	Maqbool R. et. al., 2022 [21]	UK	n/a	Factor impacting sustainability	Instrumental	SbP	n/a	n/a
4	El Touny A.S. et. al., 2021 [22]	Egypt	n/a	Critical Success Factors for Project Success	Instrumental	SbP	n/a	n/a
5	Fesenko T., 2022 [23]	Ukraine	n/a	Quantitative assessment of sustainable construction PM in the initiation and planning processes	Instrumental	SbP	n/a	Initiation and planning
6	Cvijović J. et. al., 2021 [24]	Serbia	Industrial - Small Hydro	Importance of stakeholder management in SPM	Instrumental	SbP	Construction	Executing
7	Willar D. et. al., 2021 [25]	Indonesia	Building and infrastructure	Sustainable implementation	Constraint	SbP	Construction	Planning and executing
8	Tan J.-S et. al., 2020 [26]	China	Infrastructure - Bridges	Poor project and sustainable management lead to project failure	Instrumental	SbP	Operation and maintenance	n/a
9	Hazem R.T. et. al., 2019 [27]	Iraq	n/a	Convert traditional construction process into sustainable process	Instrumental	SoP	n/a	n/a
10	Gijzel D. et. al., 2020 [28]	Netherland	Infrastructure - Tunnel	Sustainability for tunnel projects	Instrumental	SoP	Planning and design	n/a
11	Dong N. et. al., 2019 [29]	China	Infrastructure - Railway	Sustainable Evaluation Model	Instrumental	SbP	n/a	n/a
12	Gunduz M. et. al., 2020 [30]	Qatar	n/a	Critical Success Factors for Project Success	Instrumental	SbP	n/a	n/a
13	Xue B. et. al., 2018 [31]	Multiple countries	Infrastructure	Framework for sustainable project management	Instrumental	SbP	n/a	n/a
14	Bhandari R. et. al., 2018 [32]	Nepal	Industrial - Mini Hydro	Sustainability Assessment Model	Instrumental	SbP	Planning and design	n/a

Table 2. Summary of SLR findings on sustainability integration with PM in construction projects.

No	Authors	Country	Sub-industry	Focus	Values	SbP or SoP	Specific project phase	Specific PM process groups
15	Yu W.D. et. al., 2018 [33]	Taiwan	Building and infrastructure	Construction Project Sustainability Assessing System during project execution	Instrumental	SbP	n/a	n/a
16	Yu M. et. al., 2018 [34]	China	Energy, civil, transportation	Sustainable project planning	Intrinsic	SoP	Planning and design	Planning
17	Ihuah P.W. et. al., 2014 [35]	Nigeria	Residential	Critical PM Success Factors	Instrumental	SbP	n/a	n/a
18	Yun S. et. al., 2017 [36]	China	Industrial facilities	Framework for sustainability benchmarking	Instrumental	SbP	n/a	n/a
19	Zhou J. et. al., 2015 [37]	China	Infrastructure-sewage treatment	Sustainable construction & operation model	Instrumental	SbP	Construction and operation	n/a
20	Othman I. et. al., 2014 [38]	Malaysia	Infrastructure - bridge & earthworks	Factors causing successful completion and sustainable construction	Instrumental	SbP	Planning, design and construction	n/a
21	Aboushady A.M. et. al., 2013 [39]	Egypt	Infrastructure - water pipelines	Sustainability indicators	Instrumental	SbP	Planning and design	n/a

4.1. Sustainability values

With regards to the interpretation of sustainability role in PM in terms of sustainability value, we find that 90% of the included literatures adopt sustainability as instrumental value in PM. There is only one study regards as intrinsic value and another one regards sustainability as constraint. Sustainability as instrumental value is the dominant research in SPM for construction sector, possibly due to majority view that the sustainability strategies contribute to improvement of the project outcomes and goals, and not part of the objectives as yet.

Another interpretation that could also be perceived from these findings, is in order to promote sustainability adoption in the construction industry at a faster pace, it is much easier to address sustainability as the supporting role to improve the outcome of the project. Perhaps the adoption is to be more 'lenient' and not too abrupt for the industry to adapt, and move away from the idea that sustainability is a constraint, hindering project outcomes and increasing the project's capital cost.

From the included articles' finding, it is clear that sustainability role as in intrinsic value in construction industry is understudied. As suggested by Friedrich [15], the role of sustainability as intrinsic value that underlines SPM as paradigm shift, is where all sustainability dimensions are regarded as equal parts of project success. This line of thinking is creating a business case for sustainability as now that it has become part and parcel of the project's objectives. The paradigm shift as mentioned in his study, perhaps is still relatively new concept, compared to instrumental value in PM, hence the low numbers of intrinsic value studies.

4.2. Sustainability by the projects (SbP) and sustainability of the projects (SoP)

From the included literature findings, 76% of the studies is covering the SbP relationship between sustainability and PM, whereas only 24% is covering the SoP relationship. To recap, SbP reflects the sustainability of the deliverables or content of the project, whereas SoP deals with the project's processes. It can be concluded that even though both aspects are related to sustainability and PM, study with regards to sustainability relationship and project's processes is still lacking. It can also be perceived that since PM is the processes' aspects of a project, study between sustainability and PM for construction should be further encouraged to cover related PM processes and knowledge areas, in terms of sustainability integration.

4.3. Other observations and interpretations

More than half of the included literatures is exploring sustainability integration in infrastructure sub-sector of construction industry. It is worth noting that there are rooms for further studies on industrial facilities sub-sector, including power plants construction. The industrial facilities construction is often a complex sector which involves dangerous, hazardous facilities [36]. Furthermore, the impact of sustainability issues such as environmental or safety accidents are far more severe for industrial project construction.

One of the famous examples is 2010 Deepwater Horizon oil spill incident in the Gulf of Mexico, where it costed British Petroleum about USD65 billion in various costs and penalties as the result of the incident [40]. This incident shows that industrial construction projects need to be managed sustainably to minimize negative environment, social and economic impacts throughout the project delivery process [36]. As shown in the findings, industrial construction only accounts about 17% of the included literature, as compared to 61% and 22% of infrastructure and building projects, respectively.

In terms of construction project phase, the most phase studied in specific (not general all phases study) are planning and design phases, whereas construction phase trailing behind at 24% and followed by operation and maintenance phases at 12% and 6% respectively. As for the specific PM process groups, the planning process is the most studied in specific at 50% of the included literature, whilst executing and initiating trailing behind at 33% and 17% respectively. In summary it could be observed that with regards to project phases and PM process groups, sustainability is much more concerned to be studied at the earlier part of construction project i.e. in the planning aspects.

4.4. Theoretical framework

Based on the SLR and gaps identified, a theoretical framework that outlines key elements and considerations to ensure sustainability strategies are incorporated throughout the project lifecycle for certain construction sub-sector is shown in figure 4.

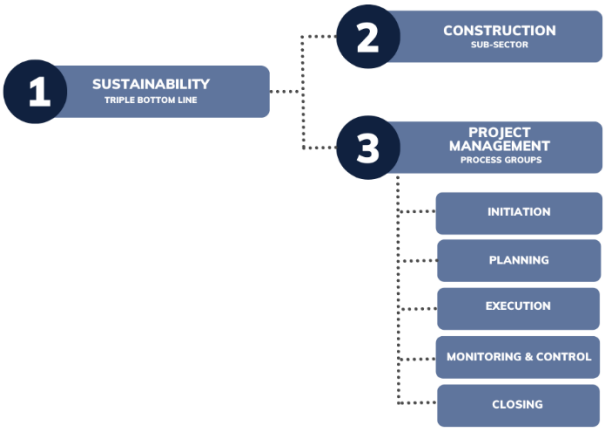

Figure 4. Theoretical framework for sustainability integration with PM in construction industry.

Sustainability of the project or SoP, mainly investigates the sustainability aspects of project processes and management. From literature this scope is part and parcel of sustainability integration with PM. This theoretical framework highlights the integration of sustainability considerations throughout the project management processes, aiming to deliver construction project that achieve its objectives as well as contribute positively to environmental protection, social well-being, and economic prosperity.

5. Conclusions

Harnessing sustainability strategies in the PM for construction projects is a necessary venture by practitioners and growing area of research in the academic field. The value stage model shows stages of evolvement of the way value is ascribed to sustainability aspects of PM. The intrinsic value to sustainability aspects has been recommended to create a business case for sustainability, where sustainability is part of the project's objectives which will push sustainability integration in PM practices. Sustainability also could be integrated in the PM of construction projects by virtue of sustainability considerations to the project processes and management.

From the SLR, almost all of the mentioned aspects have been given due consideration from researchers for construction PM. Nonetheless few areas for future studies are suggested to be implemented surrounding adoption of intrinsic value to sustainability aspects in PM (sustainability as the goal), sustainability relationship with project's processes and management (SoP) and SPM adoption in industrial facilities sub-sector projects, including power plants construction.

Despite this SLR contributions, this study has limitations as to the amount of literatures identified and screened, and interpretations of the literatures.

Acknowledgments

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The Current Trend of Big Data: An Overview of Strategies to Leverage The Implementation of Big Data in The Construction Industry

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Abstract. Utilizing big data is currently a widespread trend across different sectors, altering how businesses handle and evaluate enormous amounts of data to make wise decisions. With the implementation of big data solutions, the construction industry, which historically has been conservative and slow to absorb technology innovations is also going through a paradigm shift. This scoping review of the research goal is to investigate, map and identify the approaches being taken to fully exploit the endless possibilities of big data in the construction sector. This study aims to gain an understanding of the most current developments, difficulties, and potential customers through a thorough review of the literature.

1. Introduction

Urbanisation, infrastructure expansion, and global economic growth are all significantly influenced by the construction industry. However, it has consistently suffered from inefficiency, excessive expenses, and project delays. By combining big data technology with automated prediction and process optimization, it is feasible to address these issues by providing data-driven insights for the construction industry business [1]. As per the research conducted by [14], big data is the term for enormous, complex datasets that are more difficult for conventional data processing tools and methodologies to successfully collect, store, manage, and analyse. It is distinguished by its quantity, velocity, variety, and truthfulness. The volume describes the vast amount of data, often measured in terabytes, petabytes, or even exabytes—produced by many sources, including social media, sensors, machines, and transactions. When data is generated and collected quickly, frequently in real-time, or very close to real-time, it necessitates quick processing and analysis. Variety refers to the different forms and formats of data, including text, photos, audio, video, and log files, which might be structured, semi-structured, or unstructured [12].

Big data encompasses not only the volume of data but also the potential knowledge that may be gained from it. But, without effective data management and analysis procedures, the enormous amount of created data makes it difficult to extract useful information. Massive collections of both organized and unorganized information are referred to as big data when they cannot be managed or evaluated using conventional database administration systems. Big data in the context of construction may include knowledge collected from multiple sources, including sensors, social media, weather data, Internet of Things (IoT) devices, building information modelling (BIM), and more [17]. Therefore, construction

stakeholders are better equipped with big data technology to make wise decisions, improve project management, increase safety, and allocate resources efficiently credits to the collection and evaluation of important information from these data sets [14].

Big data deployment in the construction industry has important ramifications for construction industry stakeholders. Through data-driven decision-making, construction organisations can improve project effectiveness, reduce expenditures, and eliminate hazards [16]. For example, advanced analytics can be employed by engineers and architects to create creative, sustainable building solutions. The benefit of actively gathering data is that it can assist in improving development strategies continuously for more sustainability or to more quickly manage carbon footprints based on lessons from prior initiatives. Throughout the entire life cycle of a building, it can also be used to reduce construction waste. Not only that, but buildings will also be able to operate as resource-efficiently as possible and considerably reduce their carbon footprints by using data from already existing smart cities and buildings to gain a greater understanding of human behaviour, requirements, and trends.

Moreover, big data insights could help government organisations and urban planners build smarter in less susceptible cities [9]. Numerous opportunities exist for policymakers to track the construction industry's progress towards sustainable construction thanks to big data, which has five key characteristics: a large amount of data, few properties, high data generation speed, a great variety of data formats and sources, and high economic benefits. Thus, the findings can be used by construction industry stakeholders and policymakers to understand the current level of big data incorporation in the construction industry, pinpoint best practices, and create regulations that support technological development in the field. The methodology used and the summary of the literature will be covered in more detail in the following sections of this review of the scoping literature, which will also explain the methods and techniques employed to fully utilize big data in the building and construction industry.

6. Scoping Review Methods

This paper adopted the scoping review methods and aims to gain an understanding of the most current developments, difficulties, and potential businesses through a thorough review of the literature.

6.1. The Rationale for Choosing the Scoping Review Approach

The broad scope of the research objective led to the selection of the scoping review approach. A scoping review enables an organised exploration and modelling of the present big data adoption trend in the construction industry as well as the methods employed in capitalising on its application. Scoping reviews are better suited for handling complicated and diverse topics that need a thorough overview of the body of literature than systematic reviews, which concentrate on specific research concerns and seek for synthesis of quantitative findings [11]. This scoping review will provide a comprehensive overview of the subject and assist highlight gaps in the available literature by incorporating a wide range of methodologies and sources, including academic papers, indicators, and industry publications. These insights will be helpful for subsequent studies and practices.

6.2. Research Objective and Guiding Research Question

This scoping review of the research aims to examine and analyse the present adoption trend of big data in the construction industry and to pinpoint the tactics being employed to capitalise on its utilisation. This review primarily seeks to address the following research question: what are the methods that are currently being used to benefit the construction industry from the use of big data? The inclusion and exclusion criteria shown in Table 1.

Table 1. Inclusion and Exclusion Criteria for scoping review

Inclusion Criteria	***Exclusion Criteria***
Studies published from 2010 onwards.	Studies published before 2010.
Studies related to big data in construction.	Studies not related to the construction industry.
Original research studies.	Review articles, opinion pieces, and editorials.
Studies written in English.	Studies in languages other than English.
Studies reporting strategies to leverage big data in construction.	Studies without clear relevance to the research question.
Studies conducted in various geographical regions.	Studies limited to specific geographic regions or countries.

6.3. *Search Strategy.* The search method was created to provide a thorough identification of pertinent material regarding the use of big data in the building and construction industry. The accompanying databases were looked up:

Table 2. Scoping Review Search Strategy Databases

Database	***Search Terms (Keywords)***
PubMed	("big data" OR "large-scale data" OR "data analytics") AND ("construction").
Scopus	TITLE-ABS-KEY ("big data" OR "large-scale data" OR "data analytics") AND TITLE-ABS-KEY("construction").
Web of Science	TOPIC: ("big data" OR "large-scale data" OR "data analytics") AND TOPIC: ("construction").
Engineering Village	("big data" OR "large-scale data" OR "data analytics") AND ("construction").

According to the goal of the research, the search phrases were chosen, and modifications are needed to identify the collection procedures. In order to assure targeted results, relevant terms have been merged using Boolean operators (AND, OR).

6.4. *Process for Study Selection and Data Extraction.*
Data extraction methods and the process for choosing studies were both methodical and open. The full-text papers of possibly pertinent research were retrieved after the initial filtering and checked for eligibility. After analysing the articles, both the admission and exclusion requirements were used. A

uniform extraction of information form was created to extract the necessary data from the listed research. The essential components of the data harvesting form were as follows:

- Author(s) and year of publication
- Methodology and study design
- Sample dimensions and properties
- Big data techniques are used
- Key conclusions and results
- Effects on the construction sector

This scoping review seeks to reduce bias and assure the reliability and correctness of the results by using these stringent research selection and data extraction techniques. For professionals, researchers, and policymakers in the sector, the systematic method enables a thorough synthesis of the tactics employed to use big data in the building profession and offers insightful information [4].

7. Results

Scopus, the Science Direct website, the Web of Biology, and JSTOR databases were used to conduct the literature search. Relevant keywords were used in the search approach, including "big data," "data analytics," "construction," "building," and "infrastructure." A total of 85 apparently pertinent studies were found after the initial search. After duplicate records were eliminated, 75 distinct articles for the title and abstract scanning remained. Studies that did not fit the inclusion criteria were eliminated throughout the title and abstract assessment phase. Nineteen articles were left for full-text evaluation after 56 of the 75 items were eliminated. After that, both the inclusion and criteria for exclusion were applied to the whole works of these 19 publications. Finally, 10 articles were chosen for this scoping review after careful consideration. Table 3 presents a summary of the study selection procedure and the number of documents at each stage.

Table 3: Study Selection Process

Stage	***Number of articles***
Initial search results	85
Title and abstract	75
Full-text assessment	19
Included in review	10

7.1. Characteristics of the Included Studies

The 10 research articles included covered a range of big data application issues in the construction industry and were released between 2016 and 2022. Three of the documents that were chosen were reviews that offered in-depth analyses of the prospects, trends, and current state of big data in development. The following seven publications included studies of cases, application frameworks, surveys, and empirical investigations. According to the study approach which ranged from case-specific initiatives to industry-wide surveys, the sample numerals changed.

7.2. Organising Findings Based on Key Findings

The findings have been organized based on its key findings:

7.2.1. Big Data Applications in Construction. Big data applications in the field of the construction industry have been the subject of several research [5][10][13][18]. Technologies included big data

analytics for contract management, failure-predicting methods for construction companies, and decision-making based on data.

7.2.2. Integration of Big Data and Building Information Modeling (BIM). The study conducted by [2] studies from 2018 covered the incorporation of big data research with BIM systems to promote better project collaboration, interpersonal interaction, and information management.

7.2.3. Use of Machine Learning and Artificial Intelligence. [7] and [18] investigated how to use machine learning techniques in big data analytics for managing contracts and cost analysis of power transportation and transformation endeavours.

7.2.4. Smart Building Management Process. [8] focused on leveraging big data technologies to improve the comprehension of data-driven malfunction detection and diagnosis approaches in smart building administration.

7.2.5. Construction Safety Management. [12] investigated the status, trends, and difficulties of using big data technologies in the management of safety in construction and looked at the field's current state.

7.2.6. Technology Capability and Construction Project Quality. [15] looked at how big data, technology, and architecture project quality relate to one another.

The essential characteristics of the studies that were examined, including the primary emphasis, research methodology, number of participants, and key findings are summarized in Table 4.

Table 4: Key Features of Collected Studies Summarized

Study	Focus	Design	Sample	Key Findings
[5]	"Trends and opportunities of big data".	Review paper.	Not applicable.	Discusses the present situation and potential applications of big data in the construction industry.
[13]	"Spoken dialogue BIM systems".	Case study.	Not applicable.	Showed how to use BIM systems with spoken dialogue and large data to improve collaboration in building endeavours.
[2]	"Big data analytics for construction firms".	Empirical study.	Dataset of 200 construction firms.	Employing big data analytics, a failure prediction model for construction firm was developed.
[10]	"Potential application of big data".	Review paper.	Not applicable.	Examined possible uses for big data in the construction industry.
[18]	"Machine learning in contract management".	Empirical study.	Not applicable.	Examined how machine learning techniques could be used in big data analytics towards negotiating contracts in the construction industry.

[3]	"Industry revolution IR 4.0".	Empirical study.	Not applicable.	Investigated potential prospects and difficulties for the construction industry in the age of Industrial Revolution 4.0.
[8]	"Fault detection and diagnosis in smart building management".	Empirical study	Lists of expert rules, knowledge of maintainability, and international/local standards were concluded for various M&E services, including heating, ventilation air-conditioning (HVAC), plumbing, fire safety, electrical and elevator systems based on surveys of 110 buildings in Singapore.	Big data technology has improved the interpretability of approaches for data-driven defect detection and diagnosis in smart building administration.
[7]	"Power transmission and transformation project cost information platform".	Empirical study.	Not applicable.	Built a platform for tracking the costs of transmission of energy and transformation projects using big data analysis.
[12]	"Big data technology in construction safety management".	Empirical study.	Related 66 articles.	Analysis of big data technology's position, advancements, and difficulties in managing construction safety.
[15]	"Big data, technology capability, and construction project quality".	Empirical study.	Chinese construction enterprises.	Examined the link involving big data, technological advancement, and building project quality.

Table 4 gives a thorough summary of the studies that were a part of this scoping examination, highlighting their various focuses, methods, and conclusions regarding the use of big data in the building and construction industry. The discussion section is going to analyse the findings considering the research purpose, highlight major themes, compare the findings to prior research, and evaluate the consequences for policies, practices, and forthcoming studies in the field of construction in the parts that precede.

8. Discussion

8.1. Article 1:

The study by [5] analysed how big data technology has been adopted in the construction sector. Despite the industry producing enormous amounts of data, its use of big data remains behind other industries. The investigation emphasised how technology has become commoditised, generating interest in using it for improving construction procedures. While certain constructions subdomains have implemented data-driven analytics, the adoption of more flexible and potent big data technologies has lagged. The study pinpointed several applications for big data approaches that may benefit the building sector. The study highlights the need of harnessing the potential of big data to create cutting-edge business applications for architecture professionals and researchers. Further discussion of Article 1 is shown in Table 5.

Table 5. Article 1 Discussion

Key Themes	Gaps/Limitations	Implications
1. Slow uptake of big data in the construction industry. 2. Big data technology's commoditisation. 3. Big data technology adoption is slow. 4. Potential uses for big data in the construction industry.	1. The scope and reliability of the conclusions may be impacted by the article's failure to disclose the number or categories of studies it reviewed. 2. Although the article concentrates on the use of big data in the home building sector, it skips over any potential issues with implementation.	The results highlight big data's latent potentiality in the building sector. To improve construction processes, lawmakers and professionals should be urged to investigate and embrace big data technological devices. The incorporation of big data within construction procedures can be sped up by addressing the stated constraints and difficulties. In order to further advance the construction industry, future research can be deeper into tackling challenges and investigating ways to combine big data with other rising technologies such as BIM, IOT, cloud-based computing, intelligent construction, and virtual and augmented reality.

8.2. Article 2:

The study by [13] explains a system that serves as a conversational expert agent for issues with building maintenance. It helps users find solutions by locating pertinent information from previously saved cases. The system provides comprehensive data retrieval for new issues in an effort to increase the effectiveness of tracking and upholding the performance of buildings. The results show that the system's development makes it easier to identify and capture solutions, which improves building maintenance procedures. Further discussion of Article 2 is shown in Table 6.

Table 6. Article 2 Discussion

Key Themes	Gaps/Limitations	Implications
1. To identify the problems with building maintenance, requiring an interactive expert. **2.** Recovery alternatives from captured understanding improved monitoring and maintenance efficiency of building performance. **3.** Retrieved information for new challenges and in-depth analysis.	1. The lack of information in the text regarding the system's deployment, sources of information, or validation outcomes may make it difficult to gauge how effective it is. 2. The system's reliability, scalability, or user-friendliness are not indicated, which are essential elements for real-world deployment.	The innovation that is being discussed shows potential in terms of enhancing building maintenance processes by providing a thorough and effective method of problem-solving. To improve building performance administration, policymakers and practitioners ought to think about introducing such knowledgeable agents. Future studies should concentrate on confirming the system's efficacy, resolving any shortcomings, and looking into how to properly integrate it with current building maintenance procedures. Moreover, studies contrasting this method with other maintenance strategies would also offer insightful information for potential developments in the sector.

8.3. Article 3:

The study by [2] aims to conduct an architectural framework of construction-related businesses and offer a conceptual architecture for creating a "Big Data Analytics (BDA)" and "Construction Business Financial Performance Model (CB-FPM)". Due to inadequate support for iteration, MapReduce was found to be unsuitable for creating BDA CB-FPM. Alternative BDA initiatives were emphasized, including Hadoop, the city of Dayton Twister, and Spark. In order to create a BDA CB-FPM using accounting information from 30,000 development enterprises, the study employed Spark, which showed adaptability. A standard CB-FPM created with a lesser dataset fared worse than the BDA CB-FPM. The study concludes that BDA can enhance CB-FPM productivity by overcoming the disadvantages of classical analytics in managing enormous databases. Further discussion of Article 3 is shown in Table 7.

Table 7. Article 3 Discussion

Key Themes	Gaps/Limitations	Implications
1. BDA CB-FPM development framework. 2. BDA initiatives towards CB-FPM comparison. 3. BDA CB-FPM performance enhancement.	1. The recommended BDA CB-FPM framework accuracy, limits, and generalisability are not discussed at length in the text.	The study's conclusions show how BDA has the ability to enhance the efficiency and efficacy of CB-FPM innovation using sizable financial data sets from the

4. The appropriateness of the suggested framework.	2. There is no mention of the difficulties or moral issues that may arise while managing huge financial datasets.	construction industry. BDA methodologies may be adopted by policymakers as well as practitioners in the building industry in order to improve the accuracy of financial performance modelling. Future studies should focus on the shortcomings and investigate additional BDA programs and algorithms for machine learning to make improvements. When managing significant amounts of financial data during the development of the BDA CB-FPM, ethical issues, and data safeguarding must also be carefully considered.

8.4. Article 4:

The study conducted by [10] is an exploratory study approach, which sought to determine whether big data existed in the construction industry as described in the text. Using predetermined search criteria and pertinent keywords drawn from the study's goals and objectives, the researcher executed a literature search. The snowballing method was used to find pertinent material by taking both backward and forward steps. The UTM Library Virtual Database made academic journals from multiple sources available, and papers pertinent to big data in the construction industry were chosen using specified keywords. Further discussion of Article 4 is shown in Table 8.

Table 8. Article 4 Discussion

Key Themes	Gaps/Limitations	Implications
1. Investigation of big data in infrastructure. 2. Snowballing and literature searching. 3. Database and keyword selection. 4. Content filtering for big data in development.	1. The text does not mention how many publications were found and incorporated into the study, which could have an impact on how thorough the evaluation is. 2. It is difficult to judge the importance of the research purpose because neither the specific findings nor the major themes that arose from the research that was incorporated are mentioned.	The methodology outlined makes the possibility to investigate big data's prevalence and significance in the construction industry. The study methodology can be used as a manual for practitioners, researchers, and policymakers to carry out reviews of a similar nature. To guide policies, procedures, and future research paths in using big data for breakthroughs in the construction industry, future research should concentrate on providing particular results and major themes that arose from the included studies.

8.5. Article 5:

The study by [18] is about the book examines how big data is becoming increasingly important across a range of industries, including the construction industry. The main focus of the paper is on utilising machine learning techniques to estimate the likelihood of a contract being successfully executed at its inception. The study examines the variables affecting contract default and suggests customer-friendly correction measures. To create predictive models based on the techniques of logistic regression, decision trees, and random forest frameworks, the inquiry makes use of linear and non-linear methods, feature extraction, conversion, and selection. When engaging in new contracts, construction companies can reduce client risks by using verified models. Further discussion of Article 5 is shown in Table 9.

Table 9. Article 5 Discussion

Key Themes	Gaps/Limitations	Implications
1. The value of big data in various sectors. 2. Using algorithms for learning in construction agreements. 3. Elements that affect contract default. 4. Construction of prediction models for contract performance.	1. The specific criteria that were examined, as well as the volume and the representativeness of the previous information utilized for model validation, are not discussed in detail in the text. 2. Neither the accuracy of the models nor the magnitude of advancements over conventional contract execution prediction techniques are mentioned.	The study emphasizes how machine learning could enhance contract execution forecasting in the construction industry. To reduce risks and improve decision-making in contract setup, practitioners as well as policymakers should think about implementing such models. Future studies should look at extra variables affecting contract execution frequency and provide greater detail concerning the model's performance in order to solve the constraints. The research has significance for real-world applications in the construction industry, encouraging better contractual oversight and risk management procedures.

8.6. Article 6:

In order to obtain the greatest life cycle value, the study conducted by [3] the future growth of the construction industry with an emphasis on component industrialisation, construction failure, design equivalence, construction assembly, and operation data techniques. The “Industrial Revolution (IR) 4.0” idea and its prospective effects on the growth of the “Construction Industry (CI)” are introduced in this article. In order to integrate IR 4.0 ideas into the CI, it underlines the necessity for numerous disciplines to develop rules, procedures, methodologies, and know-how. According to the report, despite stakeholders' awareness of the impact of digitalisation, genuine applications are still in their infancy. It urges fusing ideas from IR 4.0 with the construction industry, using cutting-edge knowledge for intellectual engineering, and attaining long-term prosperity. Further discussion of Article 6 is shown in Table 10.

Table 10. Article 6 Discussion

Key Themes	Gaps/Limitations	Implications
1. The construction industry's future. 2. The start of the Industrial Revolution 4.0 to CI. 3. The requirement for specialized knowledge and multidisciplinary approaches. 4. Problems with the real-world use of the digitization of information in construction.	1. The claims stated concerning the CI's present situation and advancement toward IR 4.0 are not supported by concrete examples or data from recent literature. 2. The obstacles and potential problems to integrating IR 4.0 technologies in the building industry are not well understood.	The study's findings emphasize the necessity for more research into how to apply IR 4.0 concepts to the construction industry. To enhance digitisation and sustainable growth in construction industries, lawmakers, practitioners, and researchers must work together to design specialised norms and procedures. Big data is capable of having an influence on a city's transport, public safety, budgets, and other aspects. Cities can employ prediction analytics of big data to figure out the exact place of crimes and determine what regions are likely to be crime hotspots. In order to support the potential advantages of incorporating IR 4.0 principles in the CI, subsequent research ought to focus on the gaps and difficulties in actual application by offering specific examples and case studies. The ramifications point to the significance of using multidisciplinary strategies and investigating new areas of knowledge to maximize IR 4.0 advantages in the construction industry.

8.7. Article 7:

The study conducted by [8] focuses on data-driven failure detection and diagnosis (FDD) techniques in relation to the development of smart cities and buildings. Although data-driven FDD techniques have outperformed conventional approaches in terms of efficiency and accuracy, there are still questions about how well they can be interpreted, which is preventing their widespread use in practical industrial applications. The article examines current data-driven FDD methods for mechanical and electrical engineering (M&E) defects in buildings and suggests two ways that use expert reasoning. The findings from the survey of 110 Singaporean buildings help to improve interpretability and might even increase the accuracy of FDD performance, encouraging the use of data-driven FDD techniques in managerial practices. Further discussion of Article 7 is shown in Table 11.

Table 11. Article 7 Discussion

Key Themes	Gaps/Limitations	Implications
1. Data-driven FDD techniques for smart city and smart building design. 2. Concerns with data-driven FDD methods interpretability. 3. Integrating expert reasoning to improve interpretability. 4. Using surveys to improve data-driven FDD for monitoring and evaluation services.	1. The article does not go into detail about the various data-driven FDD approaches examined or compare the levels of each approach's interpretability. 2. No difficulties or restrictions encountered throughout the survey of Singaporean buildings are mentioned.	The study emphasizes how important interpretability is for data-driven FDD methods used in practical industrial settings. To improve FDD performance and interpretability, practitioners and policymakers should think about incorporating expert reasoning. Future studies should fill in the gaps, in particular, based on data FDD approaches, and investigate other strategies to improve interpretability. The results highlight the significance of enhancing data-driven FDD approaches usability and applicability in smart construction facility management, ultimately assisting in accurate and efficient fault identification and diagnosis in the building sector.

8.8. Article 8:

The development of China's power transmission and transformation projects (PTATP), which are aiming for integration, informatisation, scalability, and systematisation, is discussed in the study conducted by [7]. In order to meet societal needs, it underlines the necessity of project costs determined by Big Data (BD) technology. Various databases are used using an information platform to facilitate project cost analysis. The research suggests collecting, classifying, and analysing PTATP cost data utilizing BD technologies to increase the value of the data. It emphasizes how crucial project cost informatisation is to solve the problem of information exchange and obtain more precise cost estimates. A more scientifically informed approach to cost management will be made possible by the research's goal to build a PTATP expense data portal based on BD analysis. Further discussion of Article 8 is shown in Table 12.

Table 12. Article 8 Discussion

Key Themes	Gaps/Limitations	Implications
1. PTATP development and cost informatisation need. 2. Making use of big data technology and information platforms. 3. Data value exploration for PTATP cost evaluation.	1. The paper fails to describe the algorithms examined or contrast them with current methods of PTATP cost estimation.	The study emphasizes the significance of incorporating Big Data technologies into PTATP projects for more precise and knowledgeable cost estimation. Such cost informatisation strategies

4. Project cost analysis algorithms are important.	2. The execution of the suggested PTATP expense data platform is not mentioned in terms of potential difficulties or constraints.	should be adopted by policymakers as well as practitioners to improve project management. Future research should fill in the gaps by comparing particular algorithms and analysing the practical difficulties in putting the suggested PTATP data collection platform into practice. Through data-driven cost evaluation and management, the implications point to the possibility of increased effectiveness and economics in electrical transmission and transformation projects.

8.9. Article 9:

In recognition of the high-risk character of the construction industry, the research conducted by [12] examines the use of big data technologies in construction safety management. The research highlights the present-day status of big data use in the construction industry by gathering information for analysis through a systematic examination of 66 pertinent articles. It lists innovative outcomes for enhancing construction safety using big data analysis in a categorised manner. The three areas of employee behaviour, incorporating big data technology, and fusing big data with building administration are all covered in the discussion of trends and problems. The study's objectives include directing future research and offering insightful recommendations for improving safety at construction sites. This work is supported by funding from a number of sources. Further discussion of Article 9 is shown in Table 13.

Table 13. Article 9 Discussion

Key Themes	Gaps/Limitations	Implications
1. Big data applications for construction safety management. 2. Groundbreaking findings in big data evaluation for reliability enhancement. 3. Big data and construction safety: trends and challenges. 4. Research supporting funding.	**1.** The article does not examine the limitations of current big data techniques for construction safety or give particular instances of ground-breaking findings. **2.** Because there is no comparable study to earlier reviews or studies, it is challenging to determine the uniqueness and importance of the study's findings.	The study underlines the value of big data technology for improving construction safety management. Big data applications should be adopted by policymakers and practitioners to reduce safety hazards and enhance job site safety. Future research should fill in the gaps by highlighting real-world instances of big data implementations that have been effective and by investigating potential difficulties in applying big data for security management in various construction

	environments. The results highlight the potential for big data technologies to fundamentally alter safety procedures in the construction industry, opening the way for safer practices and regulations.

8.10. Article 10:

The study conducted by [15] demonstrates how big data can boost technology capabilities and project quality performance. The study emphasizes how technological competence affects the adaptability of organizations to big data and forecasting, which in response influences the association between big data adaptation and project quality. Additionally, this mediation effect is positively moderated by the goal and task interdependence kinds of project team interdependence. Further discussion of Article 10 is shown in Table 14.

Table 14. Article 10 Discussion

Key Themes	Gaps/Limitations	Implications
1. The impact of big data on technology capability. 2. The effect of technology capability on project quality and performance. 3. Big data-project quality relationship: addressing the role of technology capability. 4. Project team interdependence has a moderating effect.	**1.** Specific information about the nature and extent of the research, as well as the kinds of projects and businesses examined, is missing from the text. **2.** No mention is made of potential confounding variables or additional explanations for the associations that have been discovered.	The research conclusions made it clear how crucial big data is to improve technical competency and project quality performance. The importance of big data and predictive analytics in fostering organisational adaptability and technological innovation should be acknowledged by policymakers and project managers. By taking into account more varied project contexts and looking into potential factors that could affect the observed connections, future studies should solve the limitations. The conclusions imply that promoting big data and predictive analytics flexibility can enhance the results of projects while recognizing that project team interdependence is crucial for maximising the influence of technological capabilities on project quality.

9. Conclusion

The scoping review findings demonstrated the importance of big data applications in the construction industry, as it demonstrated the potential advantages of defect detection, predictive modelling, and data-

driven analytics for managing projects, safety, and quality enhancement. To improve the interpretability and practical utilisation of big data technology, the research highlighted the necessity for transdisciplinary approaches and expert reasoning. Big data should be embraced by practitioners and policymakers to enhance decision-making and construction processes. Future research should examine particular techniques to incorporate big data into the construction industry, ways to overcome the challenges, and assess the useful benefits of incorporating big data in various construction settings. Last but not least, it is advised to conduct more research on the integration of big data with building administration and employee behaviour.

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A Thematic Review on the Attributes of Theme Park Attraction

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Abstract. Malaysia's witnessed a tremendous expansion on the development of theme park since 1970's. Despite the vast development of theme park in Malaysia, it is also experiencing the closure of its theme park, which has a detrimental effect on the tourism sector. There were several recent studies that have been carried out on Theme Park destination, however, the absence of a specific criteria of theme park characteristics has become a major research gap. This review is one of the initiatives necessary for a theme park to continue to exist despite an intense competitive environment and to remain viable. The aim of this study is to explore the potential strategies for improving Malaysia's theme parks' viability as tourism attractions. A thematic review has been used as a methodology to synthesize the literature from 2018 to 2022 on the theme park studies. The ATLAS.ti.9 was utilised to conduct the thematic analysis. This study identified 27 peer-reviewed articles from a keyword search in various online databased. The result of this study revealed 10 initial codes that classified the characteristics of theme parks into three groups: core, augmented, and tangible. Hence, this paper incorporates the most recent information regarding theme park destination characteristics. Despite the knowledge and industry relevancy, this study is expected to provide a benchmark of successful theme park in Malaysia. The result can serve as a reference for Theme Park developers, the Malaysian government, and tourism policymakers in the twenty-first century and is beneficial to future research on theme park destinations.

1. Introduction

Malaysia has seen a considerable increase in the number of tourists visiting the country. With the expansion of Malaysia's tourism industry comes the emergence of a new generation of tourism alternatives, which are being promoted as tourist destinations. Attractions such as theme parks are considered to be one of the most essential components in marketing a tourist destination that focuses not only on attractions, but also on economic growth and development of the local economy [1]. It attracts both local and international travelers, making it one of the commodities in the tourism industry that has a wide potential market. In 2019, The Themed Entertainment Association (TEA) reported the theme parks across the world expected total of 253.9 million people.

According to Pikkemaat & Schuckert [2] , defines a theme park as an amusement park in which the rides, attractions, shows and building revolve around a central theme or group of themes. It is also an amusement park in which all of the entertainments and facilities are designed around a specific subject

or idea [3], which explained the development of theme park must be based on specific subject. This demonstrated that the theme park has specific differentiation from other recreational area because it emphasized on the theme as the essential elements that will be used in the entire theme park elements, from the management to the attractions. As such, all the elements in theme park should be parallel with its theme which becomes the branding of the park.

The visitors are the primary stakeholder in theme park destinations. Unfortunately, the criteria that were expected by the visitors to Malaysia Theme Park, were never tested. It is crucial to discover the characteristics that visitors look for, when choosing a theme park destination, since this is believed to be a success element for the survival of theme park industry. Therefore, the aim of the research is to explore ways in which Malaysia's theme parks may become more successful as tourist attractions. In order for a theme park to continue existing despite the very competitive and tough conditions, finding the appropriate theme park attributes may be a part of the initiatives that can lead to better outcomes, and this can enable the theme park stay viable.

2. Literature Review

Initially, this research has outlined the dimensions of theme park criteria that will be measured based on the previous literature. With the growing concerns about the closed down of a few theme parks in recent years, efforts to determine the element that measures the potential and performance of theme parks must be taken into consideration.

2.1 The Theory of Tourism Attraction

According to Gunn [4] , tourist attractions have a magnetic 'pulling power' that draws people in. There are three components of a tourist attraction: the nucleus, the inviolate belt, and the zone of closure, which have all been identified (Figure 1).

The Nucleus of an attraction is its main attraction that attracts visitors. It may be the qualities or characteristics of a place that have influenced or encouraged people to visit [5][6]. It is expected that Nucleus will be the primary tourist attraction in the area. Meanwhile, the Inviolate Belt is the path that visitors take to reach the Nucleus [7]. Therefore, the inviolate belt would enhance the experience and happiness of tourists because it offers attractions not only at the specific destination, but also in the surrounding area [8]. The area directly surrounding the inviolate belt is known as the Zone of Closure, and here is where the services and facilities are supported the destinations quality [7]. It is indirectly reflected its management and the length of time visitors spend at the destinations [8]. Visitors will feel more at ease in a destination that provides them with the necessary amenities and services for their visit.

The theory developed by Gunn [4] illustrates that tourism attraction can be accomplished through the integration of all three elements. When a visitor experiences the entire tourism cycle from one place to another, a complete tourism system is created [5].

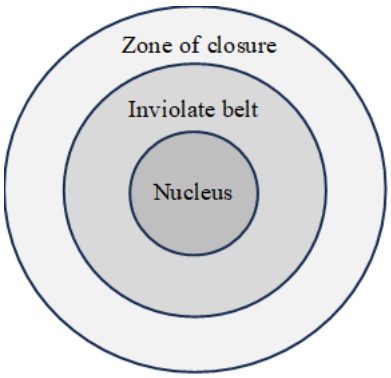

Figure 1. Model of Tourist Attraction [4].

2.2 Theme Park as a Tourism Attraction.

The relationship between tourism attraction and theme park destination has caught the interest of academics, and as a result, it has become an increasingly significant field of research in tourism studies. These aspects include the theory of tourism attraction that was covered previously as well as additional qualities of theme park attractions. According to Swarbrooke [9], there are three components that make up an attraction in a theme park: the core, the tangible, and the augmented.

It is generally accepted that the Core attraction serves as the primary focal point of the theme park experience, making it the nucleus of the attraction. According to the theory, the nucleus is one of the components that contribute to the attractiveness of tourist destinations [4],[10]. The studies came to the conclusion that the core is the actual thing that the client is purchasing [3],[9],[11]. When applied to a theme park, the excitement, atmosphere, experience, relaxation, or convenience that is evoked in its visitors is the nucleus or core of the product.

The tangible attraction for a theme park might be a unique kind of attraction that is artificially generated [9]. It consists of the components that designers and planners creatively translate to the park's content, such as rides, safety, and service quality [3]. In general, the tangible attraction is the thing that visitors may purchase to meet their needs.

The augmented attraction is regarded as the whole product package that should address all the consumers' issues [9]. In most cases, the augmented component will contribute to the convenience of visitors and increase their level of pleasure. It includes ancillary services such as food and merchandising, as well as services for guests who have specific requirements, processes for managing complaints, opening times, and the weather [3].

2.3 The Attributes of Theme Park

The book "Global Theme Park" was released by Clave in 2007, and it is the source of much of the relevant and valuable information for theme park attractions that is being referenced to by numerous academics. In his book, it examines the qualities of an attraction that may be found in theme parks. These characteristics can be found stated below in Table 1. Using the book as a reference, it identified a few features that have the potential to serve as essential components of theme park characteristics.

The first section of Clave's book outlines the fundamental criteria that can be generalised for theme park attractions. It is interesting to note that the first characteristic that been identified was related to the thematic identity of general theme parks, as well as the primary important feature in theme parks (The Main Theme). Clave [3] additionally produces characteristics that correspond particularly to the theme's attributes. This revealed that the subject of the theme is highly crucial for theme park attractions, and this synchronised with the definition provided by National Amusement Park Historical Association (NAPHA), which emphasised the importance of specific subjects for theme parks.

In this study, it is essential to incorporate the theme park characteristics outlined by Clave, [3]. As one of the most influential authors in the theme park industry, it is believed that Clave's contribution should be recognised as a fundamental for this study. It should be integrated with recent studies on theme parks to ensure that all relevant and significant variables in theme parks will be assessed.

Table 1. The Attribute of Theme Park Attractions [3]

Aspect	**Attribute**
General Characteristics	1. Thematic identity 2. Contain one or more themed areas. 3. Organized as closed spaces or with controlled access. 4. A great capacity to attract families. 5. Contain enough rides, shows and systems of movement to create a visit that lasts on average some 5 to 7 h. 6. Atmospheric forms of entertainment (musicians, characters or actors who perform in the street 'free of charge').

	7. Commercial vocation (fundamentally food and beverages and shops). 8. High levels of investment per unit of ride or show capacity. 9. High-quality products, service, maintenance and standards of cleanliness. 10. They manage their productive and consumer processes centrally. 11. Incorporate technology
Key element	1. The main theme 2. Staging concept 3. Attractions 4. Stage design 5. Management of visitor flow 6. Former experiences and expectations of visitors.
Theme characteristics	1. A mise-en-scene and must be well defined. 2. Adaptable to visit. 3. Provide identity. 4. Cohesion to the whole.
Flow and transport system	1. Mechanical transport systems 2. The management of pedestrian movement. 3. Queue management at attractions.

4. Methodology

This study conducted using the thematic review approach which carried out to identify the current trend of research perspective with regards to the tourism attraction in theme park destinations [12]. The primary sources of data were extracted from online databased mainly Web of Science (WOS), Scopus, and Science Direct. Thematic analysis is a process of identifying the pattern and construct themes over thorough reading on the subject [13]. The selection of literature was focusing on publication from 2018 to 2022 and topic related to theme park attraction.

Table 2. The Literature Discovery from Online Database.

Database	**Search string**	**No. of Publications found**
Scopus	(TITLE-ABS-KEY ("theme park*") AND TITLE-ABS-KEY (attraction*)) AND PUBYEAR > 2018 AND PUBYEAR < 2022 AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))	32
Science direct	"theme park" AND attraction	19
WOS	**(TS=(Theme park*)) AND ALL=("Theme park" attraction)** and **Article** (Document Types) and **Hospitality Leisure Sport Tourism** (Web of Science Categories)	20

The initial search from the online database was generated a totaled of 71 articles which discussed theme park attractions from 2018 to 2022. The literature extracted using the search string demonstrated in Table 2. In further process, all the article were added in the Mendeley and it was removed 13 overlapping articles from online databased sources. The final filtration excluded articles that were not eligible to the study and resulted only 27 articles valid for this study. The process of identifying articles demonstrates in Figure 2. Following process of selection, all the valid articles were uploaded into ATLAS.ti 9 to analysed the literature. The articles were categorized according to the year of publication and coding into discussion topics.

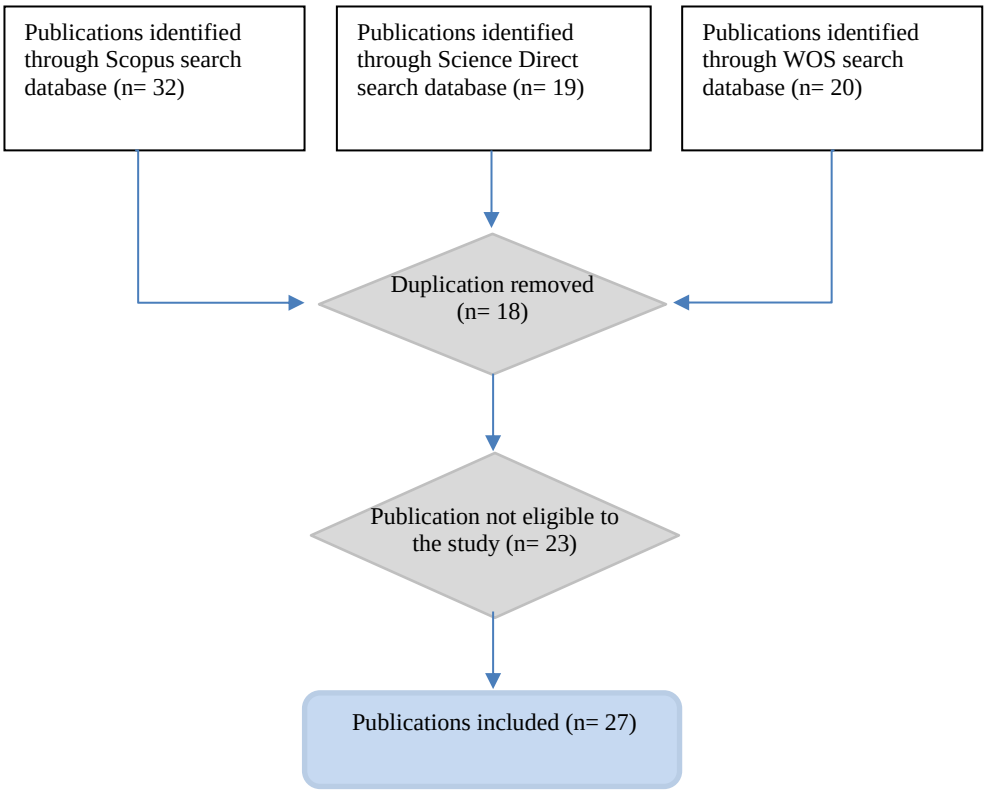

Figure 2. The Process of Identifying Articles

5. Result and Discussion

In general, the majority of the research done between the years 2018 and 2022 has concentrated on the characteristics of theme park [3],[9]. These studies analysed a total of 27 publications that were published in various databases throughout the past 5 years (from 2018 to 2022) and related to the topic. Figure 3 indicates the country of publications discussed about theme park attractions between the year of 2018 to 2022. Based on the data of 27 publications, United States dominated the study on theme park attractions which represent 10 publications, followed by China with 5 publications. Japan, Malaysia and Taiwan each with two publications, while United Arab Emirates, Thailand, Germany, South Korea, Spain and Indonesia represent one publication each.

Figure 3 shows that the majority of current research on theme parks has been carried out in the regions of North America and Asia, and very few in Europe. Based on Table 3, The North America and Asia region, demonstrates that this theme park study has examined all three elements, namely core, tangible, and augmented. However, studies in Asia region are more comprehensive which cover all the dimensions in theme park criteria. It is believed that most of the countries in Asia are developing countries that require them to study more on attraction. This study also revealed that very few studies explore on augmented element. In contrast, Europe has only two studies and focuses solely on core component, with emotion being the only variable examined.

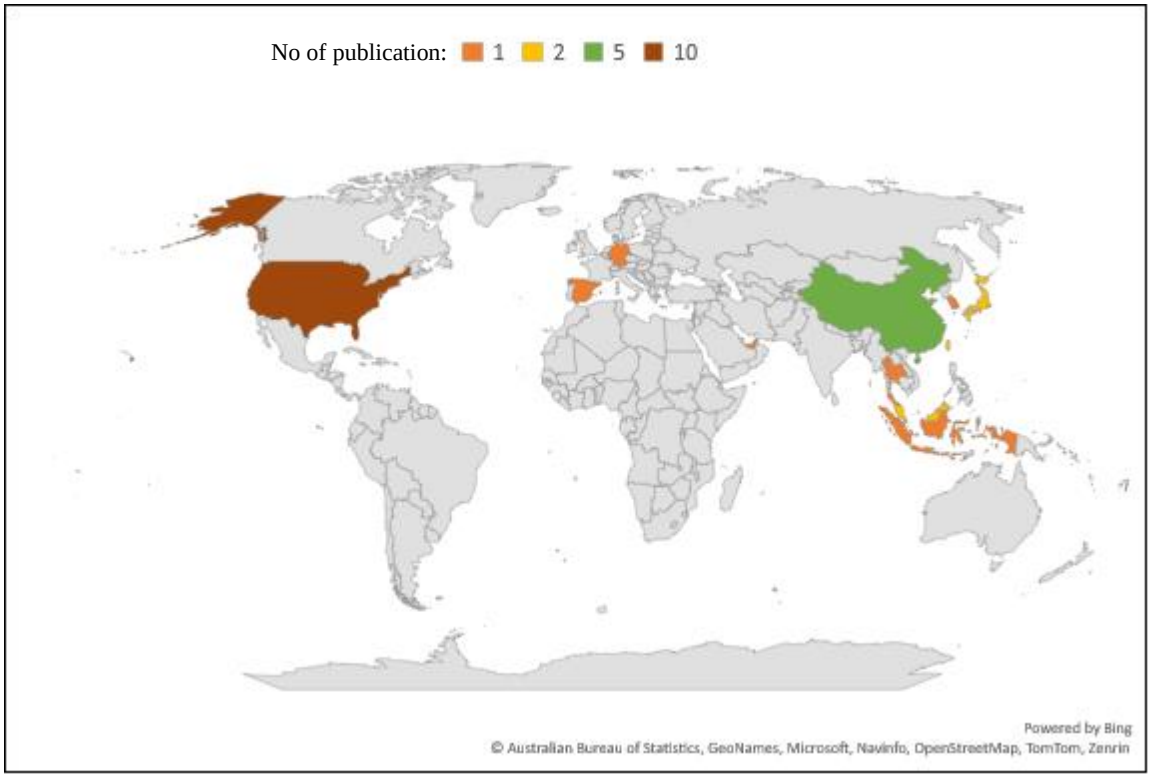

Figure 3. Country of studies on Theme Park Attractions from 2018 to 2022

Table 3. The Elements of Studies in Different Region.

Element	Dimension	North America	Europe	Asia
Core Attraction	Atmosphere			✓
	Nostalgia			✓
	Experience	✓		✓
	Emotion	✓	✓	✓
Tangible Attraction	Technology	✓		✓
	Services	✓		✓
	Image	✓		
	Physical	✓		✓
Augmented Attraction	Ancillary services	✓		✓
	Destination			✓

According to the research, it is possible to divide it into three primary components of theme park attractions, which identifies as the "Core," "Tangible," and "Augmented" [9]. On the basis of the research findings, the researches were also categorised into ten different dimensions. A summary of recent research found on the theme parks attractions can be seen in the Figure 4.

It is evident that the vast majority of studies on theme park attractions have focused on tangible attractions, whereas studies on theme park services have dominated the subject field. Despite this, there are just a few of articles that only concentrate on ancillary services and destinations as their primary focus. Between the span of this five-year period, the majority of research on theme parks was conducted in the years 2018 and 2020. The subsequent topics will go into further depth about each dimension.

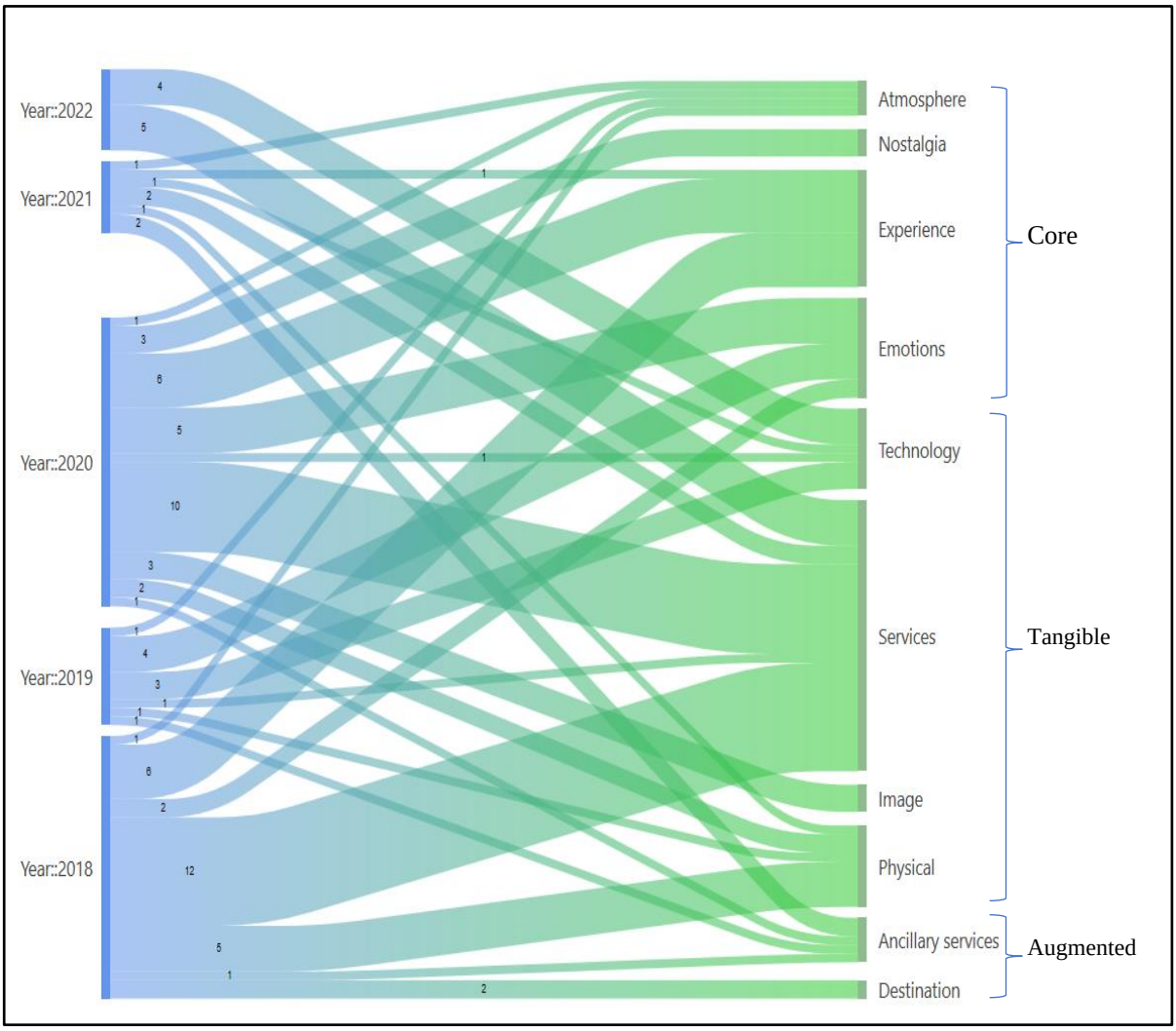

Figure 4. Related Studies on Theme Park Attractions from 2018 to 2022

5.1 Core Attractions

The researchers came up the same conclusion, which is that the core is what the customer is actually buying [3],[9],[11]. However, the core in theme parks are focus on the benefits that customers receive from the product. These benefits include the intrinsic feelings that customers acquire from the product, such as the emotions, experiences, and atmospheres that are listed in Table 2.2.

Atmosphere may be increased by the ambiance, thematic identity, and also the authenticity of the surrounding of a theme park [14]-[17], which simultaneously tries to produce favourable intents, persuade the consumer, and encourage them to acquire the products or services [15]. It was demonstrated that perceptions of ambiance and design have a favourable influence on the quality of the physical environment [17], particularly with regard to those aspects of the environment that the senses detect directly, such as temperature, odour, sound, lighting, and look [18]. On the other hand, it is considered that the presence of a themed identity as well as authenticity in a theme park may provide tourists the impression and the opportunity to enjoy the environment of a foreign country [14],[16].

Core elements can also be developed by providing a destination that evokes feelings of nostalgia [19], emotions [17],[20]-[23], and experiences [16],[24]-[26]. When the visitors is emotionally attached in the activities and attractions of the theme park, they are hit with powerful sense of nostalgia [19]-[20]. Therefore, in order to make the experience more memorable, it should include activities that are both physically and emotionally stimulating [27]. Moreover, it was discovered that the quality of the

memory was directly correlated to the level of satisfaction, the intention to return, and the intention to go to theme parks [25].

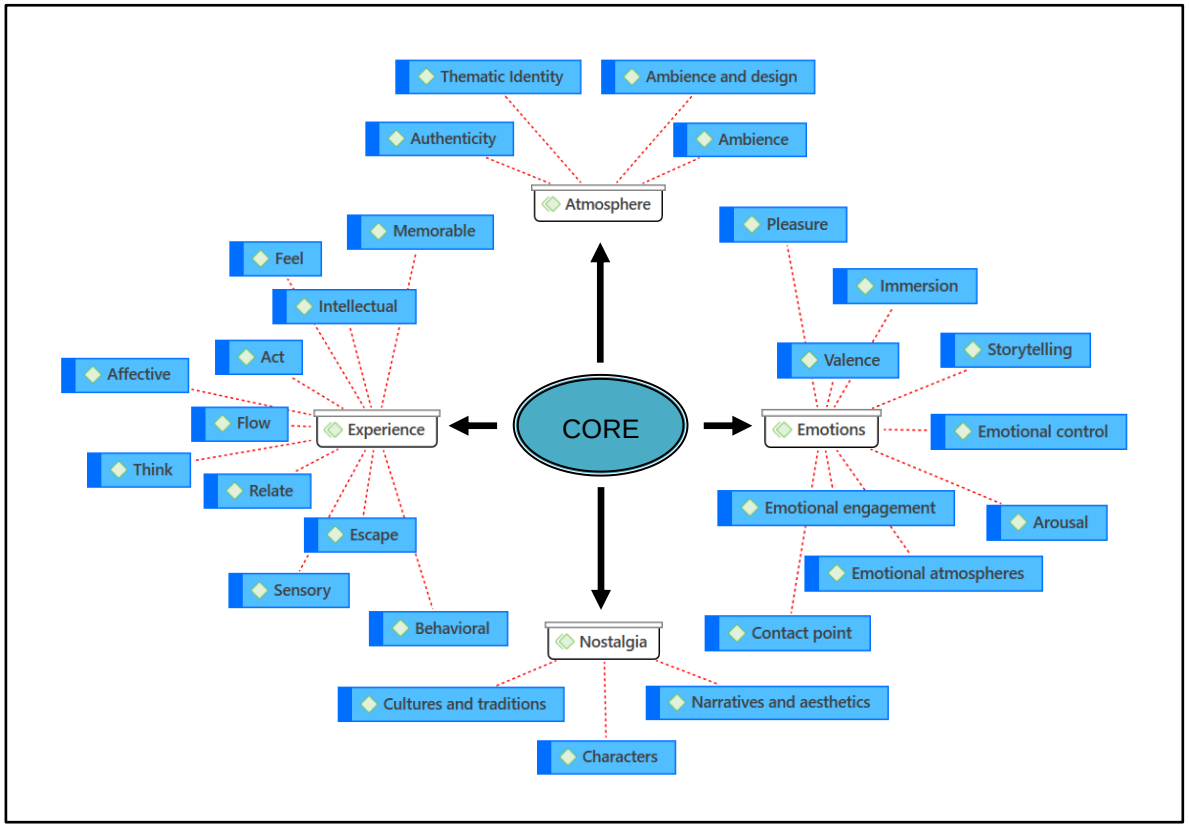

Figure 5. Theme Park Core Attraction Discussed in The Literature (2018-2022)

5.2 Tangible Attractions

The tangible elements of a theme park can be summed up as the physical elements as well as the services that are offered to the visitors [3],[9]. The findings of recent studies are summarised in Table 2.3. These studies found that technology, services, image, and physical are some of the dimensions that may be used to quantify the tangible elements present in theme parks.

Recent literature in theme park studies has explored the technology as one of the tangible elements [28]-[32]. Technology is seen not only as a channel for interacting with visitors, but also as a tool for mediating and generating unique visitors' experiences, as well as for gaining more interactive and producing immersive experiences for their guests[31],[33]. The most recent research came to the conclusion that the experience that visitors have at theme parks and the behaviours that they exhibit may be enhanced with the deployment of high technology and the function that supporting technology plays especially in crowd management [32].

Recent studies have placed a greater emphasis on the importance of services as a tangible component [14]-[15],[17]-[18],[23],[34]-[37]. It has been discovered that the interaction that takes place between customers and staff members has an effect on the degrees of pleasure that visitors feel [15],[18]. It was added that the high level of service quality allows a theme park to acquire a competitive advantage, and increase the loyalty of its visitors [35]. Apart from that, the researchers also concerned about congestion, overcrowding, and queue management since they believe these elements have the potential to affect the overall experience, enjoyment, and willingness to return of visitors [28],[37]-[38]. This problem is becoming more important as a result of the epidemic of covid-19 and emphasised that administrators of

tourist destinations had to restructure and make improvements to the queue management and congestion [36],[39].

On the other hand, the theme park image is also considered a concrete aspect. However, only a small number of researchers emphasised this element. The ability of a theme park brand to generate a powerful visitor experience is essential to the success of a theme park brand [40]. The popular image of tourist destinations is influenced by social media platforms that have the capacity to develop widespread appeal in a short period of time [33].

Also explored by the researcher in studies of theme parks is the physical dimension [14]-[15],[17]-[18],[23],[34]-[35]. The studies explored how the design, equipment, and hybrid consumption of theme park items contribute to the favourable influence on the consumer experience [14]-[15],[17]. While, the studies also highlighted the physical surroundings, stated the distinguishing elements of theme parks [18],[35],[38].

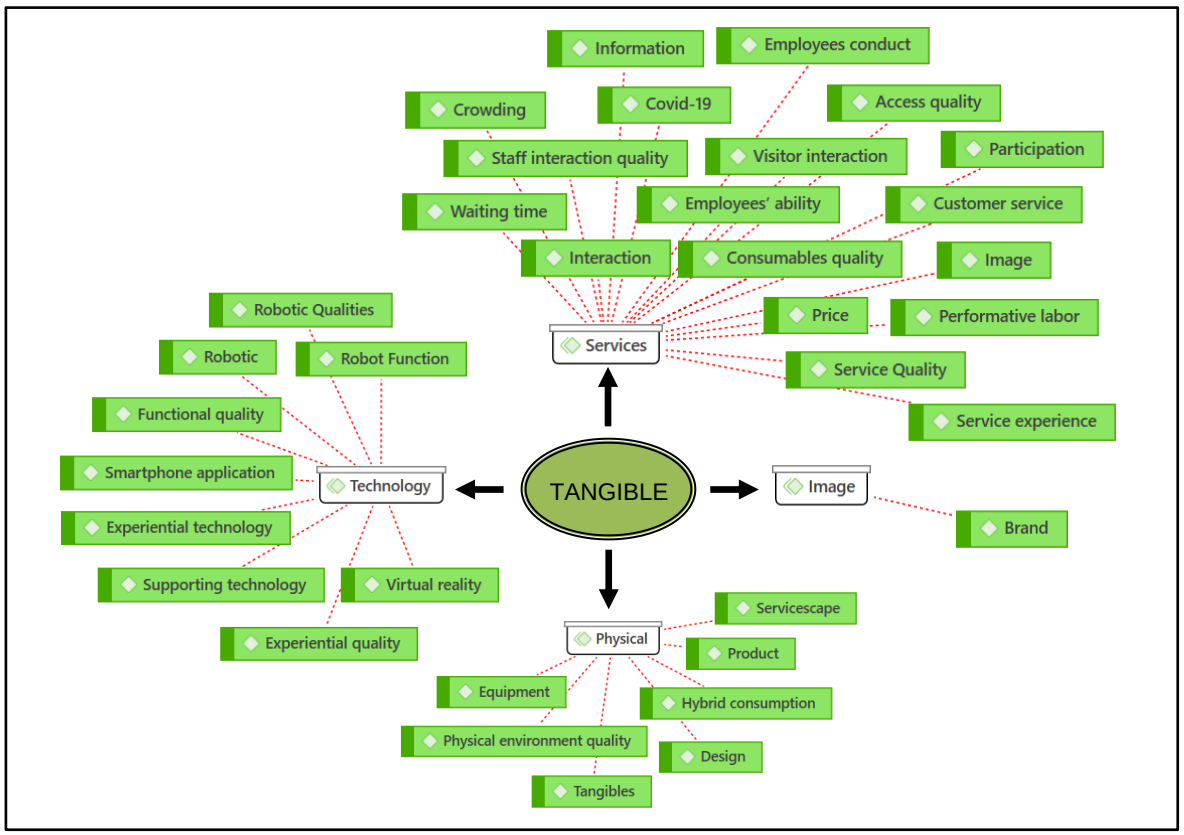

Figure 6. Theme Park tangible attractions discussed in the literature (2018-2022)

5.3 *Augmented Attractions*

Augmented attraction is the product that may not be crucial to attract and encourage visitors to come to theme parks [3],[9]. Nonetheless, the presence of this component contributes to the improvement of the visitors' convenience and contentment. As can be shown in Figure 6, relatively few research included this component in their studies of theme parks. It can be seen that the Ancillary services [14],[16],[38],[41] and the Destination [17], are incorporated into the Augmented component.

Ancillary services are supplementary services that are offered to accommodate the needs of visitors. The Ancillary services category, closed space in a theme park with controlled access emphasises the significance of carrying capacity and need to have definite boundaries [14],[41]. Aside from that, the provision of souvenirs, food and beverages, and shopping opportunities may all contribute to increased demand at theme parks and enhanced overall experience for visitors, on the other hand, scenery is one

of the augmented elements and suggested that people who are driven by the need to experience foreign scenery and escape from their daily routines are more likely to visit theme parks. This is because theme parks offer an escape from the repetitiveness of daily life [14],[38],[41]. This is due to the fact that visitors to theme parks are given the opportunity to encounter new environments outside of their normal routine.

Regarding the destination, previous studies demonstrated that theme parks chose places based on the potential size of the local market as well as the accessibility of the area [14],[17]. The location is seen as an essential component of access quality. Destination image is often defined as the total of a person's thoughts, ideas, and perceptions regarding their destination. Research on destination image can determine the correlations between destination image, visitors' pleasure, and behavioural intentions from various nations and locations [36].

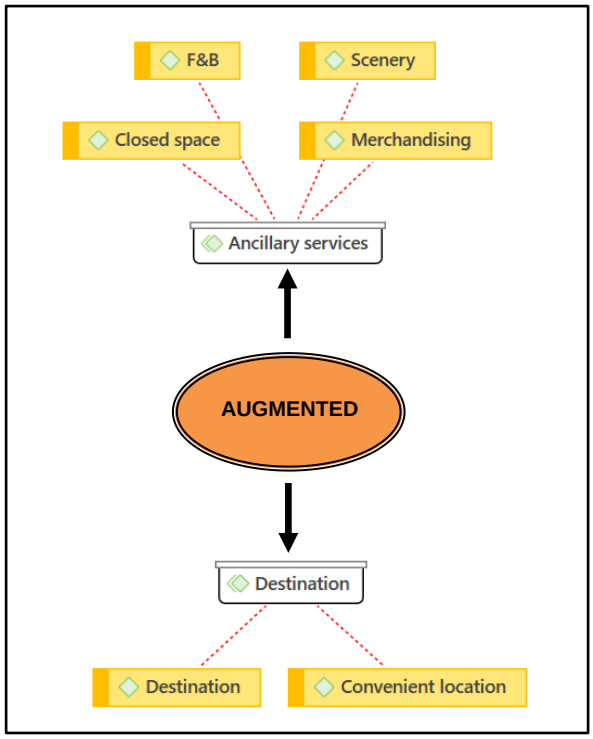

Figure 7. Theme park augmented attraction discussed in the literature (2018-2022)

6. Conclusion

Based on the result, there were several recent studies that have been carried out on Theme Park destination. The discussion on the studies had covered all the three elements of theme park (core, tangible and augmented). These studies however still leave gaps of what should be the appropriate criteria that lead to a successful theme park. Generally, most of the studies had successfully implies the factors of tourism destination in theme park studies but, the absence of a specific criteria of theme park characteristics has become a major research gap. It can be seen that some of the important criteria indicates by Clave [3] in Table 1 were missing in the recent studies. Theme Park as define by NAPHA, have a distinct character that differentiate the theme park with other tourism destination. Thus, there will be a major shortcoming without addressing the essential criteria in theme park studies. As a fundamental and basis of theme park attributes, it is important to integrate the clave with the recent studies to ensure that the appropriate criteria of theme park can be successfully identified.

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Extrinsic and Intrinsic Motivation of Tourists to Use Public Transport for Leisure: A Theoretical Review and Conceptual Framework

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Abstract. Public transport services play a major role in connecting people to a destination. In the context of tourism, urban tourists' use of public transport for leisure is based on their motivation and service quality of the public transport itself. However, a comprehensive understanding on the motivation among urban tourists is currently lacking. Therefore, this research undertakes a comprehensive literature on the motivation and service quality that influence towards the use of public transport among tourists. In this research, 32 selected journal articles were reviewed from two databases (e.g. Scopus and Science Direct). This study provides the insight of motivation and service quality that leads towards the satisfaction on the public transport services among tourists. This research reviewed and developed framework that influence towards the use of public transport. Three themes of motivation and five attributes of public transport service quality were revealed to be contributing towards the use of public transport for leisure. Along these findings, several limitations were found in this research, and one of them is this research did not study on the travel behaviour of tourists. Future research may conduct the research on the travel behaviour of tourists in using public transport in different settings. This paper extends the boundary of knowledge through the combination of transport planning, urban planning and psychology field. Practical implication of this study is that the result of this research could help policymakers of public transport and travel agencies to improve the services based on the perspective of tourists, as one of the public transport users.

1. Introduction

Public transit in urban areas is primarily tailored to cater to the needs of regular commuters, particularly individuals who engage in daily work-related travel. Hence, the provision of public transit in the region varies significantly based on distinct purposes and the corresponding demand. When comparing metropolitan areas with urban and rural areas, it can be observed that metropolitan areas possess more advanced and user-friendly transportation networks [1]. Urban regions typically have a higher prevalence of conveniently accessible public transportation options, both within residential areas and in close proximity to diverse destinations.

Urban tourism is anticipated to have a robust public transportation system. According to [2] there are four advantages to using public transportation for recreational purposes: (1) low carbon emissions, (2) job creation, (3) tourist attraction, and (4) contribution to the cost of living. The most important of these four advantages is the one about attracting tourists to a destination. [3] conducted a study on tourists' choice of transport mode, and they recommended conducting similar research in non-European or developing nations in the future. [4] investigated the mode of travel among residents of Huangzhou, a popular tourist destination. The author suggested that research be conducted on non-local residents or

tourists in order to identify the factors that may influence their mode of transportation in the tourism destination. Investigating the underlying factors that drive the transition from rental car usage to Mobility as a Service (MaaS), as well as the change from private to public transport, is a crucial endeavour in the pursuit of sustainable travel within the MaaS framework [5]. Public transport companies should take into account the factors that are of significance to tourists while seeking to enhance their services [2].

Nevertheless, in practise, public transit is generally perceived as the least preferred choice for recreational travel. One of the contributing factors to the limited utilisation of public transport among travellers is the perception that private car usage offers more efficiency in terms of both time and expense, in contrast to the perceived inefficiencies of public transport systems [6]. According to a study conducted by [7], the transport service in Melaka as a tourist region exhibits inefficiencies in its public transport system. The research on tourists utilising public transport continues until 2021, which revealed the same result [8]. While numerous research studied on service quality of public transport, the motivations of using public transport has been overlooked. Thus, this research aimed to address the intrinsic motivations in travelling with public transport for leisure. At the same time, this research also outlined the extrinsic motivations of utilising public transport.

2. Theoretical Background

Self-Determination Theory (SDT) was coined by [9], whereby this theory postulates individual's motivation. According to this theory, there are two types of motivations, known as extrinsic and intrinsic motivations. Extrinsic motivation refers to the type of motivation that is driven by external factors rather than the inherent enjoyment derived from the actions themselves [10]. For instance, in physical activities, individuals can be classified as extrinsically motivated when they participate in an activity with the intention of acquiring a tangible or social reward [11]. Social rewards, such as family's respects to the individual, are external factors that derives from outsources. In the context of public transport, service quality is the external factor that influence people's use of the infrastructure. This theory explained how a motivation of an individual can evolve from extrinsic to intrinsic.

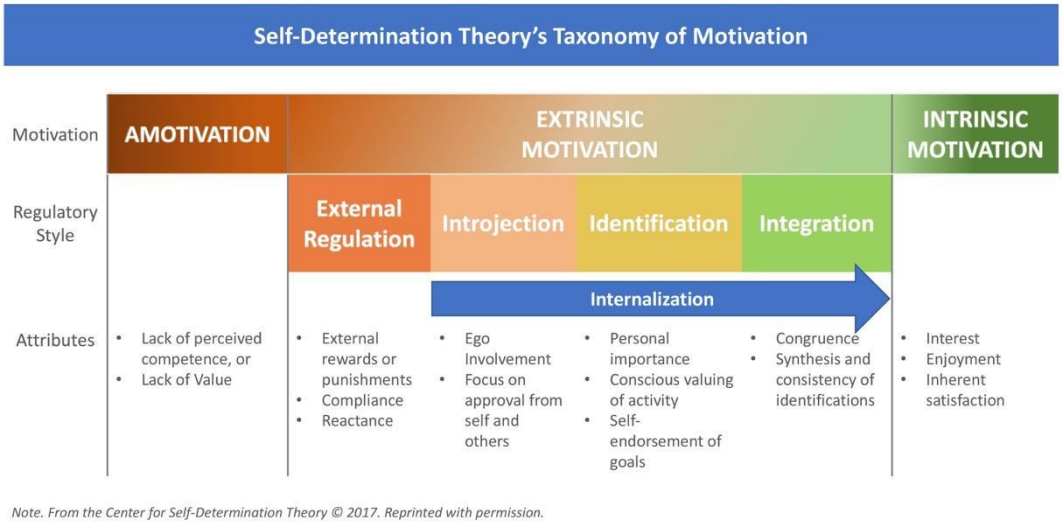

Figure 1 Self-Determination Theory's Taxonomy of Motivation [10].

Many transport studies described motivation as push and pull factors. According to [12], pull factors refer to the perceived attractiveness of a destination that influences individuals with a propensity to travel. To engage in tourism activities, individuals are pushed by their internal forces and pull by the external attractions of a destination [13]. For example, the tourists who visited the Camel Xiangzi Museum (CXM) in Qingdao, China exhibited a "literary motivation" as they experienced a sense of attachment to the cultural legacy, the authors of the Camel Xiangzi novel, their intellectual contributions,

and the dwelling associated with them [14]. The sentiments experienced by tourists towards the authors might be seen as a manifestation of their inherent motivation, serving as a driving force behind their decision to visit the museum. Push factors refer to the various forces that compel individuals to leave their place of residence and influence their decision to engage in tourism activities while pull motivation encompasses the factors that exert an attractive force on individuals, compelling them to be drawn towards a particular destination. This means, push factors are intrinsic motivations while pull factors are extrinsic motivations.

Service quality of public transport has been discussed widely throughout the years. [15] postulated five dimensions of service quality (SERVQUAL), (1) tangibles such as physical facilities, equipment, and appearance of personnel, (2) reliability the ability of the service to be performed accurately, (3) responsiveness, which is the desire to assist customers and deliver expeditious service, (4) assurance, the acquisition of knowledge and the demonstration of courtesy by employees, along with their capacity to instil trust and inspire confidence and (5) empathy, a high level of personalised care and attention to its customers. Condition of public transport and cleanliness are the examples of tangible [16] that shows the physical attractiveness.

Service quality is associated with satisfaction. Satisfaction is derived after the individual has experienced the service. The influence of travel satisfaction on the intention to revisit is greater compared to the influence of destination satisfaction [17]. Tourists see the process of travelling repercussion towards the intention to revisit to the destination. Thus, it is important to provide a good service of public transport that connects to the tourism destinations.

Intentions are postulated to encompass the motivational elements that impact behaviour, serving as indicators of individuals' level of commitment and the extent of effort they plan to invest in performing said behaviour [18]. The theory posited by [10] elucidated the affective experiences of enjoyment, pleasure and contentment that an individual undergoes during the execution of a particular behaviour. Pleasurable activities were found in tourism studies [45], [46]. This research hypothesised that travelling with public transport should be pleasurable as well. People have a tendency to engage in repetitive behaviour subsequent to experiencing satisfaction [16]. However, pleasurable feelings in travelling with public transport has been overlooked.

3. Method

This research employs Theoretical Literature Review by using Preferred Reporting Items for Systematic Reviews (PRISMA). This section explains the method used to gather all the data, namely PRISMA.

3.1 Data sources

This study searched data by referring to two electronic devices, which are Scopus and ScienceDirect between the year 2003 to 2023. English is the only language was selected, with final article published in journals. This study had to undergo the topics, scope and eligibility steps twice since this research is a combination of two fields. Gathering the selected articles in journals require search strings, which this research used “public transport”, “satisfaction”, “motivations” and “tourists” keywords for the transportation field. Meanwhile, for tourism field, this research used “tourism”, “tourists”, “motivations” and “push and pull”.

3.2 Selection of studies

Three rounds of reviewing were performed in selecting the research articles. Firstly, each title and abstract were reviewed independently. At the same time, this research also looked up to the keywords used in the articles. Secondly, the selected articles were reviewed in full text. Thirdly, this research documented all the selected articles in one documentation. This method underwent twice because of the combination between two fields.

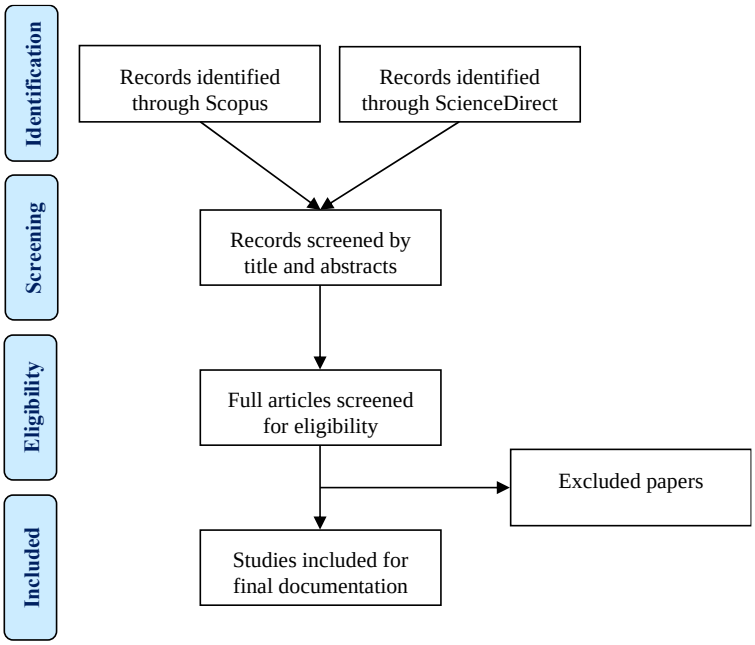

Figure 2 Selection of studies with PRISMA guide

4. Results

The use of sections to divide the text of the paper is optional and left as a decision for the author. Where the author wishes to divide the paper into sections the formatting shown in table 2 should be used.

4.1 Background of Selected Studies

The result of the query in search engines shows that many articles related to the keywords used can be found in ScienceDirect more than Scopus. **Figure 3** illustrated the research trend is increasing until 2023 in ScienceDirect, however, it decreased in Scopus.

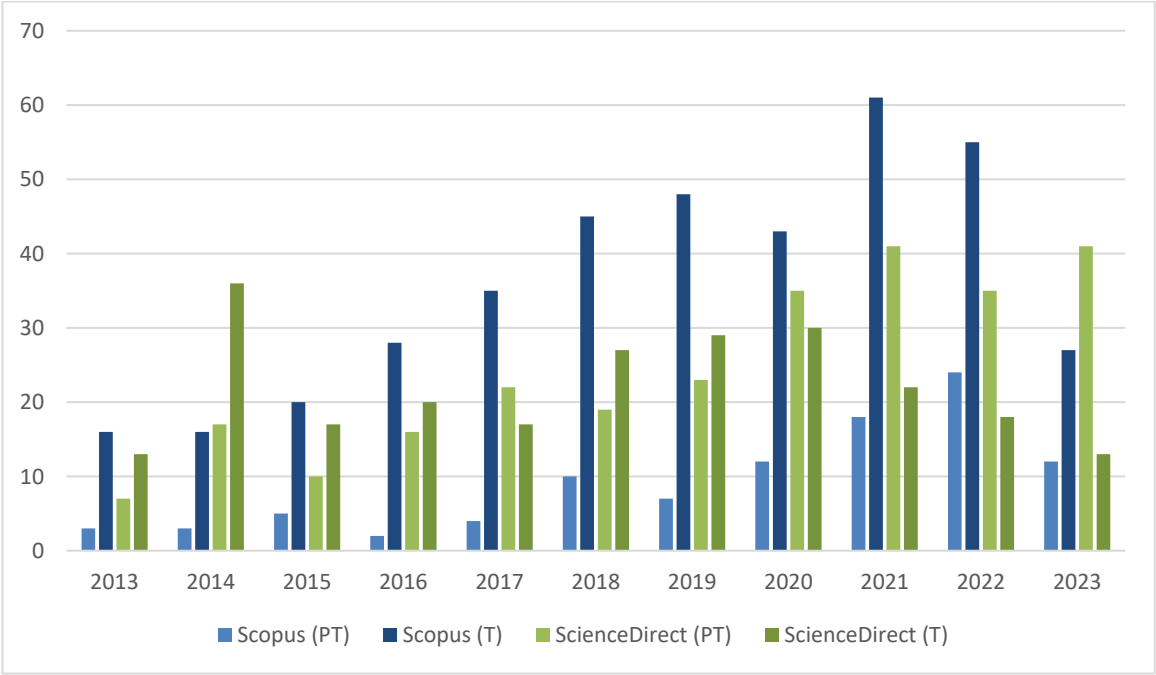

Figure 3 Research trend on public transport use among tourists

4.2 Extrinsic Motivation/Pull Factors (Service Quality)

Table 1. Summary of past studies

Study (Authors and Year)	Context	Service Quality Attributes																
		AC	IN	FR	PU	FA	TK	WL	TT	EU	INF	SF	CF	AP	FC	CS	DB	OH
Hamzah et al., 2023 [16]	Kuala Lumpur, Malaysia	X	X	X	X						X	X	X	X				
Jou et al., 2023 [19]	Mindoro, Philippines	X		X	X	X	X				X	X	X		X	X	X	
Romero, Zamorano and Monzón, 2023 [20]	Madrid, Spain	X		X	X	X			X		X	X	X	X		X		
Zhang and Wu, 2023 [21]	Brisbane, Australia	X		X		X			X	X	X	X	X			X		
Oloruntobi et al. 2023 [22]	Lagos, Nigeria	X	X			X					X	X	X	X				
Ibrahim et al., 2022 [23]	Kuala Lumpur, Malaysia	X		X	X		X		X	X	X	X	X		X	X		
Abdul Sukor, Airak and Hassan, 2021 [24]	Penang, Malaysia				X						X	X						
Miravet, Domènech and Gutiérrez, 2021 [25]	Mediterranian City	X							X		X							
Kim et al., 2021 [26]	Jeju Island, Korea					X		X	X									
Agyeman and Cheng, 2020 [27]	Ghana	X			X	X		X	X		X	X	X	X		X	X	
Jomnonkwao, Champahom and Ratanavaraha, 2020 [28]	Thailand			X	X	X	X					X	X			X		
Ni et al., 2020 [29]	China	X				X				X		X	X					
Chen, Hsu and Chen, 2019 [30]	Taiwan	X										X	X			X		
Nwachukwu, Gladys and Chikezie, 2019 [54]	Lagos, Nigeria	X									X	X	X			X		
Sam, Hamidu and Daniels, 2018 [31]	Kumasi, Ghana				X			X			X	X	X	X	X	X		
Efthymiou et al., 2018 [32]	Athens, Greece	X	X	X	X	X	X	X	X		X		X	X	X		X	X
Nutsugbodo et al. 2018 [33]	Ghana	X		X		X			X			X	X	X			X	
Efthymiou and Antoniou, 2017 [34]	Athens, Greece	X	X	X	X		X	X			X	X		X				X
Fu and Juan, 2017 [35]	Shaoxing City, China					X				X	X	X	X					
Bajada and Titherdige, 2017 [36]	Malta					X					X			X			X	
Aydin, Celik and Gumus, 2015 [37]		X				X	X		X		X	X	X	X		X		
Le-Klähn, Gerike and Hall, 2014 [38]	Munich, Germany	X	X	X	X	X	X			X	X	X	X	X		X		

AC = Accessibility
IN = Interchanges
FR = Frequency
PU = Punctuality
FA = Fares
TK = Ticketing
WL = Walkability
TT = Travel time
EU = Ease of use
INF = Information
SF = Safety
CF = Comfort
AP = Appearance
FC = Facilities
CS = Customer service
DB = Driving behaviour
OH = Operating hour

4.3 Intrinsic Motivation/Push Factors (Motivation)

Table 2. Summary of past studies

Study (Authors and Year)	Context	Influencing Factors				
		Factor 1: Relaxation/Escape	Factor 2: Cultural Experiences	Factor 3: Socialisation/Family	Factor 4: Adventures	Factor 5: Others
Andrade, Ramirez and Ramirez, 2022 [39]	Tatacoa, Columbia	Push Factors: Rest Sensory Appeal	Knowledge Fun and Entertainment Cultural Experience	Socialisation Personal Relationship	Prestige	Health experience
Valverde-Roda et al., 2022 [40]	Granada, Spain		I had an incentive offer from my employer I need an opportunity to learn	Place to enjoy company of friends An ideal place for children	To conduct research	I wanted to find a relief for my ill health Historically attached to the place
Osiako, Kummitha and Szente, 2022 [41]	Kenya					
Rehman and Alnuzhah, 2022 [42]	Saudi Arabia	**Factor 4: To escape from routine** To visit the destination To see beautiful mountains	**Factor 2: For relaxation** To relaxed and for entertainment To satisfy the longing to be somewhere else To be close to nature and enjoy natural resources To seek a unique experience To be someplace away from home Expected to have a pleasant experience To decrease work pressure	**Factor 3: To increase my tourism knowledge** To have a great experience with my travel companion(s) To see the old cultural places To visit Jubbah rock art To visit Hail museum	**Factor: Taking part in new adventures** To increase knowledge about new things Easy to reach from accommodation Would like to participate in new adventures Would like to experience a new tourist destination with friends To see and do different types of activities To see a place that have not visited before	

		The desire to appreciate natural resources The wish to The need to relax physically and mentally	To explore cultural resources To see experience new and different lifestyles	**Family and Togetherness (Family T)** The wish to increase your social interaction, The need to visit friends and relatives, The desire to be away from home (to be somewhere else), An increase in your net income	The need to acquire knowledge about a tourist destinations The interest to visit a place that have not visited before to find thrills and excitement
Bayih and Singh, 2020 [43]	Ethiopia				
		Push Factors: Novelty	Knowledge/Intellectual	Prestige	/Adventure Escape/Entertainment/ Sports
Katsikari et al., 2020 [44]	Bali, Indonesia				Amusement New experience
Hwang, Asif and Lee, 2020 [45]	South Korea	Mental relaxation			
Hosany, Buzova and Sanz-Blas, 2019 [46]	Swiss Alps, Switzerland	To escape To relax. To be close to nature. To enjoy the view.	To learn about the local history To learn about the culture To discover new places		**To do exciting things** **To experience novelty** **To feel exhilaration**
				Socialisation & challenge To be with similar people To challenge themselves	**Exploration & excitement** To look at underwater animal and plant life To explore things Because it's stimulating and exciting To create an experience I can look back on For the adventure of it For a change from everyday life Because of the sense of discovery involved To learn more about the underwater environment	**Personal development** To develop my diving skills and knowledge To see shipwrecks To keep fit To study underwater geological formations To share diving skills and knowledge To use equipment
Albayrak, Caber and Cater, 2021 [47]	Kemer, Antalya-Turkey				

		Factor 1: Drive-free benefit Want to enjoy the surroundings on the way Would like to have more time to do something else on board	To get in touch with the local people	travelling by public transport is a better way to explore Munich	**Factor : Traffic reduction** I want to avoid traffic jam I want to contribute to less traffic congestion It is difficult to find parking lots in the city centre **Factor: Car unavailability** I do not have a car in Munich I do not want to rent a car **Factor: Advantages of local PT** Public transport in Munich is convenient Public transport in Munich is very accessible Want to get to know the country's transport system
Le-Klähn, Gerike and Hall, 2014 [38]	Munich, Germany				

5. **Discussions**

5.1 Service Quality

Each case study shows different importance of service quality of public transport. SERVQUAL scale [15] is being used by to determine the service quality of public transport [16], [31]. Nevertheless, other case studies did not completely depend on the same scale [32], even so, the service quality attributes are similar. Several studies were found to be investigated the public transport services as a whole [22], [48]. Accessibility, reliability, fares, customer service, safety and comfort are some of the main attributes that past studies investigated. [34] outline four dimensions for measuring service quality of public transport, (1) general characteristics of public transport including the frequency, operation hour, ticketing services and connectivity, (2) terminals and stops that consider on walking distance, information and safety, (3) vehicles, the cleanliness, safety, information and (4) transfer points that consists of distance, waiting time and information. These dimensions were continued being adapted by [32]. Overall, service quality attributes should be covered holistically that include vehicles, staff, services and station [28].

The comprehensive evaluation indicates that there is a positive correlation between the perceived attractiveness of public transport services and the level of satisfaction reported by respondents [22]. Attitudes towards and perceptions of a sustainable city will be enhanced by a high level of satisfaction with fundamental transportation services and the physical environment of transportation [30]. It is concluded that core transportation service, such as frequency, provision hours, destinations, information provision, reserving, drivers' behaviour, and complaint resolution, as well as the physical environment of transportation, such as platforms and transportation vehicles, have significant effects on customer satisfaction [30]. Satisfaction on public transport services portray its service quality. As motivation is firmly associated with satisfaction, it follows that tourists will compare their experiences to their expectations which represent their motivations prior to embarking on their travels in order to determine their satisfaction levels [41]. Each of the case studies have different satisfaction on service quality.

Some studies listed out all the service quality attributes and grouped it into several factors by using Exploratory Factor Analysis (EFA) or Principal Component Analysis (PCA). For instance, [22] introduced 11 attributes as shows in Table 1. (Refer to page 5) of public transport services. The PCA result showed 3 main factors, which are Service Responsiveness and Pricing (SRP), Transit Features and Service Accessibility (TFSA) and Perceived Safety, Comfort and Value-for-Money (PSCV) that consists of those 11 attributes. Intangible service such as comfort, convenience, and safety, cost, and information including lines and schedule of public transport are the overall attributes that were being measured for service quality of public transport [35]. In the end, the service quality attributes are similar to any other studies. To summarise, this research found that the main attributes of public transport's service quality are accessibility, reliability, information and customer service. It then led to satisfaction of the users after utilising public transport.

5.2 Accessibility.

Accessibility refers to the ability of a particular location to be reached or entered from various other locations [49]. The proximity between the starting point of a journey and the public transport access point, as well as the proximity between the public transport access point and the final destination, serve as indicators of the level of accessibility provided by the public transport system [50]. This means, accessibility is about reaching one place to another place and both points are required to connect with each other. In other words, accessibility to public transport and transit station and accessibility to destination should be considered.

[33] revealed that one of the main issues in Ghana is on the accessibility itself, whereby the tourists preferred to use trotros and taxis. Additionally, the city governments have provided taxis and trotros with easily accessible terminals. Tourists are more likely to use the service that has been provided to make their travel journey easier. Accessible public transport exists in Lagos, but many international visitors find it unattractive [22] mainly because it was inaccessible to tourism spots. This is in contradict with [20] the primary purpose of suburban rail is to facilitate efficient transportation of metropolitan

people to the city core, and it appears that passengers express a high level of satisfaction with this function. This means, the terms accessibility is also depending on the type of users. Tourists preferred when it is accessible to tourism destination. Meanwhile, daily users preferred when it is accessible to their home, workplaces and other facilities [51].

Meanwhile, in terms of interchanges, it is imperative that public transportation stations are effectively interconnected with other transportation modes and readily accessible [52]. The level of convenience in reaching terminals and the availability of various destinations significantly impact the overall experience of existing users in terms of ridership [51]. The convenience includes the walking time required by passengers to transfer from one mode to another. This shows that connectivity from one mode to another is important.

5.3 Reliability.

The concept of reliability in public transport pertains to the examination of user satisfaction with respect to the quality of service rendered. The factor of reliability is of utmost importance when considering bus service preferences in terms of efficiency and affordability, specifically in relation to the frequency of bus services and travel duration [53]. This means, fare, frequency, travel time and punctuality aspects are included in reliability. This research also considered walkability [27], [34] in reliability.

Fare was found as one of the concerns among public transport users. People in Penang were satisfied with the fare of bus because it was free [24]. The rise in ticket prices have had an apparent effect on the dissatisfaction expressed by the public transport users [34]. This is similar with [3], which found that tourists were dissatisfied with the public transport fare in Munich because it was expensive. This illustrated that public transport users preferred cheap fares. Driving in the city has cost more money, therefore, offering cheap fares for public transport makes it more attractive to utilise it.

Low frequency of public transport is one of the dissatisfactions was found among users [24], [34] because it influenced the waiting time [24]. Long waiting time of bus is equivalent to a low frequency, which may cause by punctuality as well. Similarly, the congestion in Lagos has made the frequency considerably worse, particularly around rush hour [54]. Moreover, people in Brisbane were unsatisfied because the bus service was not as the same as stated in the timetable [21], which reveals that it was not punctual. This is in contrast with [28], whereby people in Thailand were extremely satisfied with the punctuality of the train and regarded it as a strength. This means, punctuality is important aspect of service quality for users. Frequency and punctuality affect their travel time, which also may disrupt their travelling plans.

Walkability is a concept that encompasses both objective and subjective factors related to the ability to walk in a given area. Objective factors include the distance to destinations, the density of residential areas, the mix of land uses, and the connectivity of streets. Subjective factors, on the other hand, pertain to the perceived quality of the built environment and its ability to facilitate walking for different purposes, such as accessing public transportation and amenities [55]. Proper sidewalk is needed especially for those who ride buses and for interchanges. Most of the commuters consider on the walking time while travelling. The reduction in public transport usage can be attributed to the increased distance that passengers must go between transfer stations in order to proceed with their journey [34]. Also, walkability is also being discussed with safety as well. The perceived safety is compromised due to inadequately built sidewalks that connect the residential areas to the bus stops [27]. This shows that the provision of sidewalk should prioritise safety as well.

5.4 Information.

Information of public transport should be available for passengers to refer. A reliable source of information serves as the fundamental basis for instilling confidence in a system and has the potential to mitigate uncertainty, which in turn alleviates stress [56]. Arrival and departure time [56], route [57], gate number [57], [56] are some important information needed, as well as understandable [19]. The conveyed information has an impact on the level of desirability of mobility among users [58]. The information should be accurate and precise to create consumers' trust. On the other hand, the presentation and prioritisation of information should focus on optimising visibility, positioning, content, and functionality [59] to be visible for users.

Several users expressed difficulty in utilising the bus service due to a perceived lack of comprehensive information pertaining to its operations. The prioritisation of addressing information attributes is crucial due to their significant importance for passengers, as well as their somewhat lower performance compared to other essential service attributes [20]. Some users were enthusiasm towards utilising the service due to their positive perceptions of its quality, but they were lacking sufficient knowledge regarding its intricacies [24]. Lack of information also affected tourists' travel time and indirectly affected their accessibility [36] because they were lost. Information influenced trips and plans of public transport users. Lack of information led to dissatisfaction among users, which will make them reconsider in utilising public transport for their next trip.

5.5 Safety.

Safety measures should be implemented in any kind of transportation mode. The feeling of insecurity among tourists also affected their decision in choosing transportation mode for travelling in leisure. The security dimension of the quality of service provided by public transport is of utmost importance, given the significant number of passengers being transported in a single vehicle, which directly impacts human lives [54]. In safety, crimes such as pickpocket, sexual harassment and behaviour of drivers are usually being discussed.

Bus users claimed that bus service exhibited a higher level of safety in comparison to alternative modes of transportation [24]. This relatively shows that the passengers were satisfied with the safety measures by the bus operators. However, this is contradicted with [36] and [54], which the bus users raised their dissatisfaction on the safety because the bus drivers drove carelessly. Engaging in reckless driving can result in a negative experience for passengers. Moreover, women often tend to bring attention to safety concerns, particularly in relation to reckless drivers and disregard for traffic regulations that have the potential to jeopardise the well-being of passengers [53]. Passengers and users, particularly women, prioritise the selection of the most optimal daily transportation mode based on safety and security considerations [60]. Most case studies discussed safety on the driving behaviour instead of safety from crimes. This indicated that public transport users' concern was on the behaviour of drivers during utilising the service.

5.6. Comfort.

The contentment of users is equally influenced by the status of the bus interior, encompassing factors such as seat spacings, neatness, design, and comfort [27]. However, it was found differently with the findings by [28], which found that the users' main concern was on the comfort of public transport, precisely on the neat, cleanliness on board and windows of the train. The train condition was very old, therefore, there were needs for improvement on that matter. Overcrowding in the bus often occurred in Malta because the tourists shared the same bus with the locals [36]. Tourists claimed it as uncomfortable while riding the bus. This is contradicted with [21], which it rarely happens in Brisbane. This makes the public transport users feel comfortable while commuting. This means, being comfortable in public transport does not necessarily on the facilities of public transport, but it also affected by the service. To avoid overcrowding, public transport should increase the frequency.

5.7. Customer Service.

Customer service comprises of staff behaviour, such as politeness [28], [31], responsive [16], [27] and driving behaviour [29], [30]. Some of the case studies show that they were satisfied with the customer service because of the responsive staff [21]. Attended and responsive staff are accountable to assists public transport users in the stations. In the case of driving behaviour, tourists in Malta were dissatisfied with the driving behaviour of the bus drivers [36]. The implementation of control systems and measures at minimising reckless and aggressive driving behaviours, including but not limited to overspeeding, over-taking, overloading of cars, and mobile phone use while driving, is of utmost importance [27]. Therefore, public transport agencies should look into this matter before hiring staff for customer service and bus drivers.

Table 3. Service quality attributes of past research.

Attributes	Sub-Attributes	*Authors*
Accessibility	Connectivity and route	[16], [19], [21], [22], [24], [29], [27], [30], [33], [37], [38], [54]
Reliability	Interchange	[16], [22]
	Punctuality	[24], [19], [28], [27], [31], [34], [38]
	Frequency	[16], [19], [21], [22], [28], [30], [33], [34], [38]
	Fare	[16], [19], [21], [22], [29], [28], [27], [33], [34], [35], [37], [38]
	Ticketing	[24], [19], [28], [31], [34], [37], [38]
	Walkability	[27], [34]
	Waiting and travel time	[29], [27], [33], [34], [37]
	Ease of use	[21], [30], [35], [38]
Information	Information	[16], [19], [21], [22], [24], [29], [27], [28], [34], [35], [37], [38], [54]
Safety	Safe	[21], [19], [22], [24], [29], [27], [30], [31], [33] [34], [35], [38], [54]
Comfort	Comfort	[16], [19], [22], [21], [31], [33], [35], [37], [38]
	Crowdedness	[29], [27], [37], [54]
	Facilities	[29], [19], [28]
Customer Service	Clean and neat	[16], [22], [28], [27], [30], [31], [34]
	Staff's politeness	[19], [28], [31]
	Responsive	[16], [19], [21], [27], [30], [31], [54]
	Operation hour	[30], [34]
	Driving behaviour	[29], [30], [33], [34]

Different case studies have different priorities in maintaining service quality of the public transport. A practical public transport service is required for the corporate's image [29], which it indicated the service quality. The image of public transport is gathered through experience, word-of-mouth from social media [16]. Since social media is being used heavily nowadays, the impression on public transport matters. For the case in Kuala Lumpur, the word-of-mouth from social media have more negativities on public transport, in fact, it was opposite with the responds on field [16]. The comments on postings illustrated the image of public transport, which may influence the readers. As a return, people's perception on public transport affects the utilisation of the service. There is a positive correlation between satisfaction with public transport services and overall trip satisfaction [48]. This is extremely important for public transport users because they tend to repeat the behaviour when they were satisfied with the experience [16], [41].

5.8. Motivation

Numerous public transport studies described motivation as the pull factors of people in utilising public transport. This research strongly believes that there are push factors in utilising public transport among tourists. People with leisure-based motivation was found to be satisfied with collective mode of transport more than professional-based motivation [48], which indicated that there were differences of motivation and satisfaction between these two groups. The push factors, or intrinsic motivation is the activities that bring enjoyment. Past research rarely identified the push factors of utilising public transport. Therefore, this research investigated tourism field in obtaining the intrinsic motivation. As described in Section 2, intrinsic motivation derives from activities that bring enjoyment. Table 4 shows the push factors or known as intrinsic motivation of tourists in travelling. In the end, this research outline three themes of intrinsic motivation that might occur among tourists while travelling with public transport.

5.9. Relaxation.
Relaxation may occur in that new places provide an escape from the stresses of home and therefore a more relaxing vacation [61]. It is expected that safety issues should not occurred in the public transport. Fear is no one's idea of a good time, so travellers travelling in fear or without a sense of safety [42]. Tourism destinations are most likely to be bounded with relaxation purposes, which explains the result by [42], [43], [47]. In the case of public transport, tourists were able to relax while doing something else on-board during commuting [38], such as reading, texting, on phone, looking out the window and more [62]. It was proven that travelling with public transport is more relaxing than driving [25] in unfamiliar cities. This illustrated that relaxation moment in the public transport gives the opportunity for travellers to work on something else.

5.10. Cultural experiences.
The act of city exploration has been extensively studied in tourism studies, but no precise definition exists. Nevertheless, numerous studies have described the city-exploration activities of urban visitors. City exploration require engaging with the cities and locals. For instance, trying locals' food [40], to see the cultural places [42], [43] and to see the locals' lifestyle [43] are some examples of engaging with locals' activities and lives. In the context of public transport use, some tourists find it easier to explore Munich by travelling with public transport [38], Similarly, the Hop-On Hop-Off shuttle provides tourists with access to tourist destinations [63]. The Hop-On Hop-Off bus provides direct routes to tourist destinations, an audio guide, and extended stops for tourists to take photographs [64]. This means, exploring city could be done with public transport by the help of guides and engage with sightseeing as well. Public transport act as a mode to help tourists explore the city, while the main purpose was for commuting. However, Hop-on Hop-Off bus is not considered as public transport, but it is a commercial bus. Nevertheless, it does not prohibit tourists from exploring cities in the public transport, as long as the public transport has city views. As described by [65], tourists' "eyes" are the basis of sightseeing activity, which also involves the views they are seeing.

5.11. Personal Relationship.
Personal relationship, which involves the tourists with another individual is one of the themes found while travelling. Having time with families and friends [40], [43] and interacting with others [40], [47] are found to be as something enjoyable for some tourists. For these tourists, travelling for leisure is the best moment for them to spend time with their families, especially when they aimed for relaxation. This phenomenon is almost similar with another type of tourists, which they feel like interacting with locals was found as something fun to do among backpackers [66], [67]. Public transport is one of the modes to engage with locals [68], [69] because that is the opportunity for the occurrence of engagement with them. This shows that tourists could interact with locals by impersonate their actions, through commuting with public transport. According to [70], the concept of co-presence, refers to the minimal level of social interaction that occurs when two or more individuals demonstrate their awareness of each other's presence through various means, such as the use of physical space, and indicate their availability for potential interaction, such as individuals in resting areas. On the other hand, focused interaction refers to the collaborative effort of individuals to sustain a singular point of attention, as observed in activities like conversations and playing games. This means, tourists who utilise public transport have the opportunity to engage in co-presence interaction rather than focused interaction.

This review also added new attributes in the themes to compliment with the case of public transport use among tourists. These attributes have the possibility of tourists to perform while utilising public transport. Relaxation, cultural experience and exploration and personal relationship are found to be the relevant themes of intrinsic motivation in commuting with public transport. **Figure 3** shows the proposed framework of extrinsic and intrinsic motivations based on the theory.

Table 4. Push factors attributes of past research

Themes	Attributes	*Authors*	*New Attributes*
Relaxation	Get away from home	[40], [46]	
	To seek a unique experience	[42], [43], [47]	
	To relax, can do something else on board	[39], [42], [45], [46], [38]	Have time to do other things
	To decrease work pressure	[42]	
Cultural experience and exploration	Discover the locals' food, a better way to explore the city	[40], [38]	
	To see the cultural places, enjoy the surrounding	[39], [42], [43], [45], [46], [38]	City exploration
	To see the new lifestyle	[43], [46]	Sightseeing
Personal Relationship	Families' ties	[42], [43]	
	Interacting with tourists by recommending them	[42], [47]	
	Need a place to enjoy with friends/ To experience a new tourist destination with my friends	[39], [41], [42]	
	To be with similar people	[47], [38]	Engage with people
	Place attachment	[41]	

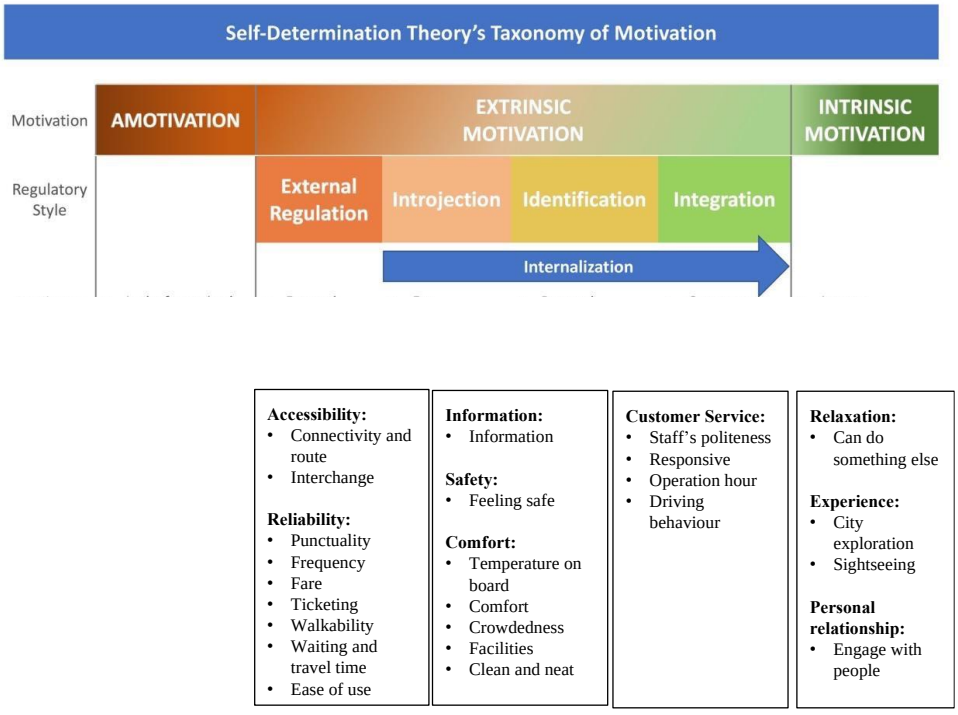

Figure 4 Framework of extrinsic and intrinsic motivation for tourists' use of public transport

7. Conclusion

Public transport studies have been widely discussed, especially on the service quality and passengers' satisfaction. This research aimed to identify the intrinsic motivations of tourists in utilising public transport. Most of the results show that tourists tend to be influenced by extrinsic motivations, followed by intrinsic motivations [41], [39]. Identifying intrinsic motivations required extrinsic motivations as well.

Based on previous research, there are many attributes of service quality of public transport, and this research simplifies the attributes. This research listed generally on the service quality because it is assumed that the service quality and satisfaction attributes could be different in different context. Meanwhile, on the intrinsic motivations, this research reviewed many tourism studies to identify the intentions and activities that tourists seek for enjoyment. In the end, three themes were found to be applicable in this research.

However, there are several limitations of this research. First, this research did not reveal the service quality that users consider before embarking their journey. It was hypothesised that service quality and their satisfaction on the service could be different. Secondly, this research has not being tested in field work. Therefore, it is suggested to test this framework to verify both the intrinsic and extrinsic motivations in utilising public transport among tourists.

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The Impact of Vandalism on Public Infrastructure Development in Nigerian Cities: A Systematic Literature Review

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Abstract. The increasing rate of public infrastructure development vandalism in Nigeria has led to the devastating delivery of economic services and hindered sustainable economic growth.The impact of vandalism incidents on the nation's infrastructure development is so terrible and worthy of investigation. This paper aims to conduct a general review of previous studies on the impact of vandalism on public infrastructure development in Nigerian cities, harmonise the essential features of the subject, and fill the literature gap. A Systematic literature review methodology was used to include the papers that presented sufficient methodological quality. Seven papers published between 2018 and 2022 were finally included. The research methodology adopted by the reviewed papers was categorized by survey, case study, and archival. The research findings revealed factors such as unemployment, poverty, insecurity, corruption, sabotage, conspiracy, loss of moral value, and unequal distribution of economic resources as the causes of public infrastructure development (PID) vandalism. Property damage,environmental decay, and economic loss were identified as the impacts of vandalism on public infrastructure development. The reviewed papers suggested that host community involvement, adequate security measures, egalitarian policy, and job opportunities for the youths could curb or minimize the incidence of public infrastructure development vandalism in Nigeria and other African countries. The study concluded that it is necessary to reduce the dearth of studies on the impact of vandalism on public infrastructure development (PID) in Nigeria and to increase the adoption of a systematic review approach in this area of research to fill the literature gap. Moreover, a framework for deterring public infrastructure development vandalism will be necessary for future research to protect the environment from urban decay and save the Government from accumulated infrastructure investment loss.

1. Introduction

Public Infrastructure development (PID) is a driving tool for advancement within the African continent and a major facilitator for productivity and sustainable economic growth. Its immense contribution towards human development, poverty reduction, and the accomplishment of the continent's Millennium Development Goals (MDGs) cannot be overemphasized. PID is defined as the infrastructure facilities and systems developed, owned, and made available for use by the government. It includes all basic amenities open to general public use, facilitating economic service delivery and enhancing the masses'

standard of living. It includes public utilities such as roads, electricity, telecommunication, housing, and water supply among others.

However, Nigeria is experiencing a huge infrastructure gap in the area of roads, electricity, railway, hospitals, pipelines, schools, housing, seaports, and airports as a result of the incidence of vandalism in our environment [1]. Similarly, despite having abundant natural and human resources, the nation nevertheless struggles with poor infrastructure, which contributes to the urgent worry of vandalism of assets and infrastructure [2]. This criminal act is so rampant in Nigerian cities that it was ranked as the world's number one in power assets vandalism [3]. Vandalism is one of the common property crimes in any society, especially in developing countries, where the sharing of economic resources is very important. It is a mischievous act of destruction in any form caused to property or any utility owned either by Government or private.

Vandalism has been identified in different studies as the major hindrance to sustainable economic growth in most developing countries. According to [4], vandalism is perceived as an environmental issue affecting green life performances in the cities of the world. Similarly, [5] identified Property damage and economic loss as the highest impacts of petrochemical vandalism. Another report, [6], from its finding argued that vandals were killing the transport system and thus discouraging investments in rail infrastructure development in Nigeria. Likewise, [7] stressed that the Nigerian Government lost billions of Naira annually on pipeline vandalization and crude oil theft. Meanwhile, the country loses over 300,000 barrels of crude oil per day (bpd) to oil pipeline vandalism [8].

On the other hand, many researchers have investigated the causes of the rampant incidence of public infrastructure development vandalism in Nigeria and they figured out diverse influencing factors responsible for the reoccurrence of the incidents. For instance, [9] argued that high population growth rates with high unemployment rates, poor wages, poor living conditions, urban culture, improper urban transport management, poor health care system, housing crises, and more are the causes of property crime in Africa. Moreover, [10], argued that vandalism is driven by Government's non-egalitarian policy, unemployment, and poverty among others. Another study carried out in the United States of America, the United Kingdom, and Australia by [11] revealed a vivid correlation between arson attacks and the conspiracy connecting the 5G network and COVID-19.

In addition, [5] in their study identified sabotage and conspiracy as the root causes of infrastructure development vandalism. Meanwhile, Shackleton and [12] perceived the causes of public infrastructure development vandalism to include substance abuse, low level of education, unemployment, and loss of hope for the future among others. Furthermore, [13] in their investigation on the efficiency and performance of the facial security technology (FST) integration against theft and vandalism, and other physical security threats in private oil and gas company facilities in UAE. The study shows that there was a positive and statistically significant relationship between the physical security culture and physical security performance, facial recognition technology efficiency and its integration within the physical security system, physical security threats and physical security performance, as well as external factors and physical security performance. The study concluded that the successful integration of facial recognition technology (FRT) into the physical security system could introduce a new approach of protection for essential infrastructures as an alternative to other security control such as CCTV surveillance limitation.

From the literature review so far, it is evident that none has considered systematic review in its methodology besides, none has considered a framework on how to curb or prevent public infrastructure development vandalism except [13], though its study focused on how to protect infrastructure development of private industries only, but not inclusive of public infrastructure development (PID). Thus, this study aims to conduct a general review of previous studies on the impact of vandalism on public infrastructure development, to harmonize the essential features on the subject and fill the literature gap. The study objective is to examine existing studies on the impact of vandalism on public infrastructure development (PID) with the aid of scientific methodology.

The remainder of this paper is organized as follows: Section 2 described the methodology adopted for the study, section 3 explained the results and discussion of the study, and finally, section 4 contains the conclusion and indication for future direction.

2. Methodology

[14] defined a systematic literature review as a review of clarity questions that utilize systematic and explicit approaches to recognize, choose, and critically appraise relevant studies and collect and analyze data from such studies included in the review. It could be defined as "a set of scientific approaches in reporting, previous studies with the expressed purpose of reducing the error of bias, through identifying, appraisal, and synthesizing of all relevant studies in whatever paradigm to provide an answer to some set of questions" [15]. The method adopted for conducting this research is a systematic literature review (SLR) and its reporting rests on the framework of the "Search Strategy-Selection Criteria-Quality Assessment-Data Extraction" approach just as shown in Figure 1.

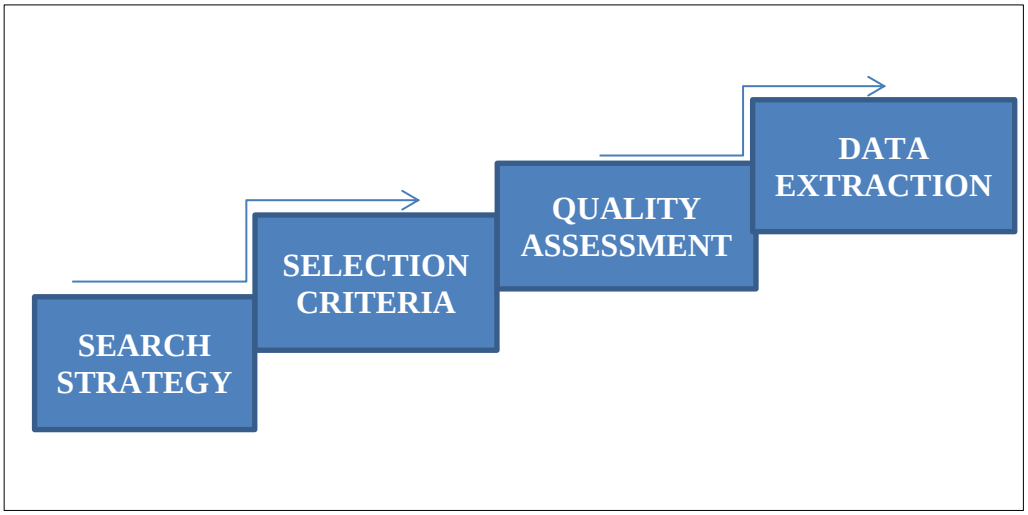

Figure 1. Systematic Literature Review (SLR) Framework

2.1 Search Strategy

The methodological approach commenced with a search string to identify relevant published articles on the topic. This search was conducted in two separate databases: Scopus and Web of Science using the keywords "vandalism and infrastructure" while all searches spanned across a combined field of abstracts, keywords, and document titles. The result from this first stage of the search revealed 237 documents. The reason for limiting the online search to these two databases is because of their recognition as one of the world's most trusted publisher-independent global citation databases.

2.2 Selection Criteria

The selection criteria were based on the preferred reporting items for-systematic reviews-metal-analysis" (PRIMA) statement [14]. The researchers focused on the mapping existing literature on infrastructure development vandalism across all fields of study, searching then prone down to include: publications between 2018 and 2022 (because we are concerned with recent publications and new ideas); publication in the English language only; journal articles; conference proceedings, book chapters; all countries. Thus, a total of 111 research articles were excluded from the record at this stage.

2.3 Quality Assessment

This study is based only on original research articles, review papers, conference proceedings, and book chapters. To maintain the quality of the review, article abstracts were read carefully and purified to

ensure the quality and relevance of academic literature included in the review process. A careful evaluation and filtration of the research papers were conducted at this stage by reading the full text of each article. As such, 18 articles were selected based on the aforementioned inclusion and exclusion criteria. An overview of the inclusion and exclusion process at every stage is shown in the PRISMA flowchart in Figure 2.

2.4 Data Extraction

This is the final stage of the methodology, where the researchers cross-checked their data management spreadsheet to resolve any disagreement on the data selection criteria. More so, all duplicates were cross-checked from the two databases thoroughly. Subsequently, all included items were extracted and coded. At this stage, 7 articles were selected and the characteristic for the extraction are as follows:
(a) Article must be an original paper, journal article, or conference proceedings, and book chapter
(b) Article must be written in the English language from any field of study
(c) Extracted articles were limited to publication between 2018 and 2022
(d) Extracted papers were from all countries.

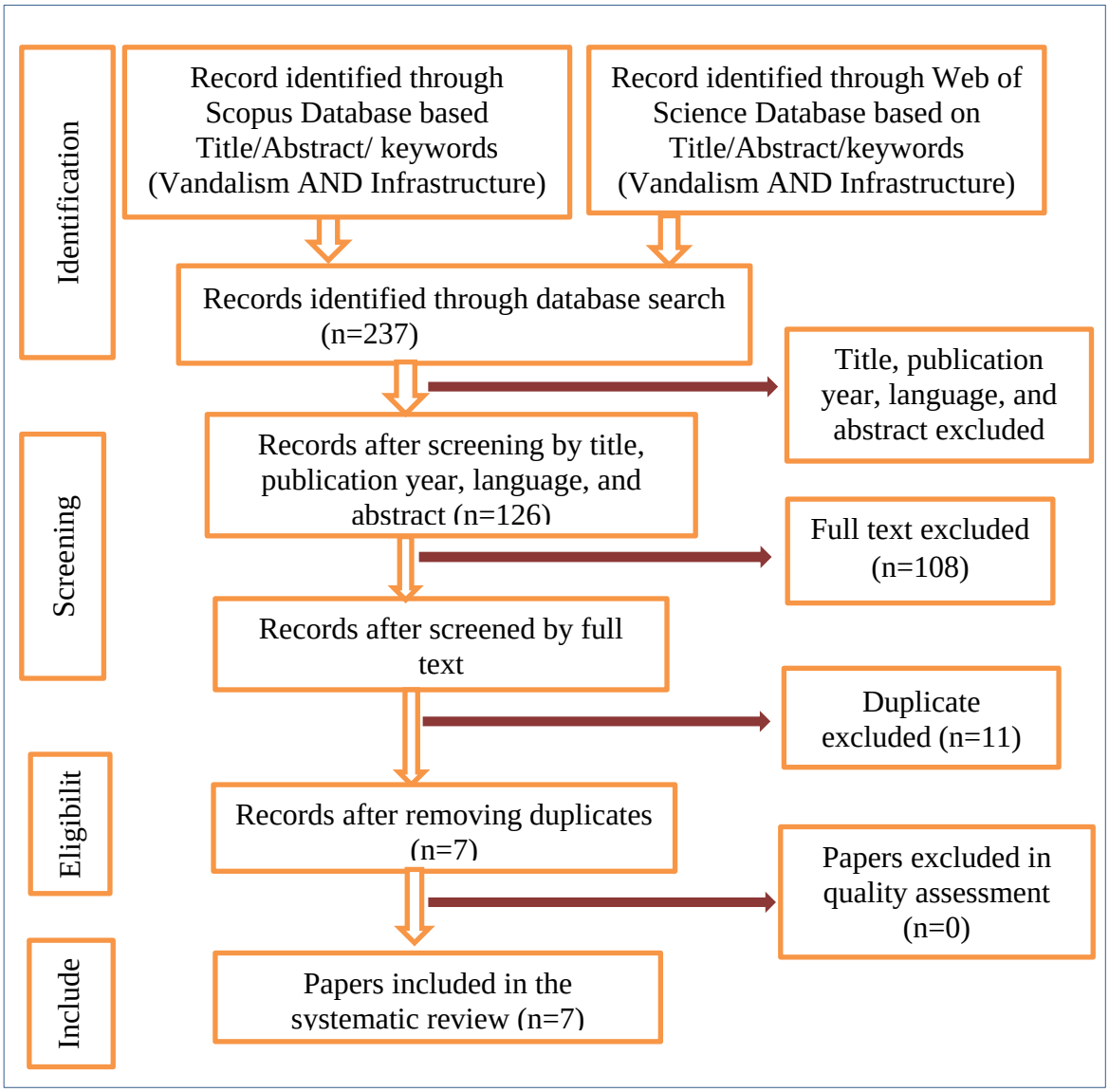

Figure 2: PRISMA Flowchart for the Selection Process

3. Result and Discussion

The attempt to implement a systematic literature review was prompted by the need to summarize various factors that aid the incidence of public infrastructure development vandalism and its impact on Nigerian socio-economic development to harmonize the essential features on the subject and ultimately to aid the development of a framework that could curb the vandalism incidents. This section described and explained details of the results and methods adopted in each study reviewed on the impact of vandalism on public infrastructure development (PID).

3.1 *Illustration of Papers by Year of Publication*

Seven (7) papers were recognized to be relevant and useful for the study out of the initial Two Hundred and Thirty-seven (237) papers identified from the online databases; Scopus and Web of Science. All these Seven included papers are journal articles. Moreover, 2021 has the highest number of publications with Three (3) published papers and a percentage rate of 42.86%, followed by 2018 with Two (2) published papers and a percentage rate of 28.57%. While the year 2020 and 2022 recorded only one (1) publication each from the included papers. This statistical information is illustrated in Figure 3.

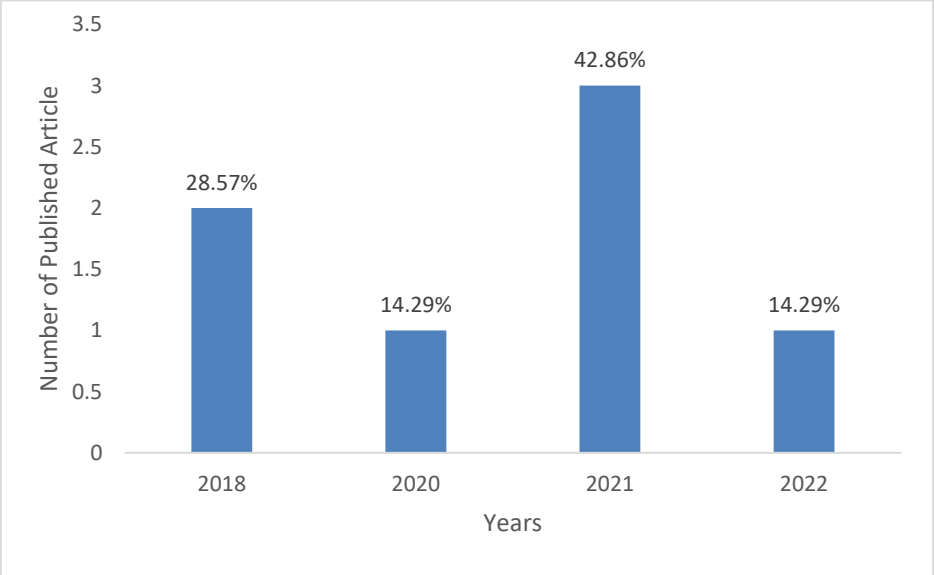

Figure 3: Papers Publication Graph

3.2 *Illustration of Screened Papers Distribution*

The final list of papers considered from the digital library after the exclusion and inclusion criteria is Seven (7) from the year 2018 to 2022. According to Table 1, Mdpi has the highest number of publications with 3 papers and a percentage rate of 42.86%, followed by Elsevier with 2 publications and a percentage rate of 28.57%. While Sage Publications Ltd and Vilnius Gediminas Tech Univ. have one published paper each and a percentage rate of 14.29% each.

Table 1: Screened Papers Distribution Frequency.

S/N	Digital Library	Frequency	Percentage (%)
1	MDPI	3	42.86
2	ELSEVIER	2	28.57
3	SAGE PUBLICATIONS LTD	1	14.29
4	VILNIUS GEDIMINAS TECH UNIV	1	14.29
	Total	7	100.00

3.3 *Description of Papers by Research Method*
Table 2 result, shows that the majority of the papers screened from the database adopted both case study and survey approaches for data collection by a percentage rate of 42.86% each. While the archive method was used for data collection by only one paper 14.28%.

3.4 *Description of the Papers Review by Factors*
All the studies reviewed identified various factors that often led to public infrastructure development vandalism. Among these factors are, Government inequalities, poverty, unemployment, and sabotage [10]; sabotage and conspiracy [5]; illiteracy, unemployment, and loss of hope for the future [12]; conspiracy and geographical location [11] and others. Details of these factors and other features of vandalism incidents are shown in Table 3.

3.5 *Illustration of the Papers Review by Impact*
According to the illustration in Table 3, the impact of vandalism on public infrastructure development was identified to include economic loss to the nation, discourage investment in public utilities, and urban facilities decay among others. For example, [16] argued that the adverse effects of vandalism were the increase in maintenance costs in the transportation sector. Moreover, [11] opined that infrastructure breakdown and social unrest were impacts of telecommunication infrastructure vandalism. Meanwhile, [5] identified property destruction and economic loss as the impact of petrochemical vandalism. In another study, facilities littering, and graffiti were identified as side effects of monument tourism vandalism [17]. These essential features are depicted in Table 3.

However, none of these reviewed papers considered any framework on how to prevent or curb public infrastructure development vandalism. Although, [13] opined that the successful integration of facial recognition technology (FRT) into the physical security system could introduce a new approach to protection for essential infrastructures as an alternative to other security control such as CCTV surveillance limitation. However, the study focused mainly on private oil and gas companies' infrastructure protection not inclusive of public infrastructure development (PID).

Table 2: Papers by Research Method.

S/N	Research Methodology	Number of Papers	Percentage (%)
1	Case Study	3	42.86
2	Survey	3	42.86
3	Archival	1	14.28
	Total	7	100

4. Conclusion
In this study, we have demonstrated explicit research on a systematic literature review of the impact of vandalism on public infrastructure development based on methodology, impact, year of publication, paper frequency distribution, factors, study population, and sample size in the last five years (2018 – 2022). The research methodology adopted by the reviewed papers was categorized by survey, case study, and archival. Likewise, public infrastructure development vandalism influencing factors were categorized by Government inequalities, poverty, unemployment, sabotage, conspiracy, theft, illiteracy, location, and terrorism among others. Moreover, the study findings identified economic loss, urban decay, and discouraging public infrastructure investment as the major impact of vandalism. Generally,

public infrastructure development vandalism is a nefarious activity mitigating the delivery of socioeconomic services of any nation, especially in the African continent that needs immediate Government intervention.

Besides, it was observed that there was a dearth of systematic literature reviews on public infrastructure development vandalism and framework on how to prevent it.

We need to increase studies on the impact of vandalism on public infrastructure development (PID) and the adoption of systematic literature review in this field to fill the wide gap in the literature. A framework for the deterrent of public infrastructure development vandalism will be necessary for future research to protect the environment from urban decay and to reduce Government costs of maintenance and repairs on public utilities.

Table 3: Summary of Main Features of the Included Papers Review.

Authors/Year	Paper Title	Type of Study Population and Sample Size	Research Methodology	Factors/Indicators/Variables	Results and Discussions
Ikejemba and Schuur (2018)	Analyzing the impact of theft and vandalism in relation to the sustainability of renewable energy development'	• Project developer/financers/Project beneficiaries • 144	• Survey • Quantitative data analysis • Questionnaire	• Government inequality • crime to survive • sabotage • human security interference • societal security interference • technical security interference • Types of offenders	The study through the respondent's response confirmed theft and vandalism of Renewable Energy Projects in the study area. 56% of the participants were pushed to vandalism and theft by Government inequality distribution of resource and development projects, 36% were instigated by the will to survive (poverty), while 8% were as a result of sabotage.
Khalilikhah & Heaslip (2018)	Prediction of traffic sign vandalism that obstructs critical messages to drivers	• Utah Department of Transport (UDoT) • 97000	• Survey • Quantitative data analysis • Survey	• Mount height • Traffic sign • Road types • Sign colour • Exposure • Localized condition • Vandalized sign	while warning signs which are typically colour yellow had the highest vandalism rate of 3.69%, followed by the red sign with 1 Finding show that arrow signs had the highest rate of vandalism followed by text signs at 9%. However, among all the sign attributes, the height of the

					sign above the road was by far the most important variable. In addition, traffic sign vandalism causes a decline in the overall legibility and visibility of signs which could result in an increase in road accidents. It also leads to an increase in maintenance costs incurred by transportation agencies.
Meese et al., (2020)	COVID-19, 15G Conspiracies and infrastructural future	• News reports and Media Publications •	• Case Study • Quantitative data analysis • Secondary data	• National security • 5G network infrastructure • Economic Stability • Geopolitical • covid-19 • conspiracy theories • Protest/Arson	Evidence of a public demonstration (protest) against the 5G telecommunication network led to arson attacks on 5G towers across the United Kingdom. 77 towers were set on fire between April & May 2020 and an assault on 5G mobile Technicians. There is a vivid correlation between arson attacks and the conspiracy connecting the 5G network and COVID-19
Iaiani et al. (2021)	Analysis of events involving the intentional release of hazardous	• Data-based information	• Archival Research	• Location • Vandalism	Sabotage and conspiracy were identified as the root causes of petrochemical

	substances from industrial facilities	• 313	• Qualitative Database analysis • Correspondence Analysis (CA)	• Terrorism • Theft • Sabotage • Cybercrime • Insider • Petroleum & Chemical • Pipeline • Transportation • Energy production • Hazardous material • Explosion • Fire • Loss of process control	facilities' vandalism. Property damage and economic loss were identified as the highest impacts of petrochemical vandalism. Vandalism and other security threats identified in the study have a strong correlation with the transportation of hazardous substances and theft of materials with oil and gas pipelines.
Almasri and Ababneh (2021)	Heritage Management: Analytical study of tourism impact on the Archaeological site of Umm Qais- Jordan	• International and local visitors and key stakeholders (Tourism manager, Museum curator, Ticketing officer etc.) • 7	• Case Study • Qualitative data analysis • Interview and Observation/Checklist	• Power • Telecommunication • Septic services • Water & sanitation services • Visitor centre • Tourism police station • Antiquity office • Vegetation & wide life degradation • Air & water pollution • Archeological erosion	Vandalism negatively affects the Archaeological monument tourism service, facilities, and historical structures in Umm Qais. Graffiti, lightning damage, and sanitary unit littering were identified as the effects of vandalism in the study area.

				• Littering • Graffiti • Noise & congestion	
Shackleton and Njwaxu, (2021)	Does the absence of community involvement underpin the demise of urban neighbourhood parks in the Eastern Cape, South Africa	• Residents of Adelaide, Alexandra, Bedford, Bathurst, Kenton & Makhanda towns • 47	• Case Study • Qualitative Data Analysis • Interview	• Fence proportion • No. of the park with a fully intact fence • No. of the open access point • Infrastructure damage • Litter score • Dung score • No. of domestic stock • No. of workers • Location • Altitude • Population • Unemployment rate • No. of park assessed • Park monitored	There was an increase in the level of damage made to amenities and infrastructure available in the parks. Items vandalized include metal equipment, windows, and block walls among others. Reasons perceived as the cause of vandalism of parks infrastructure are substance abuse, low level of education, unemployment, and loss of hope for the future. Loss of public amenities and investment is the perceived impact of vandalism
Al Zaabi and Zamri (2022)	Managing security threats through touchless security technologies Al: An overview of the UAE oil and gas industry.	• UAE Oil and Gas Company's Employees • 371	• Survey Strategy • Quantitative data analysis • Questionnaire Instrument	• physical security culture (PSC) • physical Security performance (PSP) • facial recognition technology efficiency (FRTE) • physical security threats (PST)	The effect of physical security culture on the performance of physical security was positive and significant (β=0.163, P<0.001). Facial recognition technology integration had a positive and significant effect on

				• external factors (EF) • facial recognition technology integration (FRTI)	the performance of physical security (β=0.241, P<0.001). The effect of physical security threats on the performance of physical security was positive and significant (β=0.120, P<0.006). External factors had a positive and significant effect on the performance of physical security (β=0.254, P<0.001). The study opined that FRT could be a new approach to infrastructure protection against vandalism

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Land Use Practices Causing Climate Change: A Review

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Abstract. Houses, business premises or complexes, industrial spaces, or buildings that are built for the social and economic development of a country are carried out through progressive land use. However, inefficient use of land has emerged as one of the causes that contribute to the emergence of climate change in the pursuit of each nation's development growth. This have being stated in past research whereby, 1/3 of the biggest contributors to the occurrence of climate change such as hot weather, droughts, floods, and others in the world today is from uncontrolled and unsustainable land use factors. Therefore, the objective of this paper is to identify land use activities that contribute to climate change. This is achieved by reviewing the existing literature based on past research findings. The insight of this paper will assist authorities to strategize how to control land utilization. The inefficient use of land, which will contribute to the occurrence of climate change, needs to be controlled and taken seriously by the government. Such measures must be taken to ensure that land development for economic and social growth does not overlook or harm the environment, which will eventually be accelerating climate change.

1. Introduction

The basis for numerous developmental activities, including houses, enterprises, and industries, is laid by land use, which is crucial in determining the economic and social landscape of a country. In order to support urbanization and population increase, as well as to promote economic growth and social well-being, land resources must be used effectively [1]. However, the importance of land use goes beyond how it affects human activities right away since it is now widely acknowledged as a significant component in global environmental problems, most notably climate change [2] as shown in Figure 1 below. Concern over the connection between land use and climate change has grown in importance as we work towards sustainable development. The management and use of land can have a direct impact on the onset and escalation of climate change events [3]. This relationship has previously been shown by prior studies, which found that unrestrained and unsustainable land use practices are responsible for around one-third of the key contributions to climate change, including severe weather, droughts, floods, and other associated phenomena [4]. Understanding the significance of land use activities in determining the trajectory of climate change is crucial for enlightened policymaking and strategic planning as the effects of climate change continue to be felt globally.

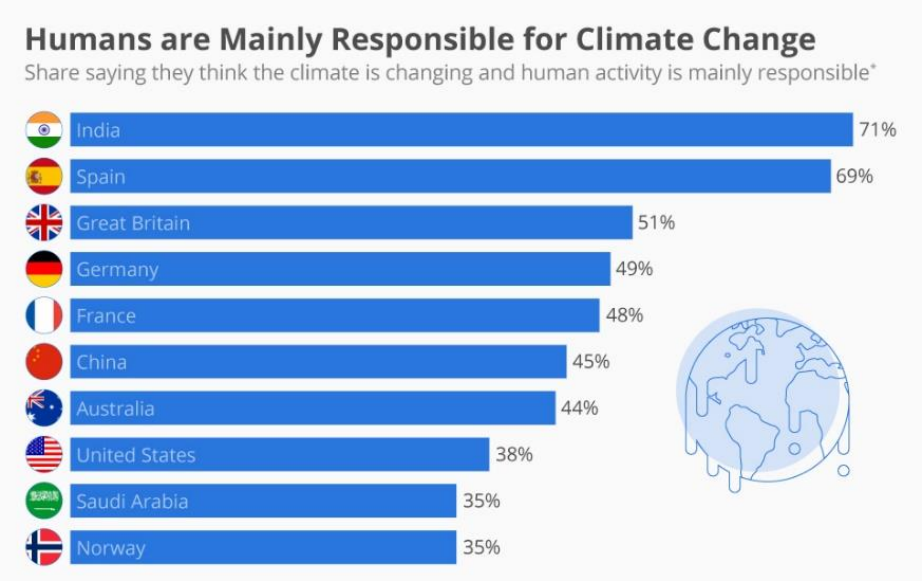

Figure 1. Human activities contribute to Climate Change by selected country.

The link between land use and climate change stems from the intricate relationships that govern the Earth's delicate environmental balance. The inefficient use of land stands out as a crucial factor in the current worldwide efforts to combat climate change and advance sustainable development. Uncontrolled deforestation, urban development, and intensive agriculture have been highlighted as the main contributors to climate change, which has had a significant negative impact on ecosystems and natural resources [5]. For example, extensive deforestation reduces the Earth's ability to absorb atmospheric carbon dioxide, which amplifies the impacts of global warming and adds to the emission of greenhouse gases [6]. Likewise, urban sprawl leads to the formation of urban heat islands, elevating local temperatures and disrupting regional climate patterns [7]. These intricate interactions underline the urgent need for comprehensive research into specific land use activities that play a significant role in driving climate change.

2. Literature Review

2.1. Land Administration, Land Use, and Climate Change

Land administration and effective land use planning play a pivotal role in sustainable development, encompassing the management, allocation, and utilization of land resources for various societal needs. Land administration is a crucial factor in determining how humanity will respond to climate change [8]. The way humanity uses and manages land resources has a direct influence on ecosystem resilience, greenhouse gas emissions, and human capacity to adapt to the effects of climate change [9]. In order to manage, allocate, and use land resources for varied purposes, competent land use planning and administration are essential components of sustainable development in order to mitigate climate change effects.

The rules, procedures, and organizations involved in administering land tenure, land rights, and information pertaining to land are referred to as land administration. It includes the institutional, legal, and technical frameworks that control who owns the property, how it should be used, and how it should be managed. Secure land tenure, sustainable land use, and fair access to land resources are all supported by efficient land administration [10]. On the other hand, land use refers to the human activities and practices that occur on the land, including agriculture, forestry, urban development, infrastructure construction, and conservation efforts [11]. It encompasses the decisions we make regarding land allocation, land development, and resource management. These decisions have far-reaching implications for the environment, society, and the climate system.

Climate change, driven primarily by human-induced greenhouse gas emissions, poses significant challenges to our planet. It leads to rising global temperatures, changes in precipitation patterns, sea-level rise, and increased frequency and intensity of extreme weather events [12]. These changes have direct and indirect impacts on land resources, ecosystems, and human settlements.

2.2. The Relationship between Land Use, and Climate Change

Numerous interrelated elements that have a significant impact on the sensitive climatic system of Earth are included in the complex interaction between land use and climate change. Along with land use practices, human civilizations engage in a variety of activities that have a direct and indirect influence on climate change, resulting in significant changes to landscapes and the distribution of greenhouse gas emissions [13] as shown in Figure 2 below. Deforestation, the extensive clearing of forests to make way for urban growth and agricultural expansion, is one of the most notable land use changes. This practice releases large amounts of stored carbon in the form of carbon dioxide (CO2), a significant greenhouse gas that promotes global warming [14]. Deforestation has been ascribed as a pivotal driver of CO2 emissions, contributing to approximately 10% to 15% of total global greenhouse gas emissions [15]. The Intergovernmental Panel on Climate Change (IPCC) underlines that deforestation not only diminishes the Earth's capacity to absorb CO2 but also prompts the release of massive carbon reservoirs that have accrued over centuries. Consequently, this release of carbon into the atmosphere accentuates the greenhouse effect, culminating in the retention of heat and consequent global warming and climate change [16].

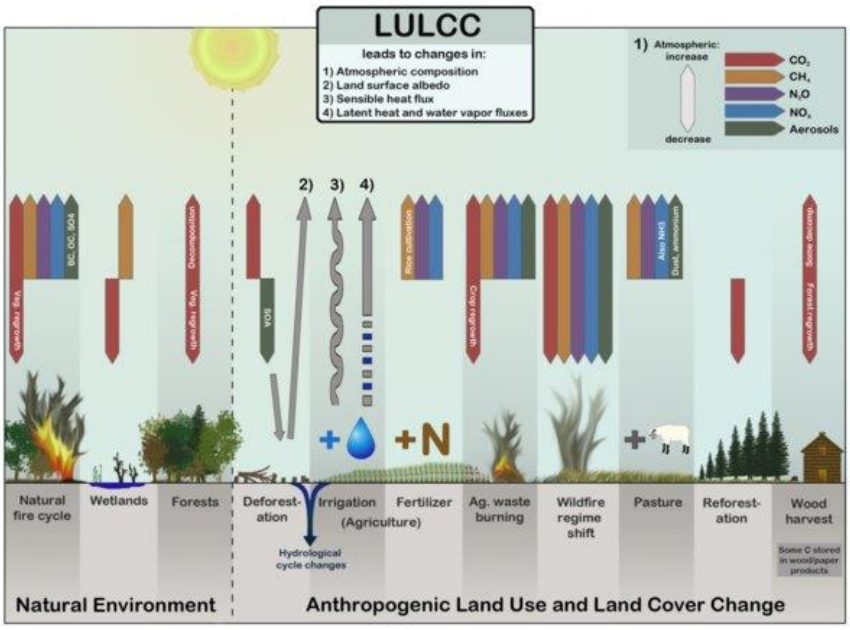

Figure 2. A schematic illustration of the climate impacts of land use and land cover change.

Unsustainable land use patterns help to magnify the effects of climate change by promoting the destruction of vital carbon sinks and the emission of more CO2 into the atmosphere. Consider the negligent management of peatlands, which results in the draining and degradation of these ecosystems and the release of significant volumes of CO2 [17]. Peatlands serve as invaluable carbon sinks, proficiently sequestering carbon and impeding its release into the atmosphere. Nevertheless, when subjected to ill-advised land use practices, such as drainage for agricultural or forestry purposes, peatlands lose their efficacy in retaining carbon, thus engendering greenhouse gas emissions and exacerbating the climate change crisis [17].

Furthermore, the conversion of natural ecosystems, exemplified by forests and wetlands, into alternative land uses, engenders not only a loss of biodiversity but also engenders disruption in carbon sequestration processes, thereby intensifying the accumulation of greenhouse gases in the atmosphere [18]. Natural ecosystems play an indispensable role in capturing and preserving carbon, effectively impeding its release into the atmosphere. However, the degradation or conversion of these ecosystems for human endeavors compromises their capacity to serve as carbon sinks, subsequently resulting in heightened CO2 concentrations in the atmosphere and furthering the severity of climate change [19].

The far-reaching consequences of land use changes on climate patterns transcend the scope of greenhouse gas emissions. These changes engender profound impacts on energy balance and hydrological processes, facilitated by the transformation of land cover that alters surface characteristics, including albedo (reflectivity) and roughness, consequently precipitating shifts in energy absorption and distribution. The phenomenon of urbanization, typified by the proliferation of impermeable surfaces and the contraction of vegetated areas, constitutes a paradigmatic example of land use change giving rise to the formation of urban heat islands [20]. Urban heat islands are regions where temperatures soar compared to their rural environs owing to augmented heat absorption and curtailed cooling capacities. These localized temperature disparities intensify heatwaves and profoundly influence local weather patterns, consequently exerting a tangible impact on the climate system.

Given the momentousness of the relationship between land use and climate change, a comprehensive understanding is vital to fostering proactive interventions. The accurate comprehension of the catalysts and implications of land use changes on climate is imperative for devising effective strategies geared towards climate change mitigation and adaptation. Integrated land management practices that prioritize sustainability, exemplified by afforestation, reforestation, and wetland restoration, constitute pivotal strides toward combating climate change while bolstering ecosystem resilience. Governments, policymakers, and stakeholders must forge collaborative endeavors aimed at formulating and implementing policies that champion responsible land use planning and incentivize sustainable practices. Through concerted efforts, we can alleviate the adverse impacts of climate change and safeguard the planet's future for posterity.

Climate change stands as one of the most intricate and pressing global challenges of our time, with far-reaching consequences for the environment, economies, and human societies. Among the myriad of factors contributing to this phenomenon, the significance of land administration and land use practices emerges as a profound driver of greenhouse gas emissions and environmental degradation. As the effects of unregulated growth become more and more obvious, the influence of human activities on the Earth's climate system has attracted more and more attention recently [21]. A significant amount of carbon dioxide and other greenhouse gases are released into the atmosphere as a result of land use practices like deforestation, land conversion for agriculture or urbanization, and improper management of peatlands, which exacerbate the greenhouse effect and contribute to global warming [22]. Deforestation, in particular, is a prominent land use change that poses significant environmental repercussions. As vast forests are cleared for agricultural expansion or urban development, massive carbon stocks, accumulated over centuries, are released into the atmosphere [22]. The Intergovernmental Panel on Climate Change (IPCC) emphasizes that the loss of forests not only reduces the planet's capacity to absorb CO2 but also contributes to the release of massive carbon stocks that have accumulated over centuries [12]. This release of carbon into the atmosphere exacerbates the greenhouse effect, trapping heat and leading to global warming and climate change.

Unsustainable land use patterns worsen the effects of climate change by causing the loss of vital carbon sinks and the release of more CO2 into the atmosphere. For instance, the improper management of peatlands involves draining and degrading these ecosystems, releasing vast amounts of stored carbon as CO2 [23]. Peatlands serve as vital carbon sinks, efficiently sequestering carbon and preventing its release into the atmosphere. However, when subjected to improper land use, such as drainage for agriculture or forestry, peatlands lose their capacity to retain carbon, contributing to greenhouse gas emissions and intensifying the climate change crisis [23]. Moreover, land conversion and urbanization have far-reaching consequences on climate patterns and exacerbate the urban heat island effect. The

transformation of land cover can modify surface characteristics, such as albedo (reflectivity) and roughness, leading to changes in energy absorption and distribution [24]. Urban heat islands are regions with elevated temperatures compared to surrounding rural areas due to increased heat absorption and reduced cooling capacities. These localized temperature variations can exacerbate heat waves and impact local weather patterns, further influencing the climate system.

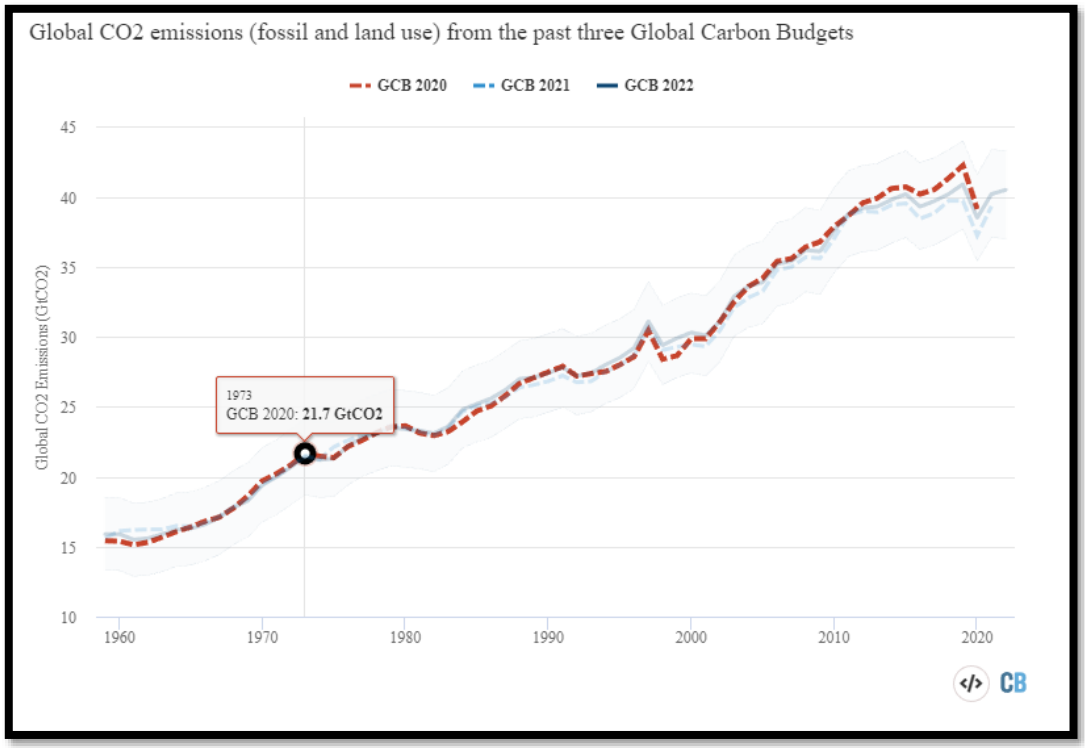

Figure 3. Global CO2 emissions (fossil and land use) from the past three Global Carbon Budgets.

3. Research Methodology

The systematic review carried out in this work is the culmination of a lineage of earlier research initiatives that have collectively probed into the complicated world of land use practices and their interaction with the phenomena of climate change. This review assumes the role of an intellectual torchbearer, illuminating the pathways of knowledge that have been previously studied by meticulously sifting through a wide range of scholarly investigations that have traversed the spectrum of land use activities, including deforestation, urbanisation, and intensive agriculture. Through its systematic methodology, this review not only consolidates the diverse threads of past research but also weaves them into a comprehensive tapestry that reveals the intricate mechanisms through which these practices contribute to greenhouse gas emissions and ultimately steer the trajectory of our changing climate. As a custodian of knowledge, this systematic review not only validates and amplifies the insights of prior research but also identifies the lacunae that continue to persist in our understanding of specific practices and their nuanced climate implications. In doing so, it underscores the ongoing scholarly journey, steering us toward informed policymaking and proactive interventions that are paramount to curbing the adverse ramifications of these practices on our planet's delicate climate equilibrium.

4. Finding and Discussion

To combat climate change effectively, comprehensive strategies encompassing land administration and land use practices are essential. Establishing robust land tenure systems that secure equitable rights to land not only encourages responsible land management but also incentivizes long-term investments in climate-friendly practices, such as reforestation and conservation efforts [25]. In order to ensure

sustainable growth and protect important ecosystems, integrated land-use planning becomes essential. This can protect environmentally sensitive places from development and maintain natural barriers against the effects of climate change, such as mangrove forests, by determining appropriate locations for diverse activities. Promoting sustainable land management practices plays a fundamental role in mitigating climate change. Strategies like afforestation and reforestation enhance carbon sequestration capacities, mitigating greenhouse gas emissions [26]. Agroforestry practices that integrate tree planting with agriculture offer multiple benefits, such as soil fertility enhancement and carbon sequestration [27]. Embracing sustainable land management techniques like no-till farming and conservation agriculture further contributes to combating soil degradation and enhancing carbon storage in the soil. Engaging various stakeholders is critical in developing adaptive and resilient land administration systems that respond effectively to climate change challenges. Collaboration between government organizations, regional communities, scientific professionals, and non-governmental organizations enables the co-creation of climate-responsive land policies that incorporate both conventional wisdom and empirical data [27]. Involving local communities in decision-making processes fosters ownership and acceptance of climate adaptation and mitigation measures, leading to more successful and sustainable outcomes.

To ensure the effectiveness of climate-resilient land administration and land use, continuous research, capacity building, and awareness-raising efforts are necessary. Ongoing research and data collection enables evidence-based decision-making and identification of emerging climate risks. Equipping land administrators, planners, and stakeholders empowers them to navigate the complexities of climate change and integrate climate considerations into their practices [28]. Public awareness campaigns foster a culture of sustainable land use, encouraging individual actions that contribute to climate change mitigation and adaptation.

5. Conclusion

A crucial component of modern sustainable development is the intricate interaction between land use, land management, and climate change. A stable and predictable land tenure ensured by efficient land management encourages investment in land and lessens disputes over its resources. Meanwhile, land use planning optimizes land allocation for various development activities, balancing economic, social, and environmental objectives. These instances show how poor land use planning can exacerbate climate change by boosting emissions, decreasing carbon sinks, and undermining social resilience. Examples include unchecked urban sprawl, infrastructure development without considering climate change, a lack of mixed-use developments, conversion of agricultural land, and planning for fragmented green space. To solve these issues, it is crucial to implement efficient land use planning policies that give top priority to sustainability, climate adaptation, and the preservation of natural resources.

To address these issues, it is crucial to prioritize sustainable land use planning that integrates climate change considerations. This includes preserving forests, protecting agricultural land, promoting compact and transit-oriented development, and preserving and restoring natural habitats. Doing so can mitigate the drivers of climate change and build more resilient and sustainable communities. Through proactive land administration, thoughtful land use planning, and climate-sensitive resource management, we can foster resilience, reduce emissions, and promote sustainable development in the face of climate change. By recognizing the intricate links between land administration, land use, and climate change, we can work towards a more sustainable and climate-resilient future.

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A Systematic Literature Review on 24-Hour City Concept for Urban Landscape Development

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Abstract. The 24-hour City concept is an emerging approach that involves integrating a diverse project to reinvigorate and make city centres safer through the planning and development of physical infrastructure, socio-economic and natural environment components. The strategy used in most Western cities has been determined to be compatible with its dwellers way of life across the regions but has yet to be proven successful in Asian cities development, especially in the urban nightscape development context. One of the major urban planning issues in developing Asian cities is lack of consideration and discussion amongst those who support and oppose the idea of a 24-hour city and how it has an impact on the urban landscape development at all hours of the day and night. Therefore, there is an immediate requirement exists for a systematic literature review (SLR) of the development concept to highlight the current trends and gaps, and outline a foundation for future research areas. This paper focuses on a 24-hour City and urban nightscape development research area and is based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) of 448 published journal works in Scopus and Web of Science indexes as secondary databases from the years 2013-2023. This research aims to reconceptualise the concept and the development of urban nightscapes by readdressing the urban nightlife patterns, diversity, and inclusivity in the context of growing Asian cities' night-time scenes. Thus, by addressing the important research gap which is the values of urban landscape development components such as urban streets and transitional spaces, it is possible to gain a deeper and more rigorous up-to-date understanding in accordance with the needs of growing Asian cities especially in Malaysia in line with sustainable city and community agendas as in Sustainable Development Goal (SDG) and World Urban Forum (WUF).

1. Introduction

Urban life cycles nowadays do not correspond to natural timescales as time is now controlled by machines, people no longer rise with the sun or go to bed with the sun abandoning the conventional timetables of the diurnal life cycle [1][2][3]. Contrary to popular opinion, buildings and urban areas don't just sleep at night, there is also activity during the night in cities [4]. The idea of 24/7 lifestyles or night-time living was an extension of in-homes and private settings to the external spaces during the industrial and social-culture movement that occurred in the nineteenth century [5][6][7][8]. People are more sociable and therefore more likely to dine out during the night in cities, congregate with one another, purchasing food and drinks in the presence of tourists, particularly young adults - helps to promote nightlife [9][10][11][12][13].

Although the phrase "24-hour city" suggests that all city services and activities are always available, it was coined as a result of the growth of the night-time entertainment sectors in cities in Western cities. Thus, this phrase is more appropriately related to leisure and entertainment-related activities [14][15]. Depending on local cultural, social, economic, and political norms, there isn't a particular style or approach to 24-hour city life or nightlife that applies to all cities. Each city needs a unique nightlife strategy that is in line with the social norms that apply there; not necessarily be applied to other cities [13]. Nevertheless, as nightlife has developed in American and European cities, new areas have appeared, new activities have been introduced, and specific night-time behaviours need to be adopted. These cities are lively day and night because of urban residents participate in economic activities and local vernacular culture development. In Asian developing cities, there have been many different reactions to the advent of the 24-hour city concept. It is vital to discover a more suitable nightlife pattern because the social structures developed by mixed-race people in Asian cities have unique and incomparable needs, lifestyles, religions, and cultural practices. Some cities in some Asian countries, including Malaysia, currently can be classified as 24-hour city. due to their establishment; these cities are historical heritage cities like Kuala Lumpur and Melaka **Figure 1(a) and 1(b)**.

Figure 1. (a) Jalan Alor at Kuala Lumpur, comes alive during the night-time. Photo by Yolo [35], and **(b)** Melaka's Jonker Street Night Market provide vibrant experience to the locals and tourists. Photo by Glaizel [17].

To address the issues raised above, this study will thoroughly investigate how the 24-hour city concept is applied to the creation of urban landscapes. It also intends to provide a theoretically and empirically informed knowledge of urban nightlife patterns in night-time settings that addresses concern of diversity and inclusivity in public involvement and urban landscape planning in the context of developing Asian nations [18]. As a result, the following questions can be answered by considering the case study of Asian cities:

- What relationships may be seen between urban landscape planning and the 24-hour city concept?
- What is the research gap according to the city's present nightlife conditions?

2. Methodology

This method is founded on the preferred reporting items for systematic review and meta-analysis (PRISMA) to enable a thorough examination of the subject and the appropriate methodologies relevant to this study. It offers stringent standards for conducting and publishing systematic reviews, as well as a checklist of crucial details to be included in articles describing such reviews [19]. **Figure 2** displays the PRISMA methodology flow chart for research identification, screening, eligibility, and inclusion.

Utilising Tan & Klaasen [18] unique framework of 24/7 environments, 24-hour economies, urban vitality, and time-space challenges, combined with a comparison of two different frames of references

of Asian and Western-Europe case studies (Singapore and Netherlands) - **Table 1** highlights the conditions that influence the existence and the development of 24/7 environments [18].

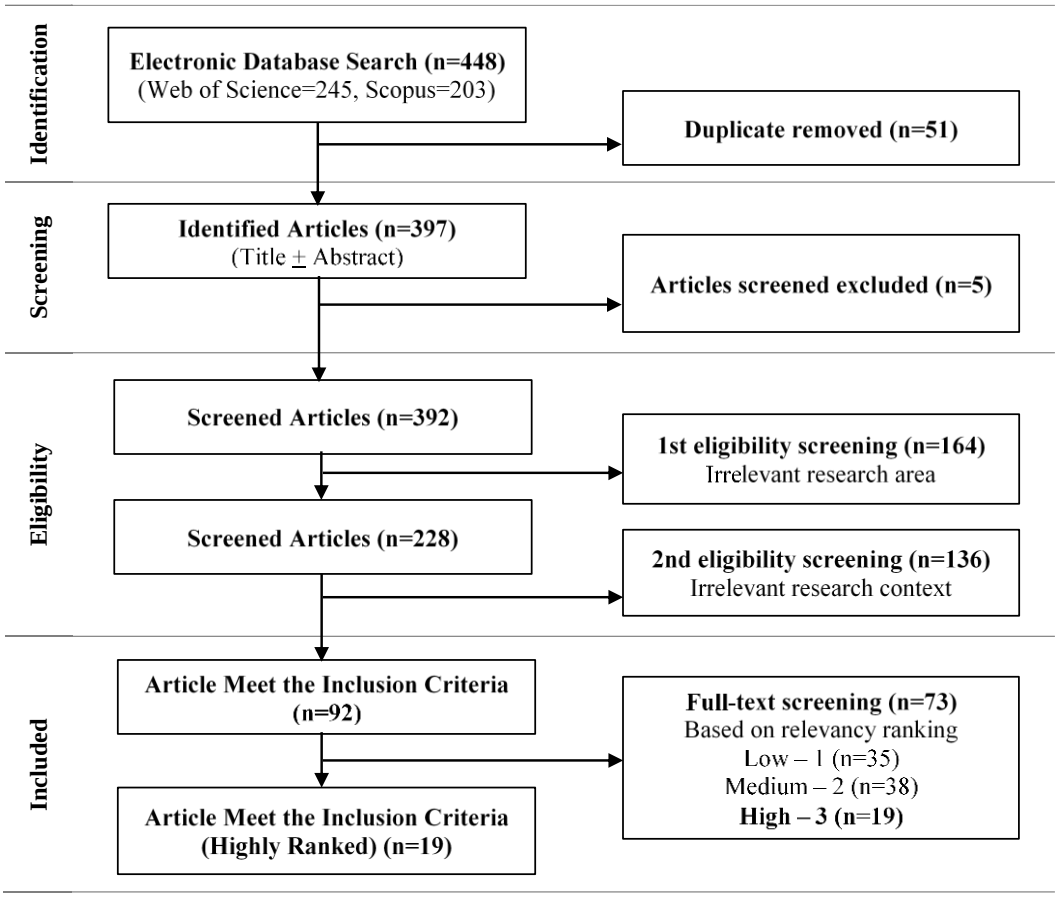


Figure 2. Flow diagram of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for this study. Own work.

2.1. Keywords and search strings

In this study, Web of Science and Scopus were the two electronic databases chosen to search for pertinent papers published between 2013 and 2023 reflecting current research practices and reporting. Then, cross-referenced with Wendy's conditions of the existence and development of 24/7 environments in 24-hour city concept **Table 1.**

Table 1. Conditions of the existence and development of 24/7 environments.

Economical Conditions	Socio-Cultural And Political Conditions	Spatial- Environmental Conditions
• Globalisation • Leisure Economy	• Multi-ethnicity • Religion • Work Culture and Family Unit • Individualism • Governance	• Accessibility • Density (critical mass) • Public Space • Climate

Note. Adapted from Conditions of the existence and development of 24/7 environments, by Tan, W., & Klaasen, I. (2007). 24/7 Environments: A Theoretical and Empirical Exploration from an Urban Planner's Perspective. http://www.gla.ac.uk/media/media_59715_en.pdf

From the process, generalised keywords were formed and applied to both search processes. The two databases' associated search strings are shown in **Table 2.**

Table 2. Applied keywords and search strings associated with the study.

Database	Search terms and applied filters
Web of Science	(urban landscape development) OR (night landscape) OR (urban night-time) OR (nightscape nightscapes)) OR (24-hour city) and 2013-2023 (Publication Years)
Scopus	(urban AND landscape AND development) OR (night AND landscape) OR (urban AND night-time) OR (nightscape AND nightscapes) OR (24-hour AND city) AND PUBYEAR > 2012 AND PUBYEAR < 2024

Note: Own work

2.3 Screening and eligibility criteria

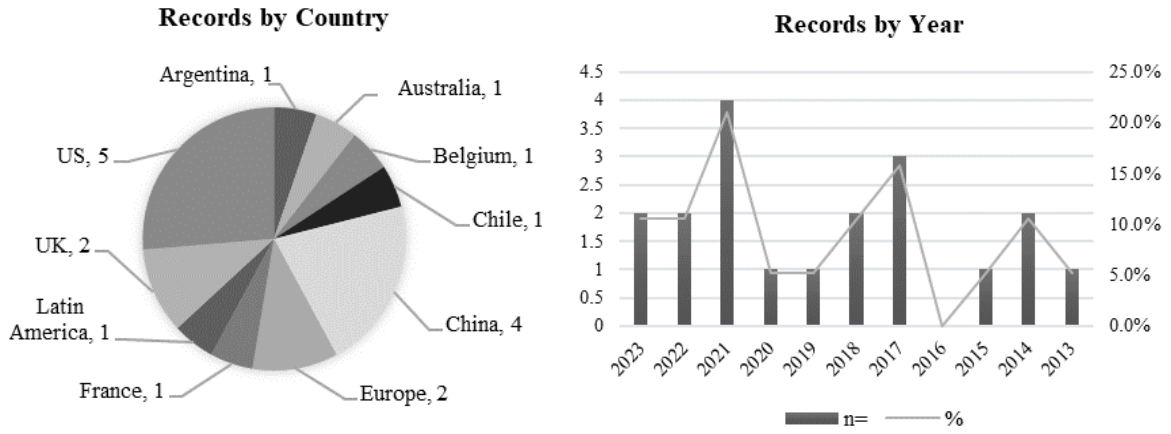
Initial 448 records were identified from the electronic database search based on the keywords and applied filters. Identification and screening continued by removing 51 duplicate records and followed by 5 records removed due to missing abstracts.

For the eligibility screening, the process is divided into two parts; (1) research area relevancy and (2) research context relevancy. 164 records were removed due to irrelevant research areas (i.e., urban forestry, urban wildlife, urban culture, GIS). Further review resulting the removal of 136 records due to irrelevant context (i.e., urban wetland, urban neighbourhood, urban park, greenway).

The remaining 92 records were further reviewed through individual full-text, focusing on the related study keywords and conditions. Eligibility screening of records was rated using the relevancy scale of 1-3; Lowly relevance (1), Averagely relevance (2), and Highly relevance (3). A total of 73 records were removed and 19 records were highly eligible based on the rating and relevancy process.

2.4 Study sample characteristics

Once the set of studies to be included in this literature review was finalised, certain characteristics of the study sample emerged. The majority of the studies were conducted in the U.S and followed by other parts of the world like China, Europe, the UK, Australia, Belgium, France, Latin America and Chile which were included in this study **Figure 3(a).** The studies also were limited between 2013 and 2023 shows the recent trend of research within 10 years' period **Figure 3(b).**



(a) (b)

Figure 3. (a) Distribution of records by country, and **(b)** distribution of records by year. Own work.

3. Main results and findings

The effects of different indicators and methods on the urban landscape planning and the 24-hour city concept have been systematically reviewed for this study to identify key indicators for the conduction of this study in urban centres. Through the PRISMA method, the review which is related to the concept of 24-hour city is defined based on three conditions related to the study thus addressing the research

questions **Figure 4**; Economical Conditions, Socio-Cultural and Political Conditions as well as Spatial-Environmental Conditions [18]. The list of nineteen important records which is reviewed for this study is given in **Table 3** for reference.

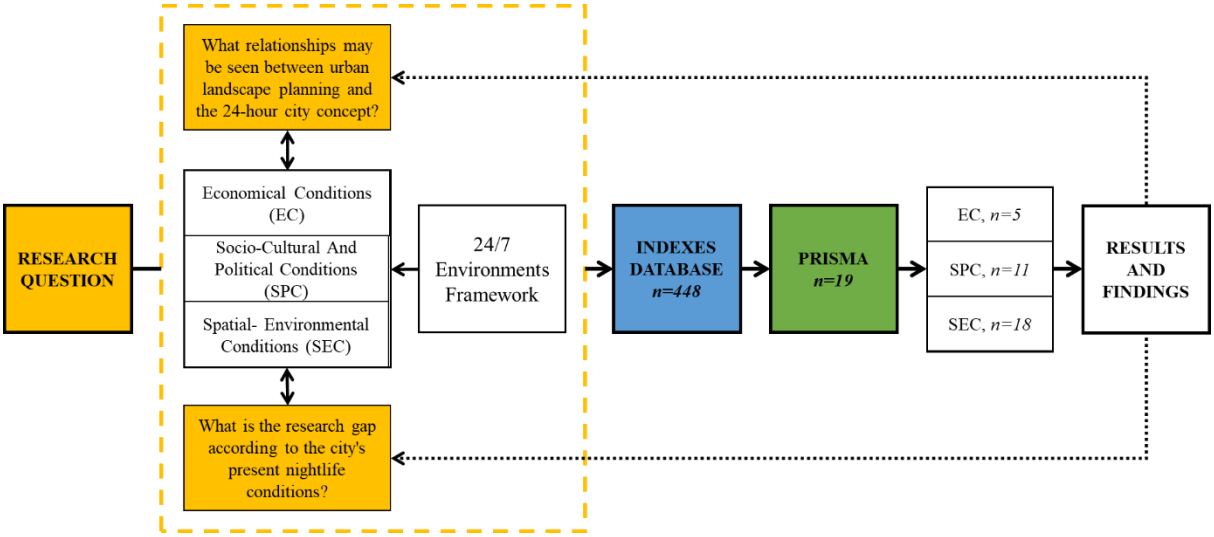


Figure 4. Diagram of process from research question to results and findings. The four main squares show the processes from research question to results for a systematic literature review using existing data. Within yellow box indicate the additional processes needed to define the research using 24/7 environments framework in relation to research questions.

Significantly, four records show findings based on all three conditions and able to gain positive results based on the intended research area and context [20][21][22][23]. All of the records had been conducted in the US and Europe regions respectively.

Table 3. Summary of included literature review.

No	Authors	Purpose	Findings	Methodology
1	Chang et al., 2023	Examines how socio-physical environments affects place attachment. China	Improved physical and social environments lead to stronger place attachment, which in turn affects place identity and place dependence in other roles. (1) Positive association of social ties with place identity. (2) Positive association of housing condition with place dependence.	Cross-sectional correlation, Hierarchical linear modelling.
2	Wang et al., 2023	Examine how subjective environmental impressions and environmental instoration indicators mediate the relationship between mental health and proximity to urban green and blue space (UGBS) along the Connswater Community Greenway. UK	UGBS influences mental well-being through multiple mechanistic pathways including changing people's subjective perceptions and promoting instoration. (1) Mental well-being with mediating pathways positively impacting physical activity, and perceived safety positively impacting social trust. (2) Subjective environment perceptions; attractiveness, traffic, amenities and perceived safety. (3) Instoration indicators; physical activity, social trust and social networks.	Cross-sectional correlation., Warwick-Edinburgh Mental Well-being Scale, Structural equation models.
3	Sordello et al., 2022	Promote the "dark infrastructure" implementation by integrating darkness qualities with "green and blue infrastructure". Europe	Dark infrastructure deployment reveals several knowledge gaps that need to be identified, protected, and revitalised at different territorial levels, thus maintain ecological night-time cycles and continuity as organically as possible.	Exploratory analysis, Cross-sectional, 4-step operational process.

Table 3. Continued.

4	Ugolini et al., 2022	Evaluate urban inhabitants' satisfactions with various aspects of the quality of urban green space with professionals' best practises for delivering UGS services, from shared amenity management and maintenance to landscape planning and design. Europe	Despite accurately recognising the need for practical solutions like proper lighting and cleanliness, UGS specialists frequently underestimate the true requirements and wishes of UGS users (i.e., anxiety experienced by users at night, especially women). (1) Users highlighted "nature" and "quiet" as elements that enhance their overall sense of well-being in urban green space, which are frequently ignored. (2) User satisfaction with particular urban green space attributes, such as park furniture and accessibility, was exaggerated.	Exploratory international study, Cross-sectional correlation.
5	Guyot et al., 2021	Examine how plants and places designated for pedestrians help to identify the urban fabric. Belgium	The findings give a precise definition and grouping of urban streetscapes. When describing residential neighbourhoods, vegetation has become essential; yet, it plays a less significant role when describing the urban fabric in small, densely populated central regions.	Multiple Fabric Assessment, Naïf Bayesian clustering analyses.
6	Ramírez et al., 2021	Determine diverse perception, its association to the presence of landscape features, and its measurement. Chile	Findings indicate that there are gender and habitual mobility preferences differences in people's perceptions of safety in public areas. The sense of safety and other elements of landscapes and public areas, specifically variances by gender and other sociodemographic traits.	Cross-sectional correlation, Computational and Statistical Modelling.
7	Song et al., 2021	Recognise the perceptions and sense of place that tourists have of the public areas around the Las Vegas Strip. US	Results identified 30 different subjects, including exploring various hotels, nightlife, people-watching, and lengthy walks. The study revealed the existence of sense of place values on the Strip and recommended urban design solutions and management and guidelines relating to the functional and purely aesthetic aspects of the Strip public space.	Cross-sectional correlation, Latent Dirichlet Allocation, Logistic regression ML methods.
8	Zhang et al., 2021	Determine the streetscapes' perceived level of safety and "perception bias" for census block groups in Houston. US	Results shows correlation between urban space qualities and "perception bias" towards crime may be counterintuitive. High number of daytime visitors seem to be safe (low crime rate and safety score). High number of visitors at night seem to pose a greater threat than they do (high crime rate).	Cross-sectional correlation, Computational and statistical Modelling.
9	Xia, Yeh & Zhang, 2020	Investigate the spatial links between street-block-level urban land use intensity and urban vibrancy. China	The intensity of urban land use and urban vitality were found to be significantly positively spatially correlated. Despite local spatial mismatches (overcrowded or underutilised urban spaces) being observed, socioeconomic activity is more prevalent in densely populated urban areas during the day and at night, as well as in different urban settings.	Cross-sectional correlation, Local indicator of spatial association.
10	Duque et al., 2019	Perform a spatiotemporal analysis of urban expansion in relation between the metrics for urban form and various variables that can be correlated with urban form. Latin America	There are not sufficient studies on the topography, size, colony, and economic performance of urban forms in developing-nation cities. Results highlight several concerning elements, a trend towards sprawl-growing in cities, and a tendency for a group of cities to build on steeper slopes.	Cross-sectional correlation, OpenStreetMap-nighttime light imagery and information, Spatiotemporal analyses.

Table 3. Continued.

11	Lai & Kontokosta, 2018	integrates urban landscape facts and qualities with dynamic environmental and socio-psychological aspects to bridge in-situ pedestrian activity observations with urban computing. US	Results provide insights on the main factors influencing neighbourhood pedestrian activity and emphasise the need of including socio-spatial dynamics and the immediate urban environment in models of pedestrian behaviour. The planning, design, and management of cities must consider pedestrian behaviour in many areas, including the development of the economy, public health, disaster preparedness, and public transit.	Cross-sectional correlation, Multivariate regression models, panel-corrected standard errors.
12	Sun, Xie & Chen, 2018	Study how different landscape types can be connected logically based on a specific season and time period in order to reduce urban heating effectively (thermal processes). China	Planning for the landscape and reducing urban heat islands must constantly take this into consideration. The findings revealed that Green spaces acted as heat sinks both day and night, with water bodies acting as heat sinks during the day and sources at night. A large distance between green and impervious land increased variations in day-night LST while a large distance for water-impervious connectivity may mitigate diurnal variations in LST. Water areas served as daytime heat sinks and nighttime heat sources.	Landscape source-sink distance index, MODIS, LST, Cross-sectional, QuickBird, IKONOS, Geographically weighted regression model.
13	Ruiz et al., 2017	Develop a design tool to assess the comfort levels and thermal behaviour of urban environment. Argentina	The findings indicate that there is a paucity of resources available to study urban climate, including the inadequacy of techniques to assess thermal behaviour and comfort levels. To improve the behaviour of cities' microclimates, a compromise solution for optimal urban architecture is therefore required.	Cross-sectional correlation, COMFA-tool, linear multivariate thermal comfort model.
14	Ward & Grimmond, 2017	Highlights the use of a biophysical model to examine the effects of urban climate change caused by population growth, energy use, urban expansion, and green efforts. UK	Results are presented in terms of the energy partitioning, which takes into account variations in the weather, the properties of the surface, and human conduct. Model simulations show how both deliberate and unintentional changes (population expansion, decreased energy usage, urban development, and urban greening activities) to the urban landscape can affect the urban climate.	Cross-sectional correlation, COMFA-tool, linear multivariate thermal comfort model.
15	Zhang, Murray & Turner, 2017	Develop a framework to determine the ideal sites and arrangements for new green space in relation to the cooling impacts of daytime and nighttime urban heat island effects. US	The findings also show that the agglomeration impact of clustered green space promotes local cooling, but dispersed patterns result in greater regional cooling overall. By creating new green space, the LST was reduced by roughly 1-2 degrees C locally and 0.5 degrees C regionally. Simultaneous consideration can yield 96% of the potential benefits of cooling during the day and at night.	Cross-sectional correlation, Multi-objective model.
16	Norton et al., 2015	Provide a framework for the selection and prioritising of urban green infrastructure (UGI) for cooling and reducing high temperatures in urban settings. Australia	Urban areas can see temperature drops with the planned application of UGI, which also offers a variety of other advantages like habitat for wildlife and reduced pollution. There are four different varieties of UGI: 1) open green areas, 2) shade trees, 3) green roofs, and 4) vertical greening systems.	Cross-sectional correlation.
17	Serret et al., 2014	Examine the changes in dynamics and locations, as well as any potential contributions made by green spaces at business sites (GSBS) to the ecological network in urban settings. France	In terms of overall acreage, the GSBS had no effect on connectivity, instead, it did so by the number of links that these sites shared with other green spaces or by their advantageous positioning within the network, i.e., their capacity to serve as stepping stones for the extension of green space.	Cross-sectional, cartographic data, Graph theoretic modelling.

Table 3. Continued.

18	Tian, Jim & Wang, 2014	Evaluating the ecological and landscape value of urban green spaces (UGS) in various districts and land uses of a compact city. China	Results show that the landscape-pattern design of UGS in compact cities optimises its ecological attributes and advantages to both nature and inhabitants, and strengthens urban nature preservation. (1) Old districts have smaller and more heterogeneous UGS due to relatively low-quality landscape attributes. (2) Larger UGS in land uses enhance connectivity and facilitate movements between proximal patches. (3) Vegetation-dominated land uses have more complex and longer UGS edges to augment interfacial benefits. (4) Government, institution and community and open space have more complex UGS edges.	Geographic information system, remote-sensing and factor-analysis, Fragstat spatial pattern analyses.
19	Tilt & Cerveny, 2013	Examine the literature on the rationale for developing master-planned communities and its physical, built, and social impacts on the nearby exurban environment. US	Finding shows that residents are driven to exurban areas because of the abundance of outdoor recreation activities and natural attractions. New master-planned community development, however, comes with both advantages and disadvantages, notably in terms of how residents perceive development impacts on the local built and natural environments.	Cross-sectional correlation, FGD, qualitative data analyses

3.1 Economical Conditions

Five records (26.3%), focusing on the urban landscape development contribution to the economic growth and activities in commercial business districts and neighbouring community context. Ugolini [20] and Lai & Kontokosta [22] respectively highlight the influence of user's perceptions towards the post-development of urban green space specifically on night-time economic activities. The leisure economy focusing on nightlife vitally also influence urban design strategies and public space management policies [21], the same positive results occurred in the green spaces at business site context [23].

3.2 Socio-Cultural and Political Conditions

Highlighted in eleven records (57.9%), this condition defined the sub-context of multi-ethnicity, religion, work culture and family unit, individualism and governance systems in the 24-hour city concept.

As Ugolini [20] and Lai & Kontokosta [22] respectively highlight the influence of user's perceptions towards the establishment of UGS, the quality aspect of the physical and social environment had been further studied and established stronger relationships with the urban fabric, place identity and dependency [24][25]. At the street block level, Xia, Yeh & Zhang [26] define on how distinct urban locations, land use characteristics (purpose and mixing), and time periods (day and night) are related to diverse socio-economic activities, and how these activities are more likely to be numerous in high-density developed urban areas.

Mental well-being also plays an important role in the user's perceptions establishment as urban green spaces at business sites through multiple mecha-nistic pathways including changing people's subjective perceptions and promoting instoration specifically on social capital and physical activity [27]. Tilt & Cerveny [28] concluded the abundance of natural amenities and outdoor recreation opportunities attract and stimulates the community's positive perceptions including night-time safety and security. Furthermore, the user's gender, habitual mobility choices and other sociodemographic characteristics are also shown in the perception of safety in public spaces [29]. Paradoxically, Zhang et al. [30] conclude tendencies of "perception bias" on streetscape safety thus set different paths to the total urban space design strategies and management policies [21][23].

3.3 Spatial-Environmental Conditions.

Public space conditions become a major context studied in all eighteen records (94.7%) followed by climate, accessibility as well as density in urban landscape development. Public space set to important sub-conditions as it showed a significant positive spatial autocorrelation between urban land use intensity and socio-economic vitality at the macro and micro scale and density of cities [26][31][23]. On the contrary, theoretical frameworks such as "Dark Infrastructure" emerged to counter Artificial light at night (ALAN) negative impacts especially contributing to habitat loss and landscape fragmentation [32].

In compact cities, the landscape-pattern design of UGS helps to optimize ecological qualities and benefits to both nature and residents, thus reinforcing urban nature conservation [33]. Higher quality of urban spaces components including natural amenities and outdoor recreation facilities [28], streetscape features [21], vegetated urban areas [25] and night-time lighting [20] forming a significant contribution to stronger place attachment while playing different roles in place identity and place dependence [24].

Accessibility is set as the second important key driver for the urban environment and socio-spatial dynamics with pedestrian behaviour toward day and night space usage [22]. Yet, the influence and impact vary according to the "perception bias" towards landscapes and public spaces, especially in both daytime and night-time periods [29][30].

Climate sub-condition is another aspect covered by researchers on seeking the effect of urban landscape configuration towards bio-physical specifically on green open spaces, clustered green spaces, green roofs, and vertical greening systems [34][35][36][37]. Planning for landscapes and mitigating urban climatic issues like urban heat islands and pollution always need to consider the impact of landscape composition on urban temperatures [38].

4. Conclusion

From the results on the idea of 24-hour cities and urban nightlife in this study, and it is clear from these studies that, despite negative effects being identified, the targeted goals have only been attained insofar as focusing on economic profitability and the promotion of consumerism.

In Western viewpoint, the activities timing is considered more than taking into account the unique night-time needs and characteristics. Furthermore, Western values and norms are materialistic, and every action is measured according to how effectively it satisfies a material desire. Such inequality, which excludes some social groups and leads to the exploitation of particular socioeconomic and gender groupings. Different from the Asian perspective, certain activities that serve the purposes of day and night are designated for each time period. The primary objective is to meet spiritual needs, even while material means are employed. According to this viewpoint, the night is the time for harmony with the universe, serenity, meditation, and prayer. Daytime continues to be the prime period for conducting business and making money in a way that respects the earth's natural laws.

This description and explanation make it very evident that Asian cities cannot directly adopt the Western model of a 24-hour city. Thus, fully create a nightlife that is compatible with the fundamentals and way of life of Asian culture and religion while also making them alike to Western cities. However, to meet the demands and behaviours derived from the Asian way of life and virtue for the creation of an Asian cultural-tradition-based 24-hour city, a localised form of nightlife with appropriate external and public appearances must be considered in specific development areas. In light of this, not all cities need to be retrofitted with new contemporary spaces for pointless night-time activity; in places where nightlife can be identified, developed following local preferences. For instance, cities like Kuala Lumpur, Malacca, and Penang are the most significant examples of how multi-cultural nightlife may be structured, and these are intended to be at the centre of the urban settings as well as being a historic heritage area.

This study clearly answers the first research question highlighting the relationships between urban landscape planning and the concept of 24-hour city in Asian cities context. The concept and urban landscape planning are inextricably linked together and can impact each other in a variety of ways. It helps city to become active and dynamic around the clock, offering a variety of events and services

during the day and night. Urban landscape planning is important in generating and supporting the circumstances required for a city to operate as a 24-hour city. Some of the connections between the two can be observed in mixed-use development, public spaces and facilities, transportation and accessibility, economic growth and job opportunities, culture and diversity. Overall, urban landscape planning is important in establishing a city's physical and social environment, which determines its ability to function as a 24-hour city.

In relation to second research question, it is important to identify specific research gaps in the context of a specific city's nightlife, researchers should conduct a thorough literature review, interact with local stakeholders, conduct surveys or interviews with residents and visitors, and take into account any recent changes or developments in the city's nightlife scene. There are several research gaps that could be important to the study of nightlife in any given city. Whilst, the following knowledge gaps about the city's nightlife: sociocultural impact; economic contributions; safety and security; sustainable nightlife; inclusivity and diversity; perception and attitudes; and the role of urban planning in shaping the city's nightlife, including the impact of zoning regulations, transportation accessibility, and spatial organisation.

It is vital to appraise the concept in urban landscape development focusing on different urban demographic to boost public engagement. This includes a variety of factors related to social well-being, land use, urban transportation, landscape design, and physical security. Therefore, future research is necessary to promote the best possible design of these factors concerning cultural heritage, particularly at night time.

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Inclusive Design in Rail Transit Space: A Qualitative Study of The Riding Experience of Visually Impaired Commuters

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Abstract. Given the United Nations Sustainable Development Goals (SDGs) and the central role of public transport, particularly rail, in urban development, this study examines the design issues of rail transit spaces from an inclusive perspective. Using a hybrid qualitative research approach that includes a case study, strategic framework construction, and design practices, aiming to interpret and define the inclusive design elements in rail transit spaces and apply them to specific commuter scenarios. First, a case study of the Thomson-East Coast Line in Singapore was conducted, simulating the experiences of visually impaired commuters through cell phone recordings. The data was categorized, and themes were extracted using grounded theory principles. The result is an inclusive design framework consisting of a three-level structure and four themes. Finally, in conjunction with the framework, this research also proposes five prototypes for inclusive design for spatial touchpoints and reconstructed the subway-riding scenarios of visually impaired commuters using storyboards for situational analysis. The inclusive design framework and prototypes offer significant insights for the planning and design of urban rail transit, particularly for emerging cities that are undergoing or planning rail transit construction. They have important implications for promoting sustainable urban development and social inclusiveness.

1. Introduction

Driven by the United Nations' Sustainable Development Goals, public transport, led by rail transit, is playing an increasingly significant role in the acceleration and deepening of urban construction. Many cities have preliminarily established extensive rail transit networks, leading to a surge in the number of subway riders and diversifying travel demands. Consequently, there is a growing dependency on the inclusivity of rail transit. However, current design and planning for rail transit spaces are solely focused on accessibility, failing to meet the nuances of its conceptual design and implementation motives in the face of evolving societal forms.

The concept of "inclusive design," as mentioned in this paper, was proposed in the 1990s. Its core tenet is to respect human diversity and uniqueness, committed to designing products and services for a broader population to meet diverse needs, opposing design exclusion [1], with a focus on fairness and

sustainable development. Similar concepts include "universal design" and "Design for all". These philosophies have influenced each other throughout their evolution [2-5] and can even be interchangeable. In this article, the term "inclusive design" was used to represent the aforementioned human-centered design advocacies.

Serve as many people as possible, meeting the commuting needs of various groups, such as the elderly, the disabled, and children [6-8]. Based on this, scholars have proposed the concept of equity in public transportation [9], often discussed alongside the issues of accessibility and the equity of medical and educational resources [10-11]. The public transportation system must offer and serve everyone in a non-discriminatory manner [12]. This stance aligns with the philosophy of inclusive design. Therefore, design concepts such as inclusive design and universal design have been applied to various dimensions of rail transit to address the challenges faced in public transportation development.

From a spatial perspective, rail transportation combines user behavioral characteristics with universally equipped environment devices at subway entrances and exits, focusing on the needs of individuals with mobility impairments and informational disabilities. Zhang et al. [13] argue, from the perspective of inclusive design, that audio-oriented message conversion is a beneficial supplement to visual recognition systems. The physical environment can influence the form of travel [14], some scholars have researched the inclusive design of rail transit facilities, suggesting that combining physical design changes with reasonable adjustment measures can enhance the user experience [15-17]. In terms of time, it's worth attempting to treat inclusive design as a process in subway development. By allowing pilot users to become stakeholders or even decision-makers in the design scheme, profoundly impactful solutions can be generated [18].

The value of these studies lies primarily in their ability to go beyond the principles of accessibility design and embrace the diversity and ability differences of users in a more humane and inclusive design approach, thereby avoiding discrimination against certain groups. However, the limitation of these studies is that they often overlook the importance of examining and understanding the perspectives of both pilot users and designers. Inclusivity in the environment is a complex and multi-dimensional concept [19]. However, for urban rail transit spaces, which elements are inclusive to a certain group of people, how they are reflected in the design of urban rail transit spaces, and what kind of use scenarios can be obtained, have not been widely discussed. Therefore, systematic qualitative research is essential.

The core objective of this study is to explore the elements of inclusive design in the context of rail transit spaces for individuals with visual impairments and to uncover the underlying logic of spatial inclusivity in design. The research attempt to establish a qualitative research process for in-depth exploration of spatial inclusivity design, consisting of three key steps: on-site case studies, strategic framework development, and design practice application. The study initially adopts design research methods by simulating the experience of visually impaired commuters through the use of simulated glasses and conducting a case study on the Thomson-East Coast Line (TEL) in Singapore. Subsequently, the grounded theory approach is employed to code and extract themes from the raw data collected through mobile recordings, leading to the development of an inclusive design framework. Furthermore, the framework is utilized to present five inclusive design prototypes for spatial touchpoints. Finally, a storyboard is employed to reconstruct scenarios of visually impaired commuters using the subway system, followed by a situational analysis. The study's significance lies in the integration of design research methods and sociological approaches to systematically examine inclusive design in rail transit spaces, thereby providing valuable insights for planning and constructing rail transit systems in emerging cities.

2. Methodology

2.1. Overview of the research subject

In Singapore, the trifecta of limited land resources, high population density, and an aging demographic structure pose considerable challenges to its development. Prioritizing public transport development not only addresses the issue of commute congestion but, with the support of inclusive design, it can also

become a key mechanism for providing environmental support for an aging society. The TEL commenced operations in January 2020, initially launching with 20 stations. The whole line plans to span 43 kilometers and include a total of 32 stations, connecting well-established residential areas. The design of TEL strictly follows accessibility guidelines, ensuring wheelchair accessibility across all stations, thereby promoting inclusivity in the public transport system. Therefore, TEL was selected as the case for this research, using it as a spatial instance to explore the specific composition of spatial inclusiveness from the perspective of the visually impaired, thereby refining the design strategies of inclusive design.

2.2. Research method

This study employs a mixed qualitative approach that combines design and sociology. The former includes role-play, immersive experience, high-fidelity prototypes, and storyboards[20], while the latter pertains to coding derived from grounded theory. Role-play and immersive experiences are regarded as methods of cultivating empathy in design, matching the user's mindset with the designer's imagination [21]. This approach yields empathetic, immersive, and vicarious insights suitable for deriving inclusive design strategies in urban rail transit spaces. High-fidelity prototypes serve to test and evaluate design concepts in the early stages, playing a crucial role in the development process. They assist the research team in better understanding how optimized inclusive design in space operates in practice. Storyboards effectively recreate the context of the user, reflecting the entire process of visually impaired commuters riding the subway holistically and concretely. The latter coding, originating from grounded theory, is a bottom-up qualitative research method that is widely used. The underlying logic of inclusive design in transportation spaces is discerned through the refinement, tagging, and conceptualization of research data, culminating in the construction of a strategic framework for inclusive design.

2.3. Research process

The research process includes three steps: case study, framework development, and design practice. Among them, role-playing, immersive experiences, and coding are mixed used to construct the inclusive design strategy framework. Design prototypes and storyboards are used to deduce the application of the framework in rail transit spaces. See figure 1 for the procedures.

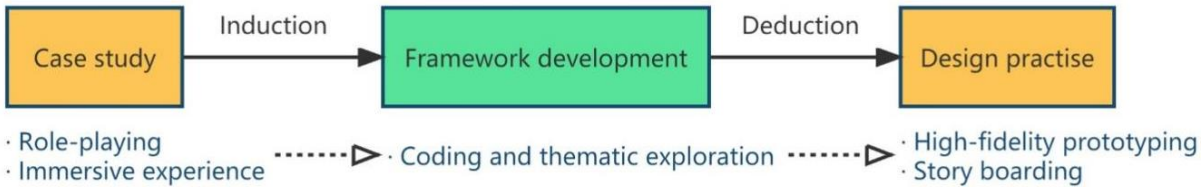

Figure 1. Research procedures

2.3.1. Case study. In February 2023, a case study was carried out on the Mass Rapid Transit (MRT) TEL in Singapore. A single journey was made from Marina Bay to Orchard Station (a total of 6 stops). The specific method involved wearing simulation glasses to role-play a commuter with mild visual impairment. An earphone-equipped smartphone was used to record spoken thoughts, typically comprising statements describing and evaluating aspects such as "listing difficulties", "proposing improvement ideas", "describing experiences", and "post-use evaluation". At the same time, photos were taken for on-site documentation, as shown in figures 2 and 3. The simulation glasses used were developed by the Engineering Design Center at the University of Cambridge. These glasses simulate the loss of detailed capture capability of the human eye, resulting in effects such as unfocused vision, reduced retinal cell sensitivity, and blurred vision. This aids researchers in perceiving features in collaboration with an impaired user [22]. While the normal vision is shown in figure4, the specific visual effect is shown in figures 5 relatively. Before this, the number of glasses to wear was determined through specialized vision tests.

Figure 2. The researcher is searching for a route while wearing simulation glasses

Figure 3. The researcher is operating the ticket machine while wearing glasses

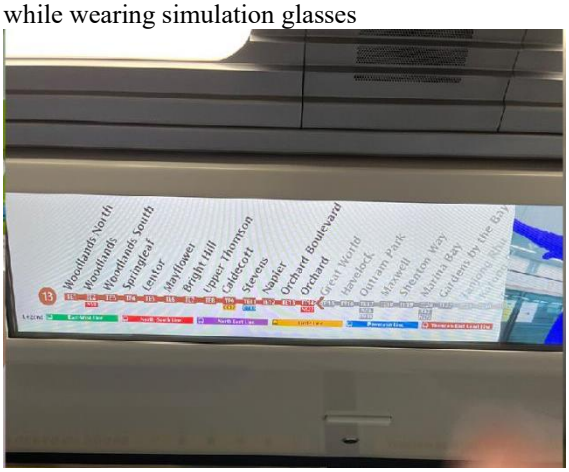

Figure 4. Visual effects under normal vision

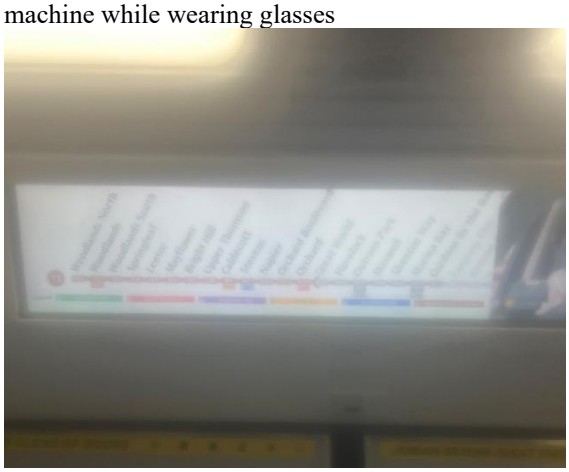

Figure 5. Visual effects after wearing glasses

It is important to note that the objective of the TEL case study is to assist designers in conceptualizing commuter usage of space from the perspective of individuals with mild visual impairments. This is achieved through the construction of inclusive design codes for urban rail transit spaces based on commuting experiences. However, this case study cannot guarantee complete inclusivity for visually impaired individuals in TEL, and negative experiences may still occur. The encoding of such adverse emotions nonetheless contributes to the formulation of an inclusive design framework. It can potentially facilitate reflective contemplation among researchers, as well as provide insights for design strategies.

2.3.2. Framework development. Coding and theme exploration are employed in the construction of the inclusive design strategy framework for rail transit. Initially, we used atlas. Ti qualitative analysis software to transcribe raw data, which included audio, video, and photos. Following this, open coding was performed on the transcribed files, generating 210 open codes. Next, through categorization, filtering, deletion, merging, and linking of codes, 39 axial codes (underlying logic) were identified. Finally, 16 selective codes (design strategy) related to inclusive design were established, from which four themes were extracted. This process helped to construct a systematic framework for inclusive spatial design in rail transit.

2.3.3. Design practice. Based on the established framework for inclusive spatial design, the research proposed and elaborately explained five optimized standard spatial touchpoint prototypes. These touchpoints involve ticketing and passage areas, location and waiting areas, and unisex toilets. Specific

standardized settings and detailed explanations were provided from various aspects of the inclusive spatial design strategy. To verify the applicability and universality of the optimized design, a storyboard was created to depict a scenario of a visually impaired commuter taking the subway. This allowed for situational analysis, displaying the ideal experience and design details. Then, following the order of a visually impaired person's subway journey, eight subway scenario storyboards were constructed to provide in-depth explanations of the specific use cases of these inclusive design prototypes.

3. Result

3.1. Framework for inclusive design strategy in rail transit spaces

Through detailed coding of ride experience records, including voice-to-text transcription and photo analysis, we obtained a total of 210 open codes. These open codes, although based on the TEL experience, do not assure that all experiences are positive; negative feedback also persists. This feedback does not hinder the extraction of codes but instead serves as a catalyst for designer reflection. After meticulous screening, integration, and categorization, these open codes were refined into 39 axial codes. These axial codes reveal the strategic implications of inclusive design in subway spaces, offering substantial practical value and real-world significance. Further integration and classification culminated in the reduction of these axial codes to 16 selective codes. These selective codes represent the design logic of inclusive design for urban rail transit spaces. Their breadth and depth are dictated by the complexity of the space and the diversity of passenger experiences.

Upon in-depth analysis, four themes were ultimately defined: minimize sensory ability burden, minimize cognitive ability burden, minimize motor ability burden, and services. In the theme of minimizing sensory ability burden, five selective codes – acoustic environment, light environment, perceptual threshold, perspective, and sensory compensation – played key roles. In the theme of reducing cognitive load, the integrality of the guidance system, the logic of the guidance system, and the systematicity of guidance exerted decisive influence. In the theme of reducing action load, effort-saving for horizontal movement, effort-saving for vertical movement, body accessibility, and specialized facilities played crucial roles. In the theme of services, continuous infrastructure optimization, open-ended interaction, and specialized services were deemed essential. Figure 6 shows a bottom-up Sankey diagram, reflecting the relationships among axial codes, selective codes, and themes. The numbers in the diagram represent the quantity of codes, and the different colored lines indicate the themes to which the codes belong.

Additionally, during the coding process, we attempted to cluster codes from the perspective of spatial touchpoints, primarily due to the significant spatiotemporal sequence inherent to the process of riding the subway [23-24]. The single-journey of the rail transit pathway was divided into five stages according to different experience locations: entering the station hall, accessing the platform, riding the subway, leaving the platform, and exiting the station hall. Key touchpoints for each stage were identified based on the interaction between individual abilities and external factors, with touchpoint judgment based on whether interaction occurred between people, machines, and the environment. These were referred to as spatial touchpoints. The setting of spatial touchpoints enabled researchers to simplify spatial demands, focus on critical aspects of inclusive design, and enhance the operability of data coding classification. These touchpoints, following the sequence of event occurrence, include ground location, entrance, using vertical transport, passages, ticket purchase, tap-in, use of vertical transport, location, waiting, boarding, in the carriage, location, alighting, location, use of vertical transport, location, tap out, passages, use of vertical transport, exiting, and ground location. It is worth noting that some touchpoints might vary depending on the actual conditions of the space and the users. In figure 6, the rightmost column represents these spatial touchpoints. By analyzing the flow of thematic coding and spatial touchpoint cluster coding, we found that almost all spatial touchpoints involve the use of perceptual, cognitive, and action abilities, intuitively validating the notion that individuals utilize multi-abilities in space.

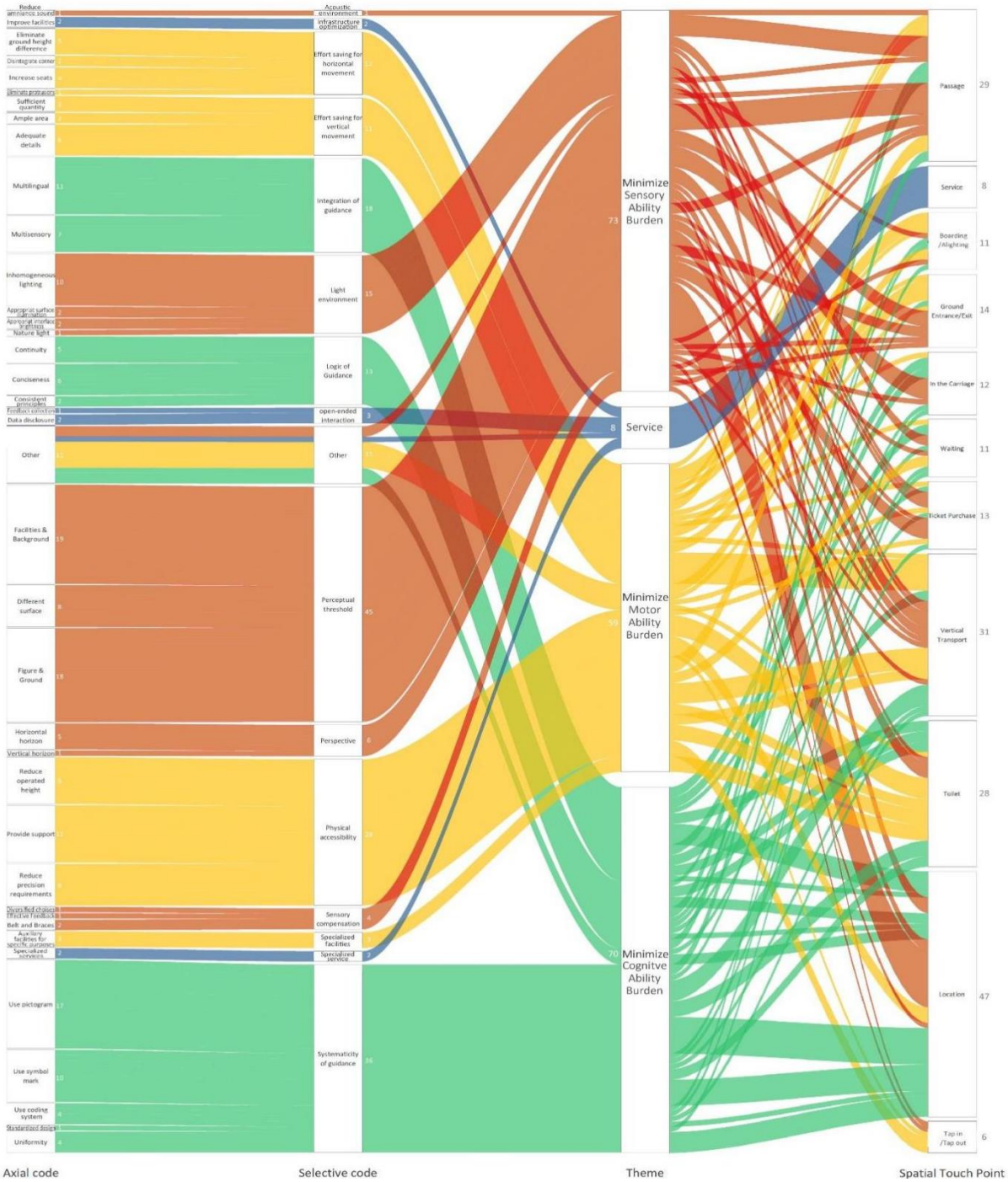

Figure 6. The refinement process of the inclusive design framework, namely the coding process

Therefore, a strategic framework for the inclusive design of rail transit space using a coding approach has been constructed. The first three themes of this framework respond to the capability and demand model proposed by Persad et al. [25], while the fourth theme underscores the characteristics of public transportation. As a public service product[26], the public transportation system requires continuous operation and maintenance, which further enhances its inclusiveness and sustainability. The innovation of our research framework lies in adopting a user-oriented perspective, an experience-based process, and a mixed research method combining role-playing and grounded theory. By investigating successful

groups in an aging society and subway lines in countries with similar cultural backgrounds, this inclusive design strategy framework has been built from the ground up.

3.2. Design Prototypes

Under this inclusive design strategy framework, optimized prototypes for inclusive design have been presented, taking typical spatial touchpoints as examples, including ticket purchasing and passage, locating and waiting, and toilets - a total of five spatial touchpoints. These optimized prototypes are built on the foundation of the inclusive design framework; thus, themes, elements, design strategies, and specific design points can be identified from table 1. Specifically, themes correspond to the themes in the coding, elements corresponding to the selective codes in the coding, design strategies correspond to the axial codes, and design points provide explanatory details about specific designs. Furthermore, design prototypes have been graphically demonstrated with textual descriptions and numerical explanations.

3.2.1. Passage Touchpoint. The optimized design prototype for urban rail transit space passages specifically focuses on five inclusive design elements across three themes, considering how to enhance the inclusive design from the perspectives of mobility, perception, and cognition, thereby ensuring an effortless, accessible, comfortable light environment, and easy perception throughout the commuting process. Details can be seen in table 1, where the first three columns represent the inclusive design strategy framework, and the column on the right includes specific details to be noted. For specific dimensions, forms, and colors, please refer to figure 7.

Table 1. Design considerations for passage.

Theme	Elements	Design strategy	Concrete
Minimize mobility burden	Effort-saving for horizontal movement	Eliminate ground height difference	Minimize the differences in ground elevation as much as possible to prevent missteps and falls
		Disintegrate corner	Reduce spatial turns and the depth and complexity of buildings to prevent difficulties in locating, and to increase visibility
		Eliminate protrusions	An integrated design of the wall and reducing protruding elements can effectively prevent passengers with impaired vision from getting hurt Treat the corners of buildings with guiding angles to avoid sharp architectural components causing harm to passengers
	Physical accessibility	Provide support where needed	Install handrails wherever possible to provide the support needed for commuters with mobility issues
	Other	Other	Make the ground slip-resistant to prevent slipping accidents
Minimize sensory burden	Light environment	Appropriate surface illumination	Anti-glare characteristics of the floor surface should be ensured to reduce visual interference
	Perceptual threshold	Different surface	Different materials and colors for walls and floors can identify the boundaries of the space
Minimize cognitive burden	Other	Other	Eliminate unnecessary advertisement spots on the walls to highlight guide signs

3.2.2. Ticket purchase touchpoint. The design prototype for the automatic ticket vending area specifically focuses on ten inclusive design elements across three themes. It contemplates how to enhance the inclusiveness of the ticket purchasing process from the perspectives of mobility, perception, and cognition, thereby ensuring an effortless, accessible, comfortable light environment, easy

perception, and understanding throughout the ticket purchasing process. Details can be seen in table 2, where the first three columns represent the inclusive design strategy framework, and the column on the right includes specific details to be noted. For specific dimensions, forms, and colors, please refer to figure 7.

Table 2. Design considerations for ticket purchase.

Theme	Elements	Design strategy	Concrete
Minimize mobility burden	Effort-saving for horizontal movement	Eliminate protrusions	Devices such as ticket vending machines should be designed to be embedded in the wall to reduce space occupation
	Other	Other	Enough open space should be reserved in front of the ticket machines to ensure a safe and effective shared space between the ticket buyers and those passing by
	Specialized facilities	Auxiliary facilities for specific purposes	Sufficient space should be provided under the ticket vending machines and ATMs to accommodate knees, making them accessible to people with mobility impairments, such as wheelchair users
	Physical accessibility	Reduce precision requirements	Devices such as cash and coin outlets should be enlarged appropriately to reduce the precision required for users' actions
Minimize sensory burden	Light environment	Appropriate surface illumination	Anti-glare characteristics of the floor surface should be ensured to reduce visual interference
	Perceptual threshold	Facilities& background	To highlight the ticket machines, the color of their decorative surface should be distinctly different from the surrounding environment The shape and color of devices like cash outlets and coin slots should be distinct from the background
	Light environment	Appropriate interface brightness	The brightness of the machine screen should be controlled within a reasonable range that matches the brightness of the surrounding environment to avoid glare that may impact vision
	Sensory compensation	Effective feedback	Set audio prompts for touching the touchscreen
Minimize cognition burden	Integration of guidance	Multilingual	Multilingual
	Systematicity of visual guidance	Use symbol mark	Use symbol mark

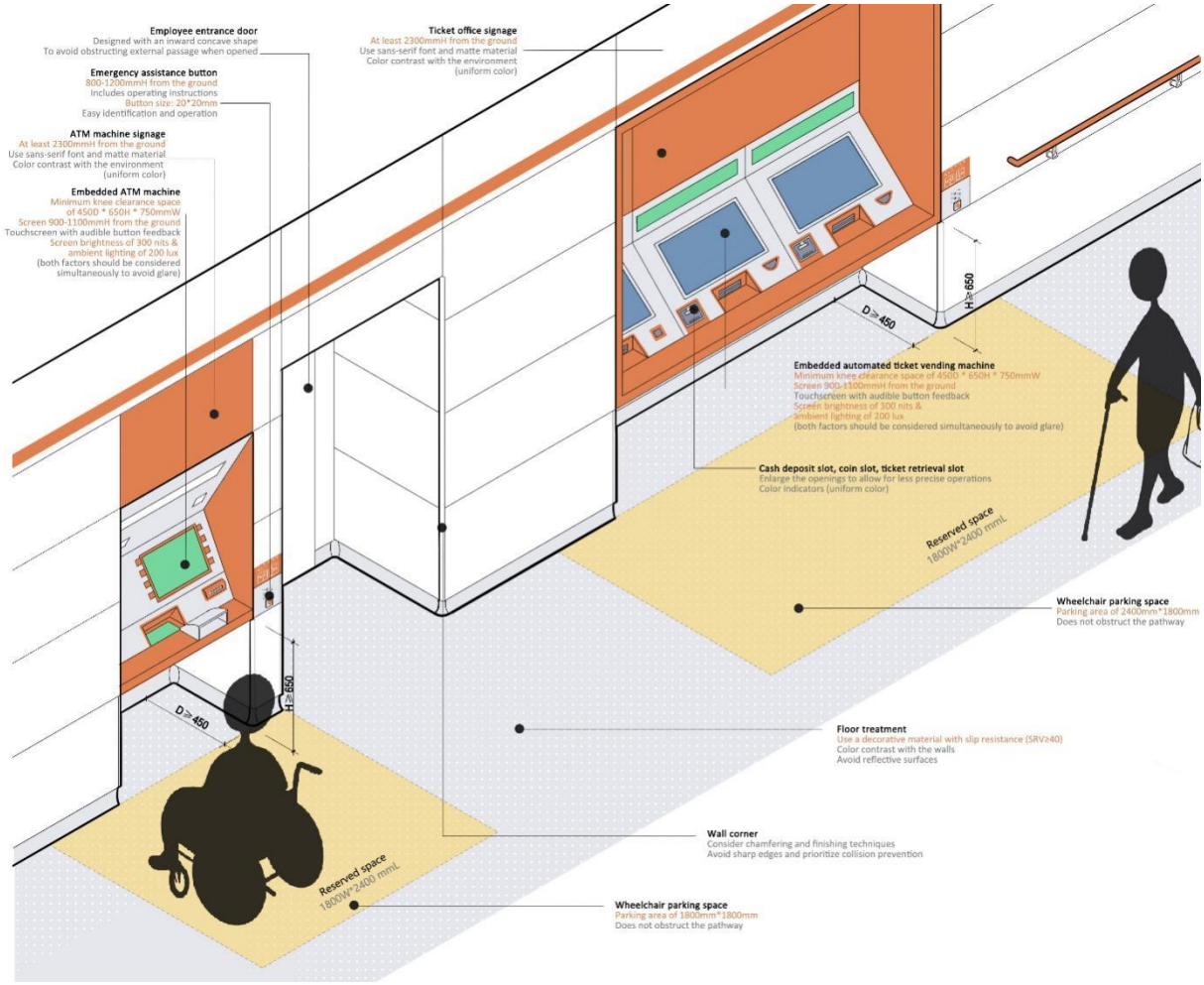

Figure7. Design prototype for passage and ticket purchase area

3.2.3. Location touchpoints. The design prototype for the location touchpoint specifically focuses on five inclusive design elements across three themes. It contemplates how to enhance the inclusiveness of location and way-finding from the perspectives of physical accessibility, perceptibility, sensory compensation, and cognitive logic. Details can be seen in table 3, where the first three columns represent the inclusive design strategy framework, and the column on the right includes specific details to be noted. For specific dimensions, forms, and colors, please refer to figure 8.

Table 3. Design considerations for location

Theme	Elements	Design strategy	Concrete
Minimize mobility burden	Physical accessibility	Reduce precision requirements	The guidance system should be designed to facilitate information acquisition for people with different viewing heights and visual acuity, such as the use of low viewing position designs
Minimize sensory burden	Perceptual threshold	Different surface	To assist visually impaired individuals in better recognition and use, the material and texture of the tactile paving should significantly contrast with the ground paving around it

		Facilities& background	The color of the guide map should contrast significantly with the surrounding environment for quick discovery by commuters
	Sensory compensation	Belt and braces	The guidance system should use multi-sensory compensatory designs as much as possible, conveying information in parallel through visual, auditory, and tactile means to meet the needs of users with different abilities
	Light environment	Appropriate surface illumination	It should use a matte material to prevent light reflection from affecting information reading
Minimize cognition burden	Logic of guidance	Continuity	When setting up tactile maps, they should be connected to the tactile paving as much as possible to enable visually impaired commuters to navigate independently The placement of the guide map should be set reasonably according to the environment and the distribution of pedestrian traffic so that commuters can easily discover and read it at key locations or paths
		Conciseness	The design of tactile paving should be simple and intuitive, and its layout should be effective and comply with the navigation logic of the visually impaired. For example, unnecessary turns and sudden endpoints should be avoided
		Consistent guiding principles	When arranging tactile paving, consideration can be given to setting up some breakpoints or transition areas to facilitate crossing by wheelchair users, baby stroller pushers, and users of personal mobility aids. These breakpoints should be clearly marked and ensure they do not mislead the visually impaired away from the predefined safe path

3.2.4. Waiting touchpoints. The design prototype for the waiting touchpoint specifically focuses on three inclusive design elements across two themes. It contemplates how to enhance the inclusiveness of the seating design from the perspectives of mobility and perception, thereby ensuring the physical accessibility, effort-saving, and easy perceptibility of resting seats for commuters. Details can be seen in table 4, where the first three columns represent the inclusive design strategy framework, and the column on the right includes specific details to be noted. For specific dimensions, forms, and colors, please refer to figure 8.

Table 4. Design considerations for waiting

Theme	**Elements**	**Design strategy**	**Concrete**
Minimize mobility burden	Physical accessibility	Provide support where needed	The form of seat should have armrests and backs for better support and comfort for passengers Sufficient space should be reserved as a wheelchair parking spot for convenience for wheelchair users
		Reduces operate height	It is recommended to set seats at different heights to meet the needs of passengers of different ages, heights, and physical conditions The sides of the seat should be widened appropriately to accommodate passengers of different body sizes

	Effort-saving for horizontal movement	Increase seats	It is recommended to set up a resting seat every 50 meters, which is in line with the average walking distance limit for users with a walking cane
		Disintegrate corner	The edges of the seats should be designed to be rounded to prevent potential injuries
Minimize sensory burden	Perceptual threshold	Facilities& background	The color of the seat should form a significant contrast with the surrounding environment to enhance its visual recognizability

Figure8. Design prototype for location and waiting area

3.2.5. Unisex toilets touchpoints. The design prototype for the toilets touchpoint specifically focuses on six inclusive design elements across three themes. It contemplates how to enhance the inclusiveness of the toilet design, particularly for unisex toilets, from the perspectives of mobility, perception, and cognition, thereby ensuring physical accessibility, special needs accommodation, perceptibility, and comprehensibility for toilet users. Details can be seen in table 5, where the first three columns represent the inclusive design strategy framework, and the column on the right includes specific details to be noted. For specific dimensions, forms, and colors, please refer to figure 9.

Table 5. Design considerations for toilet

Theme	Elements	Design strategy	Concrete
Minimize mobility burden	Physical Accessibility	Reduce precision requirements	Unisex toilets should use larger-sized buttons, and their color should form a stark contrast with the panel and wall for easy operation with an elbow or palm If possible, infrared sensors or voice recognition systems should be installed to further enhance usability
		Reduce operated height	Coat hooks of different heights should be set up in the toilet for accessibility
		Provide support where needed	A flip-up grab bar should be installed next to the toilet, and sufficient space should be left on this side to facilitate wheelchair users' transfer from the wheelchair to the restroom
	Specialized facilities	Auxiliary facilities for specific purposes	Unisex toilets should use automatic sliding doors that are at least 1 meter wide to facilitate wheelchair users' entry and exit
	Other	Other	For the regular toilets, it is recommended that the number of toilets in the women's restrooms should be twice that of the men's restrooms to better meet the needs of gender differences
Minimize sensory burden	Perceptual threshold	Different surface	The choice of floor material should be distinguished from the wall to provide visual differentiation
		Facilities& background	The color of the safety grab bars should form a stark contrast with the surrounding environment, and the material chosen should be anti-slip and easy to grip
Minimize cognitive burden	Systematicity of guidance	Use symbol mark	Unisex sign
		Standardized design	
		Use pictogram	Use pictogram as much as possible for the toilet floor plan
	Integration of guidance	Multi-sensory	Consider tactile diagrams for the toilet floor plan

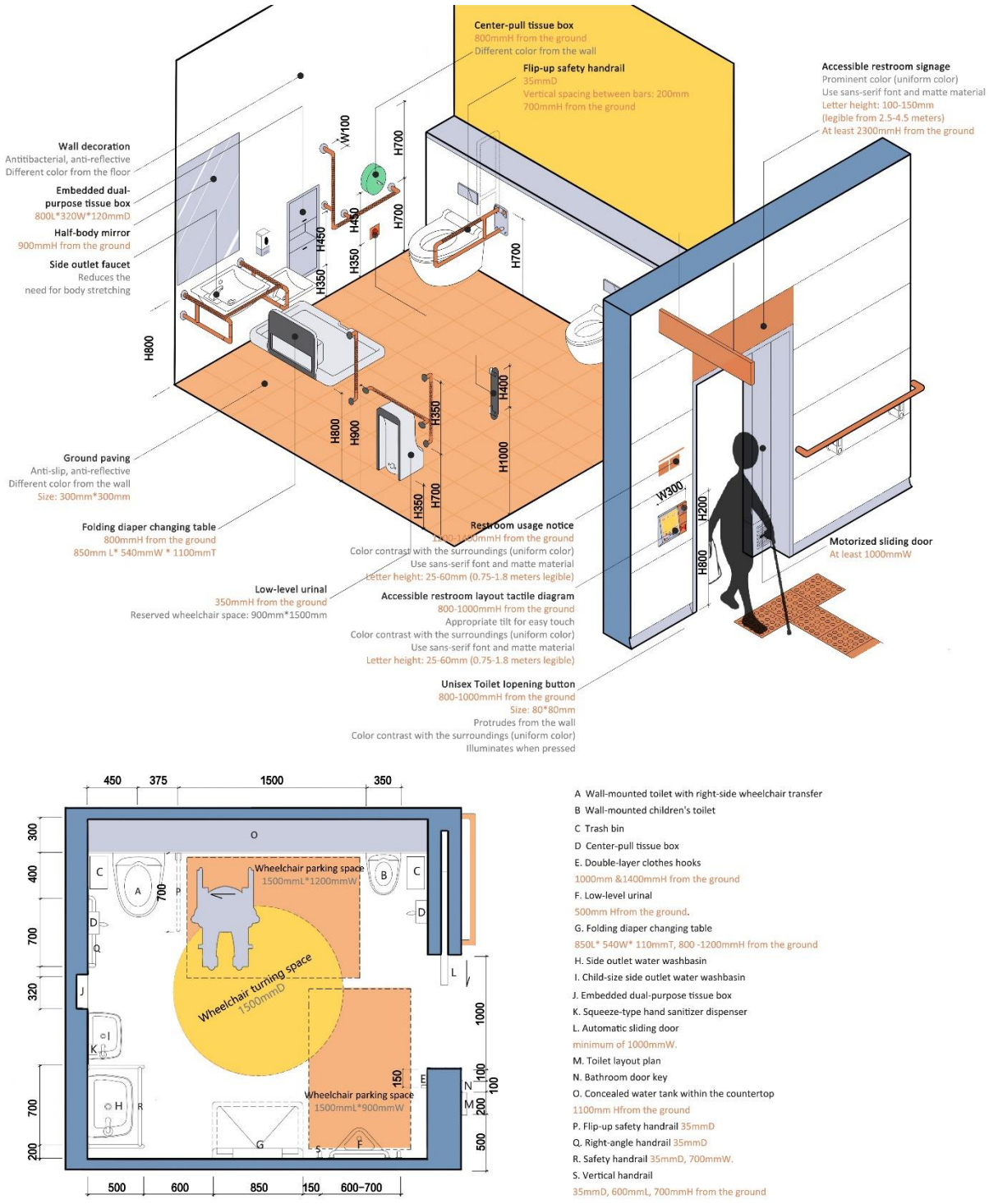

Figure 9. Design prototype for unisex toilet

4. Discussion

To validate the widespread applicability and value of inclusive design optimization, detailed storyboarding was used to portray the optimized scenarios. This research used visually impaired commuter A taking a certain subway line as an example, recreating a series of specific commuting scenarios. The eight scenarios included going out, entering the subway station hall, tap-in, taking the

elevator, waiting at the platform, tap-out, locating, and exit, with a detailed depiction of the specific details that might be encountered in these steps. The visual storyboards help us explain and validate the effectiveness of optimized design in practical applications, as shown in figure 10.

- Scene 1: Departure from Home. The scenario portrays where the visually impaired commuter A embarks on his journey from his residence to his workplace. In Detail 1, passenger A moves along the tactile paving, using a specially designed guide cane to assist in navigation. In Detail 2, A receives auditory walking navigation instructions from a smartphone via one ear, operating the phone entirely through voice commands, ensuring that all necessary information can be audibly received.
- Scene 2: Entering the Subway Station. The situation is depicted in which A successfully arrives at the subway station entrance by tactile paving. In Detail 1, A accesses the steps through an accessible ramp (in cases where there are fewer accessible elevators). In Detail 2, A proceeds along the tactile paving and hears a voice prompt from the escalator, "The escalator is descending, please hold onto the handrail, mind your steps!" Subsequently, A then chooses to use the stairs to enter the concourse level. Detail 3, the tactile paving continuously guides to the stairs, and round dots are used to alert A to be cautious.
- Scene 3: Ticket tap in. The scenario is depicted where commuter A, after going through a security check, successfully navigates through the accessible ticket-checking gate under the guidance of tactile paving. In Detail 1, the accessible ticket-checking gate is marked with conspicuous orange color, and there is an accessible ticket-checking prompt at the top of the gate to guide pregnant women, elderly people, wheelchair users, visually impaired individuals, passengers carrying heavy items, or accompanying children. In Detail 2, the tactile paving directly guides A to the accessible elevator.
- Scene 4: Taking the Elevator. The scenario is depicted where A rides the accessible elevator and successfully arrives at the subway platform. In Detail 1, the accessible elevator is designed with bi-directional signs at corners, ensuring that the elevator sign can be seen from all directions. In Detail 2, the accessible elevator is specifically designed with double-layered doors opening on opposite sides, thereby eliminating the need for wheelchair users and passengers with strollers to turn around or back up within the elevator.
- Scene 5: Arriving at the Platform. The scenario is illustrated in which A steps out of the elevator and guided by the tactile paving, arrives at the platform waiting area. In Detail 1, the accessible elevator features low-positioned, prominent buttons, each adorned with Braille indications. In Detail 2, the entrance to the accessible elevator is highlighted with the signature orange color for accessibility and equipped with a transparent observation window in the door. Detail 3 highlights the presence of audio prompts in the elevator, such as, "Ding! The elevator is ascending to the platform level."
- Scene 6: Tap out through the ticket gate. The situation is A, guided by the tactile paving, smoothly exits the station using the accessible ticket gate. In Detail 1, the accessible ticket gate features a conspicuous orange design, complete with accessibility prompts. In Detail 2, the passage of the accessible ticket gate is designed with a generous width of 900mm and stands 150mm lower than a standard gate. In Detail 3, considering the slower movement speed of the inclusive population and the frequent occurrence of unexpected situations, the gate employs a humanized sensor swing gate design to prevent sudden incidents.
- Scene 7: Locating. The scenario is A uses a tactile guide map to understand his location and the conditions of the entrances and exits. In Detail 1, the guide map is made of a transparent acrylic custom overlay featuring Braille and raised line indicators, allowing visually impaired individuals to understand the general layout of the hall and the location of the entrances and exits through touch. In Detail 2, A confirms the location of the exit through the voice navigation function of the mobile map.
- Scene 8: Exit. The scenario is A reaches the ground via an escalator. In Detail 1, the escalator features an accessibility prompt column, which includes directional signs for ascending and

descending, audible announcement speakers, and various escalator symbol mark such as no-cart and hand-hold signs. In Detail 2, the stairs are equipped with two handrails in a conspicuous color for easy identification.

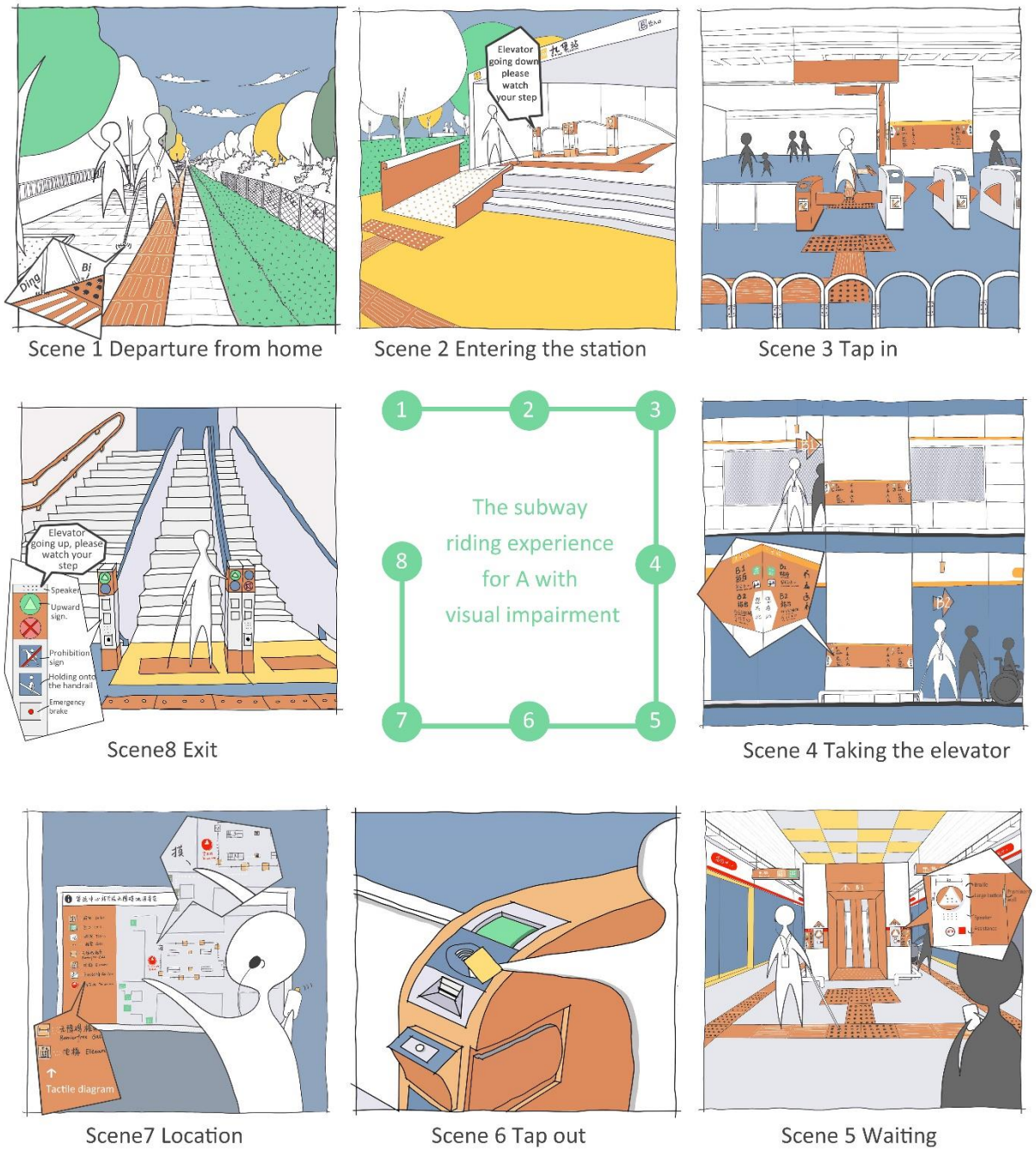

Figure10. Storyboard of visually impaired commuter A taking the subway

Through storyboards, specific scenarios were used to demonstrate the purpose, feasibility, and implementation results of inclusive design strategies. By analyzing the entire process of the visual impairer's commutes, the researchers can validate and confirm under what circumstances the inclusive design strategy framework is usable, reasonable, and reliable.

The significance of this storyboard lies in three aspects. Firstly, it demonstrates the specific plan after the optimization of inclusive design, which is innovative and practical. Secondly, it reemphasizes the importance of human-centered design. By considering the needs and behaviors of visually impaired commuters in conjunction with specific scenarios, it aims to provide a convenient and comfortable experience. Thirdly, it validates and illustrates whether inclusive design can effectively support vulnerable groups in specific contexts, enabling their equal participation in public services and social activities, which is the ultimate goal of inclusive design.

5. Conclusions

This study explores inclusive design in rail transit spaces through a qualitative research process composed of three core steps: case study, framework construction, and design practice. The innovation lies in the construction of a comprehensive, status quo-based, and practically applicable inclusive design strategy framework, while also integrating qualitative research methods from design and sociology into the process of induction and deduction. By using the TEL in Singapore as a research case, the researchers conducted in-depth field research and data analysis and utilized grounded theory coding to refine the strategy framework for inclusive design in rail transit spaces. This approach not only reveals the underlying design logic of inclusive design from a bottom-up perspective but also deepens the understanding of the fairness and inclusiveness of rail transit spaces. Furthermore, based on the inclusive design framework, prototype suggestions for optimizing five spatial touchpoints were proposed. Finally, the optimized experience effects in specific situations are explained and verified through storyboarding.

In the context of rapid changes in current social demographics, social forms, and development trends, this qualitative research method will provide strong methodological support for the inclusive design and practice of rail transit spaces in emerging cities. It will help enhance the user attraction and stickiness of public rail transit, promote positive revenue and profit, drive the city to gradually form a public transport system dominated by rail transit, and achieve energy-saving, low-carbon, and sustainable transportation development goals.

The main limitation encountered in this study is that the researchers cannot gain a comprehensive understanding of inclusive design from the perspective of all subway users. The role-playing in this study only selected commuters with mild visual impairments, however, rail transit commuters are a diverse group with their own needs. If more roles could participate, the understanding of inclusive design in rail transit spaces would be more comprehensive. Despite these limitations, the research has yielded important insights into the inclusive design of rail transit spaces. This opens up new possibilities for further research and provides valuable practical references for achieving a more comprehensive and inclusive design of public transport spaces

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Review on Methods and Algorithms Using Social Media Data Toward Public Transportation

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Abstract. Public transport services are becoming more widespread, and services are below the required levels, which could not satisfy the users' needs and expectations. Social media platforms or social media network have allowed millions of users to publicly and instantly voice out their idea related to our daily lives. From the social media we can analyses the Machines Learning and Natural Language Processing (NLP) approaches are used to modelled topics, tones, and sentiment. This analysis can be done by the sentiment analysis that classify a text into positive, negative, and neutral posts. Using social media data like Twitter, Facebook, Instagram and TripAdvisor, the text can express the dissatisfaction of users regarding public transportation performance or services. From the social media, the level of user satisfaction and perception towards public transport services and performance can be identified with the user sentiment expressed in terms of a positive reflection of the satisfaction of the user. But if the user's sentiment is expressed in negative ways; it reflects their dissatisfaction with public transport performance and service. The aim of the paper is to provide a methods and algorithms technique, which can help researchers carry out further research in this area.

1.Introduction

With the invention of social media, people have been able to publicly and instantly voice out their ideas on a social network like Facebook, Twitter, Instagram, TripAdvisor and others. This data can be collected and use analyses to see the public perception and satisfaction regarding various issues as they are facing, latest news, disruptions, or their perceptions or experiences in anything around them [1].

Users of public transit systems are progressively expressing their satisfaction with the services' comfort, cost, crowdedness, speed, and safety using their digital voice. Additionally, people use their voice to express how they feel about certain news events and react to the infrastructural services. Thus, social media data has the potential to enhance or even replace traditional data collection methods [1].

Opportunities to the government transport agencies can be utilising this social media to interact with users and customers for collecting of data in a practical way [1]. Further, there are research on the

reasons why citizens use these platforms, their preferences, levels of awareness, and expectations regarding how their data can be used [1].

In any place where economic activities, including tourism, have been successfully developed, there could be no contemporary economy without efficient transportation and a dependable transportation infrastructure. Accessibility and mobility are made possible inside a tourism area by transportation. It can either be used alone as a tourist attraction or in combination with other natural or man-made elements. From the research intends to acquire insights into the transportation by automatically detecting the various modes of transportation in TripAdvisor comments [2].

A social media like a Twitter we call a "tweet" are includes text, the current time, and possible geographic locations (geo-tagged). Due to the intricacy of text mining and text analysis tools, content of tweets has not received as much attention as other components of a post. Instead, time, date, and geographic coordinates are mostly for spatial-temporal analytics. The locations of the data that is available, which frequently requires more sophisticated computing techniques to collect and store such a tremendous amount of data and reduce processing time, is the key issue that makes using social media data difficult. In addition, one area that has received very little attention is how to efficiently extract travel mode from social media data can be use it for travel demand analysis [3].

Therefore, the aim of this paper is to provide a methods and algorithms technique, which can help researchers carry out further research in this area.

2. Review on methods and algorithms using social media data toward public transportation

2.1. Valence aware dictionary for sentiment reasoning (VADER)

From social media data like Twitter can be collected the performance of public transportation. It combines with longitudinal big data on the delay information that the network continuously broadcast over a year, creating hundreds of millions of data. Natural Language Processing (NLP) and Machine Learning approaches are used to model topics, tones, and sentiment. The models and data that are produced are compared to user and citizens comments gathered through a survey [1].

In order to evaluate social media data using Twitter (Tweets) toward public transportation performance, a longitudinal sample of Tweets via the Twitter Search API from January 2018 to April 2019 was created. The process of sentiment analysis was then carried out utilising the free and open-source using VADER (Valence Aware Dictionary for Sentiment Reasoning) rule-based approach [4]. VADER was specially modified to account for sentiment analysis in social media such as Twitter. From the statement, VADER assigns one of three values to indicate whether it is positive, neutral, or negative. The overall polarity of a sentence was represented by the transformation of these into a fourth, compound value. The Great Barrier Reef sentiment detection study [5] and the development of training data sets for more complex machine learning algorithms to forecast election results [6] are two examples of pertinent studies using VADER. A small sample of open-source VADER results were also contrasted with those from IBM Watson Tone Analyzer [7], a vendor product for "Smart Cities" that is currently free for small users but more expensive for larger enterprises. Tone Analyzer recognises emotions such as joy, fear, sadness, angry, analytical, confident, and tentative.

2.2. Topic modelling

Next analysis, called topic modelling, uses statistical modelling to find abstract "themes" and "topics" that appear in collections of "documents". Every paper is generated with a variety of subjects. A document might contain 20% topic A, 40% topic B, and 40% topic C, for instance. Other clustering algorithms or techniques allocate each object to a different group, which contrasts with this. The Latent Dirichet Allocation (LDA) was carried out utilising the free and open-source Gensim library [8]. To prepare for LDA, Tweet text undergoes a text normalization process including removal of stop words, punctuation, lemmatization, and being made lower case [9].

2.3. Text mining

According to Ainhoa Serna et.al (2018) using TripAdvisor comments as a starting point, the first step was to categorise the sources of information for walking tours in Croatia, walking and biking tours in Croatia, bike and mountain bike tours in Croatia, day trips & excursions in Croatia, and walking tours of Dubrovnik into four subcategories: taxis and other transportation, ferries, public transportation systems, and railway. The following data collected was automated and scraped from TripAdvisor. Continue with data preparation for analysis by detecting language in social media comments with Shuyo [10], editing text with Aspell [11], customising a spell checker with localization and full name abbreviation with Freeling methodology [12], and finishing with Named Entity classification and WordNet sense annotation with UKB disambiguation [13]. After that, proceed with data curation by classifying, grouping, and analysing concepts. The last stage to be optimised for Apache Solr's real-time indexing of massive amounts of data was data storage. Data visualisation is completed using the Kibana dashboard [14].

Created a dashboard platform with interactive graphics that analyses TripAdvisor social media data along with visitor reviews to find positive and negative trends and their potential effects on sustainable travel and transportation. Additionally, the various types of transportation are sorted and classified by date, location, rating, method of transportation, and language. Additionally, the comment and its corresponding title are obtained.

The analysis is based on reviews of Croatian transportation from December 12, 2007, to June 10, 2017. There are 12,928 reviews within this time period, and 11,924 of them were written in English. There are 5 top language use by the users which is English, Spanish, Italian, Portuguese, and French. The fact that over 92% of the comments are written in English is notable. Information visualisation using tables, a pie chart, a histogram, a word cloud and as well as a summary of the data on dates and their format. The following distribution (Figure 1) is generated by grouping the various transport methods and using an English language filter [2].

	# stars							
Transport Mode	5	4.5	4	3.5	3	2	1	Total
Tram	3,872	0	2,312	0	703	146	61	7,094
Taxi and others	3,548	388	145	15	22	8	43	4,169
Railway	124	0	98	0	70	10	11	313
Ferry	191	0	47	0	27	15	15	295

Figure 1. Transport modes [2].

Nearly 86% of the comments for the Tram, which is rated with an average of 55% 5 stars, 33% 4 stars, and just 3% 1-2 stars. Additionally, 24% are concerned about "Taxi and other" modes of transportation, with ratings of 88% 5 stars, 5% 4 stars, 6% 3 stars, and 1% 2 stars. The tram's views, which have been dubbed outstanding, spectacular, fantastic, astounding, panoramic, wonderful, great, and priceless, are the most popular. The tram is praised as being a fantastic experience, highly recommended, affordable, incredibly clean, swift, and modern. The ticket salespeople are quite nasty, the line is poorly organised, it is pricey, it is little, and it is horrible. Most of the time, 'Taxi and others' transport mode is qualified with positive attributes such as great, good, friendly, beautiful, excellent, wonderful, fantastic. Only 1% are negative attributes, such as dirty, expensive, and bad experienced [2].

To examine the use of any travel mode, it will be able to use disaggregated opinions from a social media dataset. This social media data is easier to access than data gathered through surveys, its utility for modelling individual choice behaviour has increased. Furthermore, accessible in real time and

throughout extensive timeframes, which makes it possible to perform the analysis. The study's findings could be helpful in formulating policy and making decisions on urban transportation and mobility in metropolitan areas. From the research the demonstrates that text mining of social media data can be utilised as a complementary strategy to the traditional methods to investigate travel behaviour in order to create a more comprehensive for urban transport planning. Social Media data would make it possible to update demand prediction models and keep track of how well the various transport modes are performing. Investments in transportation, both public and private, might be more effective as a result.

2.4. Content analysis technique

According to Mojtaba Maghrebi et al. (2016) the information was gathered, and descriptions were obtained from Twitter between 1st November 2015 and 19th April 2016 over a roughly 23 weeks by data mining the tweets within the Melbourne Metropolitan Area. This data to know how often tweets are posted each day at Melbourne Metropolitan Area. Figure 2 displays the daily frequency fluctuation throughout the course of the whole data collection period. Figure 3 displays the overall number of tweets sent on each day of the week, A constant increase toward the weekends and a slight decrease on Sundays may be seen when looking at the median numbers. Additionally, Mondays and Tuesdays saw lower activity levels whereas Saturdays saw an increase in tweet production [3].

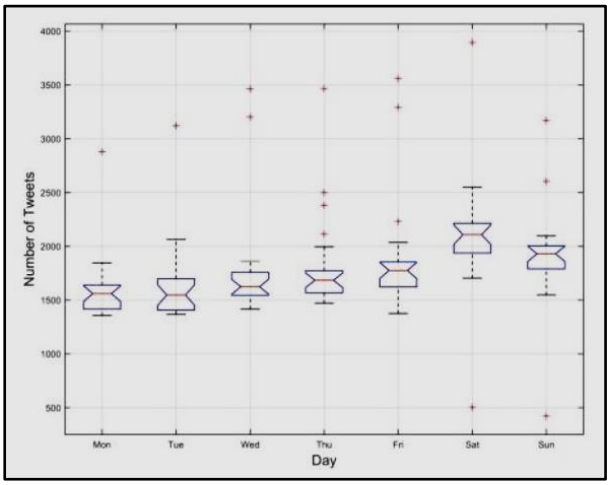


Figure 2. The frequency of the geo-tagged tweets in per day [3].

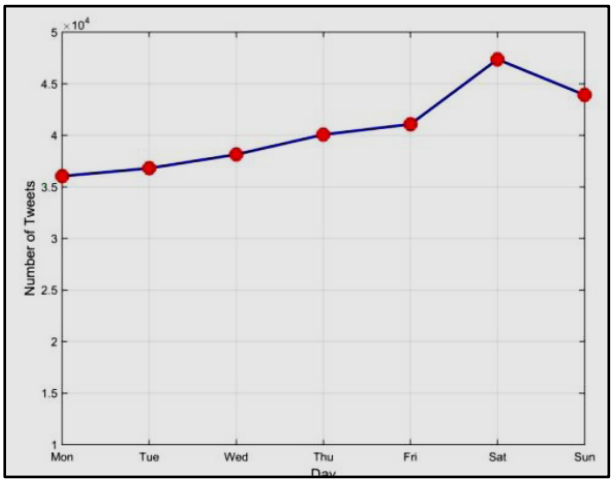


Figure 3. The total number of the geo-tagged tweets in per day for each day of week [3].

The most popular period time users “Tweet” on Twitter are after midnight till midday, which is notably greater than the afternoon and evening when individuals are likely outside their homes or at workplace.

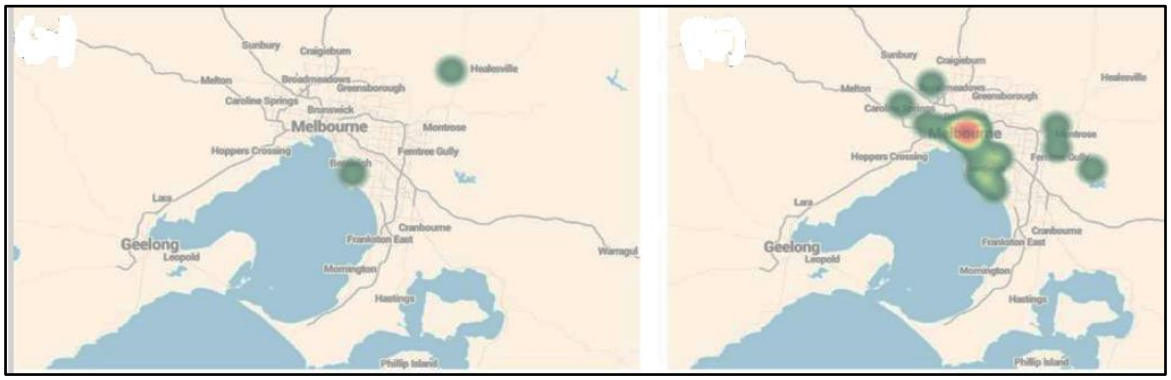
Next was extracting the trip mode from the tweets by using a content analysis technique to identify certain words and phrases that were probably used to describe mode of transports related to the activity reported in the tweets. The Twitter posts are limited to 140 characters, which is significantly fewer than the 160-character restriction for standard SMS. Due to this problem, users are forced to make their posts shorter, which may result in them leaving out some of the information they intended to give, like Figure 4 [3].

Mode of Transport	Term and variations
Bus	"bus"
Train	"train", "metro"
Taxi	"taxi"
Car	"car", "drive", "driving", "drove", "parking", "traffic"
Bike	"bike", "cycle"
walk	"walk"

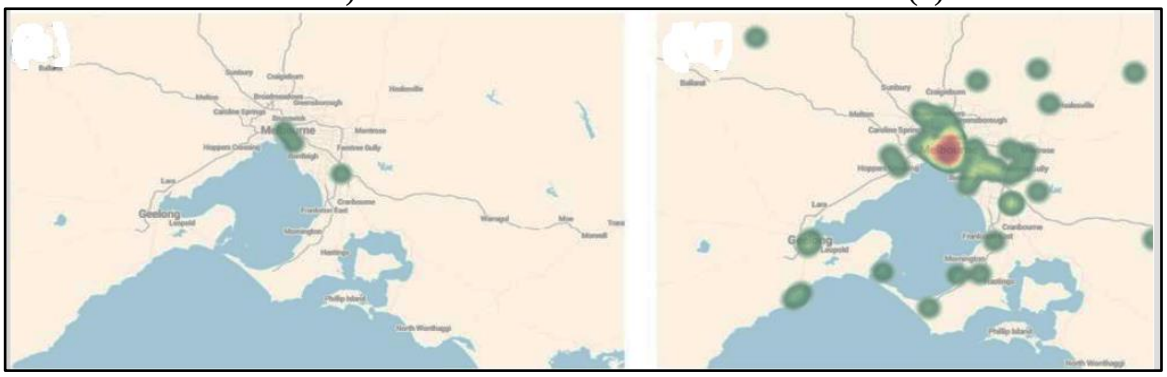
Figure 4. Terms and variation associated with transport modes [3].

To automate the procedure, transform all text to lowercase due to text sensitivity issues, and find all tweets that match, use MATLAB R2014b. Figure 5 compares each mode of transportation in subfigures (a) to (c) as it maps users' preferred travel modes in the Melbourne metropolitan area (f).

If validated and considering the socio demographic characteristics of social media such as gender, age, income, level of education, race, marital status, etc., the results can be used as a supplemental source of information. Because these values need validation, we aimed to merely give a proof of concept and a summary of the combined results instead of reporting the real data. To assess the accuracy and dependability of the available results, the acquired results can be compared with zone aggregated home travel survey results in subsequent works.



a) (b)



(c) (d)

(e) (f)

Figure 5. Spatial analyses of each travel modes extracted from twitter data: (a) bus, (b) train, (c) taxi, (d) car, (e) bike and (f) walk [3].

Social media and other crowdsourced databases are regarded as a great source of knowledge for addressing real-world issues. In this research, suggested a potential use for social media in the context of transportation. The research determined the tweets' associated mode of transportation. Following the basic data pre-processing and data cleaning, the contents of the tweets are examined to identify the posts that provide information on different transport mode options.

2. Discussion and summary

Certain idea found that the population's age distribution substantially mirrored that of the labour force. These Tweets most likely occurred during peak travel times and were made by people who commute during these times, as can be inferred from the time of posting. This should be kept in mind by researchers and practitioners so that they don't overlook the potential edge cases of off-peak travel and non-Twitter users. Inversely, this group does provide as a data source for a population that might not have as much free time as others, and when employing a mixed strategy, we might need to rely on these passively gathered data sources to engage them.

Further research on bias in this context could further generate commentary on socio economic variables, ethnicity, and gender issues. However, some research limitations should be considered in order to act wisely. Social media usernames and identifiers, for instance, can be used to infer demographic information like age and gender as well as connections between language use and socio-economic indicators. As a result, further studies must be done to compare these data and models with the objectives of users in order to monitor and enhance the transport performance, which is essential for creating smart cities.

Additionally, the original observation and its associated title were very beneficial in helping any region create a modern economy because successfully developed commercial activities, such as tourism, are impossible to have without developed transportation and transportation infrastructure. Tables, pie charts, histograms, word clouds, the five most popular languages as well as summaries of the data regarding dates and dates format, will be used to visualise the information. Social media data is easier to access than data gathered through surveys, its utility for modelling individual choice behaviour has increased. It is moreover accessible in real time and throughout extensive timeframes, which makes it possible to perform a dynamic analysis. This study may be helpful in formulating policies and making decisions on urban transportation and sustainable mobility. It can be used in conjunction with more traditional methodologies to investigate travel behaviour to provide urban transportation planning with a fuller and deeper picture.

Social media data would make it possible to update demand prediction models and keep track of how well the various transit modes are performing. Investments in transportation, both public and private, might be more effective as a result. A "Sentiment Labelled Sentences Data Set" must be created and shared in order to serve as the training dataset for supervised learning algorithms, even while research provides the data for predictive analytics. It will be finished with the development of a training corpus for machine learning models using the positive and negative comments generated by this research. The accuracy of several methods, including maximum entropy, SVM, SLDA, BAGGING, RF, and decision TREE model, will also be evaluated. In this way, unrated Social Media content in the transportation sector can be automatically assessed.

Additional research on bias in this situation may lead to additional discussion on socio economic factors, ethnicity, and gender. Social media usernames and identities can be used to infer demographic details like age and gender, even if survey data already reveal several characteristics of respondents. These findings can be further supported by connections between language use and socio-economic characteristics. The sample does not represent the opinions of people who do not post on Twitter because the recruiting approach for the sample focused on Twitter users. The research will provide data for predictive analytics. By using the “Sentiment Labelled Sentences Data Set" that serves as a training dataset for supervised learning algorithms. In fact, it will be finished with the development of a training corpus for machine learning models and Natural Language Processing (NLP) using the positive, negative, and neutral comments generated.

To identify the postings with information on travel mode choices, research was done on the extracted mode of travel that related to the success of the tweets. Using MATLAB R2014b to automate the collection of data from nearly 300,000 geo-tagged tweets sent in the metro area over the course of 23 weeks will strengthen the outcome. The obtained results, which were confirmed by considering the socio demographic characteristics of social media users, serve as a supplementing source of data for House Travel Surveys (HTS). Gender, age, income, education level, race, marital status, and eccentricity are among the socio demographic characteristics of social media users.

After being validated by considering socio demographic of social media users, the results can be indicated that which is the most popular modes of transportation. These data were extracted from Twitter and can be used as a complementary source of information for House Travel Surveys (HTS).

3. Conclusion

The integration of social media data like Tweets linked to public transportation performance with data on transport performance and users survey responses to create a longitudinal sample. Uses longitudinal big data to analyse social media data by Tweets for the public transportation performance. This is done by mining data at Twitter for the delay information that has been regularly broadcast by the network for a year, creating hundreds of millions of data artefacts. Then, by using machine learning and Natural Language Processing (NLP) strategies, themes, tones, and sentiment are modelled. The generated data and models are contrasted with user opinions gleaned from a user and employing survey data directly from those social media posts made by Twitter users. The tweets happened during peak travel times, so those who commute during peak hours posted them.

A dashboard platform with dynamic graphics that analyses social media data from TripAdvisor also has been built using a transport analytic approach based on big data and text mining analysis from social media. This information includes visitor perspectives as well as information about both good and bad aspects and their possible effects on environmentally friendly travel and transportation. The various types of transportation are sorted and classified by date, location, rating, method of transportation, and language.

Thus, more exploring the methods and algorithms need to accomplish all the challenges faced by previous research focus on social media data towards public transportation. Social media platforms we can analyses the Machines Learning and Natural Language Processing (NLP) approaches are used to modelled topics, tones, and sentiment. This analysis can be done by the sentiment analysis that classify

a text into positive, negative, and neutral posts. Using social media data like Twitter, Facebook, Instagram, TripAdvisor and etc, the text can express the satisfaction and dissatisfaction of users regarding public transportation performance or services.

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The Intangible Impacts of Servicescape towards Business Performance

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Abstract. Servicescape, also known as the physical environment in which a business operates is delivered, plays a crucial role in influencing workers' productivity and shaping customers' perceptions and experiences of the service provided. While the tangible elements of the servicescape, such as space, energy use, luminosity, and noise level, have been well-studied, the intangible impacts of servicescape are often overlooked and has been acknowledged as being extremely complex and difficult to measure. This paper aims to identify the intangible impacts rendered by the servicescape. Three major intangible impacts and various sub-impacts were identified from various literary sources. The intangible impacts were then analysed using content analysis with the assistance of NVivo software. The findings suggest that servicescape indeed encompasses various forms of intangible impacts, including emotional, cognitive, and psychological responses. These intangible impacts shape how customers and employees perceive not only the physical environment but also the service quality, image and reputation of the business organisation. The findings of this paper act as a basis for further studies that could help raise awareness among facilities managers on the importance of considering intangible impacts of servicescape in strategic decision-making, performance management, and determining return on investment.

1. Introduction

In today's fiercely competitive business environment, where products and services seem almost indistinguishable, organisations are continually seeking novel approaches to stand out and secure a competitive edge. Amidst this pursuit, an often-overlooked yet crucial factor plays a pivotal role in shaping customer experiences and, ultimately, business success, that is servicescape. Defined as the physical environment in which services are delivered, the servicescape provides a diverse range of impacts that subtly influence customer perception, emotions, and behavior [15][8][72]. According to [36], servicescape refers to a man-made controlled space where the physical facilities may have a substantial effect on consumers' satisfaction and is manipulated and designed in various ways to facilitate commercial exchanges.

In businesses such as hotels, shopping complexes, food and beverage establishments (including fast food industries and coffee shops), leisure services (like karaoke or casinos), and healthcare facilities, the servicescape plays a pivotal role as it encompasses elements that significantly influence customer perceptions, satisfaction, and overall experiences. The servicescape encompasses a multitude of elements that collectively shape the overall physical environment where services are provided. These elements include space, energy usage, luminosity, noise level, lighting, colors, sounds, and even

temperature [13][28][47]. Understanding and optimizing these tangible elements can lead to enhanced customer engagement, improved employee morale, and ultimately, increased business performance.

Additionally, beyond the tangible elements, the servicescape also exerts intangible impacts that play a vital role in shaping customer experiences. These elements of the servicescape orchestrate the internal emotional responses of customers and employees alike. For instance, a well-designed and aesthetically pleasing environment with carefully curated colors, temperature, music, and lighting can create a sense of comfort, happiness and relaxation, enhancing customers' overall experience [1][8]. Imagine walking into a cozy coffee shop with soft, warm lighting, gentle background music, and a welcoming aroma of freshly brewed coffee. The ambiance immediately puts customers at ease, making them more likely to stay longer, order more, and return for future visits. Similarly, employees working in a pleasant and conducive environment are more likely to be motivated, leading to improved service delivery and, in turn, increased productivity [3][22]. Picture a workplace with an open layout, ample natural light, and a well-balanced color scheme that fosters a positive atmosphere for employees. They feel happier and more connected to their surroundings, which positively influences their interactions with customers, ultimately contributing to the business's success. Thus, the intangible impacts of servicescape are essential for business performance, ensuring the success of the business. These subtle yet powerful influences on emotions and perceptions have a lasting effect on how customers and employees perceive the brand, leading to long-term loyalty and positive word-of-mouth referrals.

Despite the acknowledged importance of servicescape on overall business performance, a significant gap remains in comprehensive research that delves into the intangible impacts of servicescape, and their profound influence on businesses. While numerous studies focus on tangible elements such as spatial layout and design, the equally crucial psychological and emotional impacts of the servicescape on both customers and employees frequently escape notice. For instance, [76]conducted a comprehensive study that explored the concept of servicescape elements, with a specific focus on the integration of safety as an essential element. The findings revealed that when customers perceive a service environment as safe and secure, they are more likely to trust the brand and feel at ease, positively impacting their overall experience and likelihood of returning. [51] contributed to the research by exploring the application of the e-servicescape model in the context of online exhibitions. The study shed light on how the virtual environment's design and features influence visitors' engagement, immersion, and satisfaction. Understanding these factors can help businesses optimize their online platforms to create more enjoyable and meaningful experience for customers. [6] investigated the impact of both offline and online servicescapes on customer satisfaction and repurchase intention. The research found that a seamless and consistent transition between the physical and digital environment positively influenced customers' perceptions of the brand, leading to increased loyalty and repeat business. Furthermore, [53] presented a comprehensive model of the servicescape in the fast casual dining industry. The study highlighted the importance of aligning the servicescape with the brand's identity to create a cohesive and immersive dining experience for customers. By doing so, business can foster stronger emotional connections with their target audience and differentiate themselves in competitive market.

However, despite these valuable contributions, research on the intangible impacts of servicescape is still limited, especially in the realm of facilities management. Facilities managers play a vital role in shaping the servicescape and must recognize the significance of understanding and optimizing the servicescape's intangible impact. By acknowledging how elements of the servicescape influence the internal emotions of customers and employees, facilities managers can strategically design spaces that foster positive experience for both parties. Moreover, aligning the servicescape with the brand's values and identity can create a cohesive and immersive environment that enhances business performance. Therefore, research endeavors should strive to strike a balance between exploring both tangible and intangible impacts of servicescape to comprehensively grasp the full spectrum of its effects on businesses.

Hence, this article embarks on a comprehensive exploration of the intangible impacts of the servicescape on business performance. Understanding and optimizing these intangible impacts can give businesses a competitive edge and contribute to their long-term success. By delving into research on

environmental psychology and servicescape, this paper aims to shed light on the intangible impacts of servicescape on customers' and employees' experiences and, ultimately, the success of businesses. In the forthcoming sections, this paper will delve into the various elements that constitute the servicescape and explore the intangible impacts on cognitive, emotional, and psychological responses, as well as behavioral responses. By understanding the psychological and emotional impact of the servicescape, facilities managers can make informed decisions that enhance customer experience, increase employee engagement, and ultimately boost business performance.

2. Literature Review

Service experience forms the fundamental foundation upon which service offerings are built in the servicescape, shaping customers' perceptions and influencing their internal emotion responses. The subsection below provides a further explanation of servicescape, the tangible elements of servicescape, and the intangible impacts of servicescape.

2.1. Servicescape

The concept of servicescape emerged during the 1980s and has since evolved into a crucial area of research in the field of service marketing. The term "servicescape", coined by Bitner in 1992, is recognized among scholars as the atmospheric [10][38][61], physical environment [15][44], and store environment [70].

The servicescape plays a crucial role in the performance of various consumer-oriented services, including leisure services, hotels, shopping malls, restaurants, and related industries. It shapes the atmosphere for its occupants, influencing their internal responses and behavior. The term 'servicescape' pertains to the environment within which a service is provided, serving as the backdrop for interactions between seller and customer. It encompasses tangible elements that aid in the execution or communication of the service [21]. According to [86], the servicescape significantly influences customers' overall experience and satisfaction with the service, encompassing elements of the physical facility and other tangible elements of the service setting. Servicescape encompasses all tangible elements present around consumers during service transactions [43].

There are various tangible elements of servicescape identified by scholars in various fields. Below, the subsection explains the various tangible elements of the servicescape in further detail.

2.2. Tangible Elements of Servicescape

Numerous viewpoints regarding servicescape elements are derived from scholars studying various types of service settings. [1] focused on hotels, [8] on coffee shops, [63] on shopping complexes, [65] on restaurants, [5] on water sports and recreation, and [37] on healthcare services . Table 1 shows several research studies conducted during a comprehensive literature review from 2018 to 2023, investigating the essentials of tangible elements in diverse service settings.

Table 1. Servicescape elements and attributes suggested by previous studies.

Authors	Elements of Servicescape	Attributes
[1]	Ambient condition	Temperature, lighting, noise, music, and scent
	Space and function	Layout, design, equipment, furnishing
	Sign, symbols and artifacts	Signage, style of decor, personal artifacts, painting or picture, plant, flowers, furniture, and wall decor
[8]	Physical aspects	Equipment, design, and space
	Social aspects	Staff service quality and behavior intention
[63]	Ambient factors	Lighting, aroma, noise, music, air quality, and temperature
	Aesthetic factors	Interior decor, color scheme, picture/paintings, plants/flowers, ceiling/wall decorations

	Layout	The way of machinery, equipment, furnishing, seats, aisles, hallways and walkways, restrooms, and the entrance and exits are designed and arranged.
	Variety	Variety of tenant and product in a business (shopping mall)
	Sign, symbols, and artifacts	Signage and decor
	Cleanliness	Clean environment
	Social factors	Employees and customers
	Ambient factors	Scent, lighting, music, temperature, cleanliness
[65]	Design factors	Color, space, layout, aesthetic, arrangement of furniture and equipment, and design material
	Social factors	Employees and customers
	Ambient condition	Music, aroma, cleanliness, and room temperature
[5]	Space layout and function	Furniture, placement, and equipment
	Sign, symbols, and artifacts	Signage, signboard, information board, and decoration
	External variables	Entrance, parking, building architecture, building design, exterior design, surrounding area, and location
	Interior variables	Color, flooring, wall covering, finishing, material, style, and attractiveness
[37]	Ambient variables	Temperature/humidity, ventilation, noise, music, lighting, scent, cleanliness
	Functional variables	Scale/size, layout, space, traffic flow, way finding, accessibility
	Product/Furniture/Displays	Furniture, painting, picture, artifacts, decoration, equipment, signage
	Social variables	Customer, service personnel (appearance)

Scholars have made various attempts to propose elements of the servicescape in different types of business service settings. The elements of the servicescape vary depending on the nature of the business service and the customers' needs. [40] contended that universally standardized determinants for the servicescape do not exist for all service organisations. These elements represent the crucial factors within each business service that contribute to an organisation's success. [77][85] all agree that internal responses influence customers' and employees' behavior, which is influenced by elements of the physical environment, including the facility and tangible elements of the servicescape. The servicescape, with its efficient elements, plays a crucial role in influencing business performance. Moreover, the elements of the servicescape are of paramount importance for business services and can have intangible impacts on individuals' emotional, cognitive, and psychological responses, thereby influencing behavior and ultimately enhancing the productivity and profitability of businesses. [2] also supports the notion that tangible elements significantly influence people's emotions, cognition, and psychological responses.

2.3. Intangible Impact of Servicescape

The servicescape elicits various internal responses, including cognitive, emotional, and physiological reactions, from both customers and employees. Figure 1 depicts Bitner's initial structure of servicescape elements, which primarily centered on the retail sector, such as a shopping mall. This framework highlights the significance of physical environments in service organisations and examines how they are perceived by both customers and employees. Both groups respond to the intangible impact of the servicescape, encompassing cognitive, emotional, and physiological responses to the environment. These responses, in turn, influence their approach or avoidance behavior.

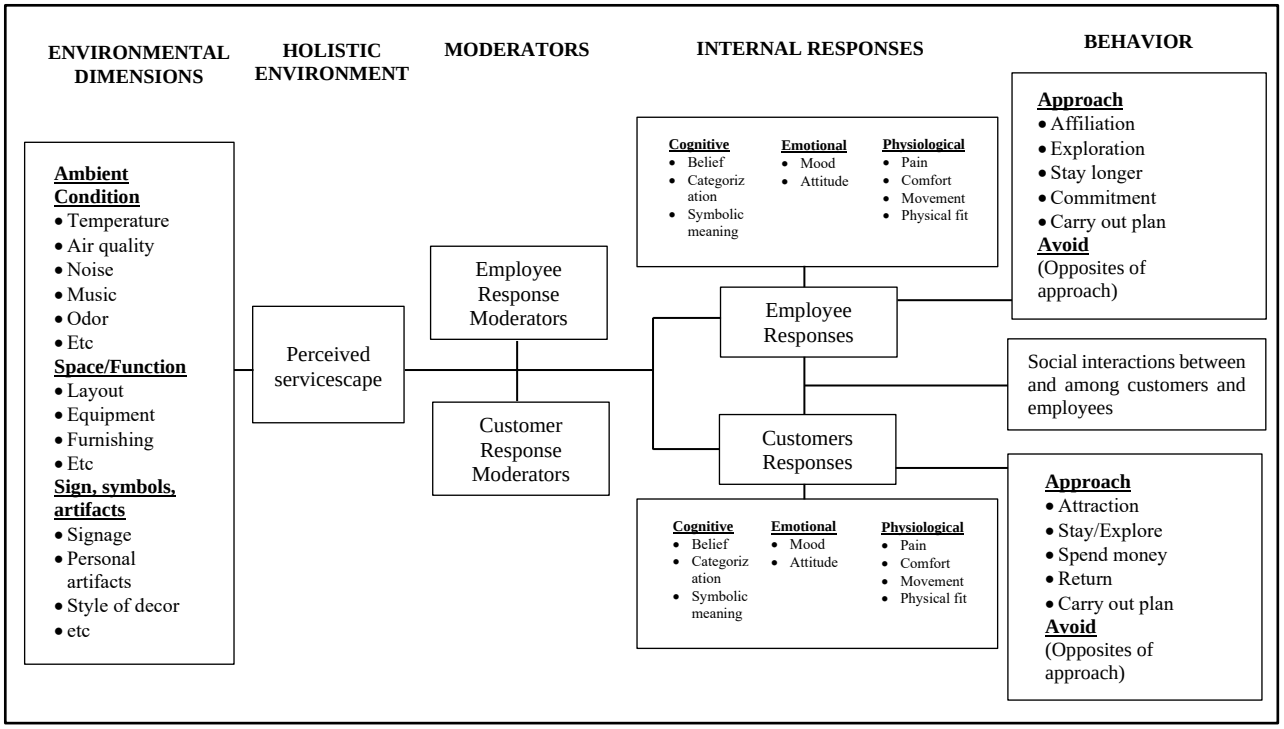

Figure 1. The Impact of Servicescape in Business Services

Cognitive responses

Cognitive responses involve the mental processes people employ when interacting with and processing information related to the physical environment of a service establishment [71]. Additionally, cognitive refers to the mental ability that individuals employ to process information acquired through perception, knowledge, and subjective experience [23][26][29]. These responses encompass perceptions of the ambiance, such as whether it is lively, relaxing, or casual.

For instance, the cognitive response can shape people's perceptions of a product or business service based on interior design or decor, influencing beliefs about the store's perceived expense or success [25]. [19] refers to cognitive processes that include beliefs, categorisation, and symbolic meaning, all of which can significantly affect people's belief about a product or service.

Moreover, cognitive responses extended to also post-consumption satisfaction assessments, evaluating whether the experience met or fell short of previous expectations [81]. This highlights the role of tangible elements of the servicescape, such as interior design, in shaping people's perceptions and satisfaction with a business.

Emotions responses

Customer emotional responses are significantly influenced by the servicescape, eliciting a wide array of feelings and emotions. According to [79], emotions refer to the benefits derived from affectionate statements or feelings, resulting in the enjoyment and pleasure obtained from a product or service. Extensive research conducted by [58][7][11][67] has identified various emotions in response to the servicescape, such as pleasure, enjoyment, comfort, satisfaction, safety, happiness, sadness, romance, passion, arousal, and excitement.

These emotional responses have been studied within the field of environmental psychology, coined by [57], which explores how physical stimuli impact individuals' emotions and behaviors, influencing areas such as work performance and social interaction. Emotions can be categorised into three fundamental dimensions: pleasure, arousal, and dominance, reflecting individuals' current emotional state.

Pleasure dimension

Pleasure is defined as the state of consciousness or sensation induced by the enjoyment or anticipation of what is perceived or experienced as good or desirable [31]. Pleasure encompasses contentment, happiness, satisfaction, relaxation, a sense of importance, care, hopefulness, and joy in the environment. [74] highlights that pleasure is associated with feelings of happiness or satisfaction, leading customers to spend more time and money in a business environment. For example, utilising visual displays, appealing scents, stylish decor, and soothing music can contribute to a pleasurable shopping environment that encourages exploration.

Arousal dimension

The arousal dimension of emotional responses encompasses a range of heightened states and sensations that individuals experience in response to the servicescape. Arousal refers to being stimulated, excited, jittery, aroused, frenzied, autonomous, wide awake, and having a sense of control [20][25][54][55]. This dimension is characterised by varying levels of stimulation and excitement, often influencing customers' perceptions and behaviors. Elements of the servicescape, such as lighting or colors, contribute to raising arousal levels. A lively environment with vibrant colors and energetic music can stimulate customers and keep them engaged.

Dominance dimension

Dominance describes the sensation of being able to 'win' in a particular situation, as observed in contexts like casinos, as pointed by [54] the case of Macau's casino industry. According to [55], dominance pertains to the extent to which an individual senses influence, control, or important. For example, karaoke venues with private rooms offer a sense of dominance to groups, allowing them to control the ambiance, song choices, and overall experience within their designated space.

Moreover, [33] notes that pleasure includes emotions such as happiness instead of unhappiness, pleasure instead of annoyance, or delight rather than sorrow. Arousal, in contrast, can manifest as feelings of stimulation instead of relaxation, excitement rather than calmness, or frenzy instead of apathy. Meanwhile, dominance is indicated by emotions related to a sense of control rather than being controlled, being influential rather than being influenced, or being in control rather than being cared for. Additionally, [35] argue that pleasure encompasses a range of emotional states, including feelings of joy or discontent, comfort or unease. Arousal, on the other hand, spans from excitement to calmness, while dominance involves emotions related to control, submission, overpowering, or obedience.

Physiological responses

The physiological response is linked to bodily reactions and responses that arise during the servicescape experience. Tangible elements of the servicescape, such as lighting, temperature, and scent, can significantly influence consumers' physiological responses, including heart rate, respiration, and stress levels. For instance, soothing background music or calming scents may lead to a more relaxed physiological state. According to [88], the physiological response arises from the ambient conditions of the business services. This can lead to either comfort or discomfort during the service encounter, influencing the customer's decision to continue or discontinue service consumption, consequently impacting their attitudes and behavior towards the service provider. Another example is that warm colors (red and orange) have been found to elicit physiological responses and, at times, even cause stress, whereas cool colors (blue and green) tend to induce relaxation and reduce feelings of stress [42]. Excessive noise or unsuitable temperature in the environment could lead to physical discomfort, while inadequate air quality might lead can to breathing difficulties, and insufficient lighting could reduce visibility of products and strain the eyes [25]. A negative physiological response, such as discomfort or elevated stress levels, may lead to a negative evaluation of the service and deter customers from returning. [19] discussed how the servicescape can trigger various physiological responses among individuals, such as experiencing pain due to uncomfortable seating, feeling comfort in a well-designed

environment, reacting to the layout with different movement patterns, and displaying physical reactions in response to the service settings. These physiological responses highlight the significant intangible impact of the servicescape on people's well-being and overall service experiences.

2.4. Behavior Impact of Servicescape

The intangible impact of servicescape influences behavioral responses, which can either be approach or avoidance. If individuals are more likely to approach the service, it indicates that they feel drawn to it and are more willing to engage with it. On the other hand, if they experience a negative emotional response, they may avoid the service, meaning they are less likely to interact with it and may seek alternatives.

Approach behaviors, as highlighted by studies [5][20][47][49][50][75][78], include desires to explore, stay for longer durations, visit more frequently, display loyalty, engage in word-of-mouth promotion, enhance corporate image, and engage in unplanned spending. For instance, the scent and the genre of music need to be congruent with a business environment, such as restaurant's, to increase the length of stay and spending [62].

On the other hand, a negative experience leads to triggered avoidance behavior. For instance, customers perceived the physical environment as unsafe, threatened, or uncomfortable, consequently resulting in a willingness not to stay, affiliate, or engage with the service. Avoidance behaviors in the servicescape include reduced visit frequency, buying less, a desire to leave earlier, switching to competitors, negative word-of-mouth, hindering promised service delivery, and seeking online alternatives due to negative perceptions or emotions associated with the service environment [20]. Additionally, negative emotional among employees may leads to ignoring communication with customers, hindering the performance of promised delivery, or avoiding service encounters with customers [44]. This highlights the significance of designing the service and work environment carefully for the organisation to ensure positive customer interaction and employee productivity.

3. Methodology

This paper is specifically devoted to explore and reviewing the literature on the intangible impact of servicescape. Figure 2 illustrates the methodology employed to achieve this objective. Qualitative content analysis was utilised to assess published material related to the intangible impact of servicescape on business performance. Following the method used by [90] and [91], three stages were employed to extract, analyse, and present the literature-based conclusions. The initial stage involved identifying the articles to be included in this review. The subsequent stage encompassed the formulation and execution of comprehensive guidelines that outlined how to capture and evaluate the literature. The final stage consisted of synthesising the scrutinized particulars and deducing the research findings.

For the initial phase of content analysis, all articles related to servicescape, intangible impacts of servicescape, environmental psychological, and business performance, published in journals, academic conferences, website, blog, posts, google scholar, and books were gathered. The literature selection encompasses English-speaking journals, peer-reviewed papers; conference proceedings, and books exploring the intangible impacts of servicescape, spanning a twenty-four-year timeframe from 2009 to 2023. To compile the literature sample, a search was conducted using a combination of keywords; "servicescape", "intangible impact of servicescape", "environmental psychological", and "internal responses to the servicescape". These keywords were queried within title, keywords, or abstracts. The structured keyword search was conducted across prominent databases subscribed to by the Universiti Teknologi Malaysia library (UTM online databases, e-journals, and e-books): *Science Direct, SAGE journals, Scopus, Emerald Insight, Wiley, SpringerLink, Web of Science, and Taylor & Francis online*. Through these procedures, a total of 87 qualitative research articles relevant to the intangible impacts of servicescape were identified. Subsequently, these 87 papers are referred to as the 'primary' set of papers.

NVivo is employed to analyse the content of the selected literature, allowing for in-depth exploration and identification of intangible impacts of servicescape. NVivo had previously been effectively used in this manner by [90] and [89]. A detailed set of guidelines was devised to organise, code, and analyse the

extracted papers in the NVivo database. All sixty articles were saved and organised as "documents" and "nodes".

The analysis involved only one level of coding. The primary areas of interest (intangible impact of servicescape) were positioned at a high level in main tree-level nodes in NVivo, aligning with the specifications of the first set of guidelines. The three-level node represents a logical location within NVivo, enabling the organisation and storage of content logically grouped during the coding process. As per the guidelines, each paper was manually reviewed in NVivo to inductively identify the key area of interest (intangible impact of servicescape). The coding process was carried out by linking relevant sentences or statements to the nodes. The result of the analysis (the coded content) was examined to derive the intangible impact of servicescape.

This process facilitated the recognition of the intangible impact of servicescape on business performance, as evidenced by the coded literature. The comprehensive research outcomes will be elaborated upon in the subsequent section.

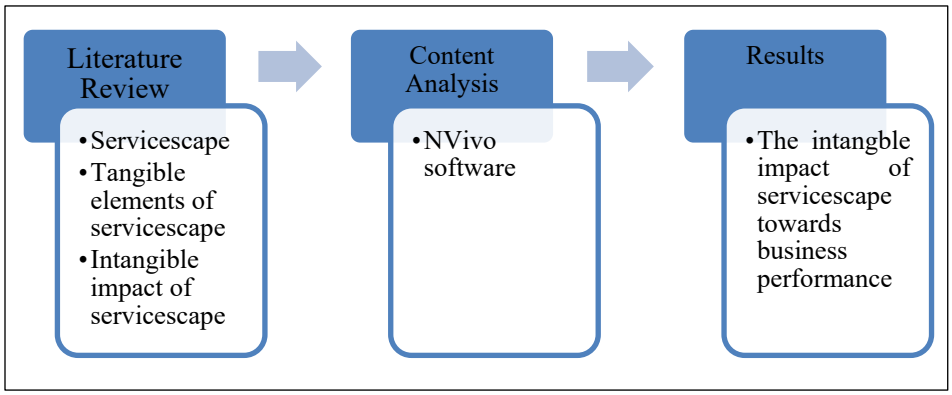

Figure 2. Methodology process.

4. Findings

In this section, the paper presents the results of the content analysis conducted to identify the major intangible impacts of servicescape. Table 2 displays the findings of these major intangible impacts, as identified through the analysis. For comprehensiveness, the list also includes intangible impacts that were mentioned only once. Additionally, table 3 provides an overview of the sub-impacts related to the intangible impact of servicescape.

Table 2. Summary of findings derived from content analysis (intangible impact).

No	Intangible Impacts	Number of Coding References	Number of Sources	List of Sources
1	Cognitive	51	25	[24][92][12][16][78][23][87][32][37][81][58] [68][30][73][41][14][45][7][52][80][46][69] [66][18][49]
2	Emotional	37	20	[68][18][14][73][41][54][67][45][7][15][27] [52][72][82][80][12][44][46][9][4]
3	Physiological	30	11	[37][77][64][23][68][18][2][41][85][16][34]

Table 3. Summary of findings derived from content analysis (sub-major intangible impacts).

No	Sub-Impacts	Number of Coding References	Number of Sources	List of Sources
1	Pleasure (Happiness, delight, enjoyment, satisfaction)	40	22	[15][56][74][16][83][52][62][46][2][55][75] [44][59][84][9][60][31][27][39][82][77][1]
2	Arousal (Relaxation excitement, frenzy)	38	10	[52][55][74][62][59][84][16][77][1][48]
3	Dominance (Feel of influential or in control)	10	3	[59][77][47]

The study identifies three major intangible impacts of the servicescape: cognitive, emotional, and physiological responses, which significantly influence individuals' behavior, leading to either approach or avoidance in the business environment.

Cognitive responses encompass a range of mental processes, including perception, memory, and decision-making. These cognitive responses are crucial for shaping customers' understanding of a service or brand. For instance, a visually appealing and well-organised retail environment can positively affect a customer's perception of the quality and professionalism of a business, ultimately influencing their decision to engage with it [93][64]. As mentioned by [58], physical discomfort resulting from disturbances in the servicescape can give rise to negative cognitive perceptions, subsequently affecting individuals' overall experience. Additionally, the significance of these cognitive responses extends to employees, as they also experience the effects of the servicescape on their performance and job satisfaction [44].

Emotional responses, on the other hand, relate to the feelings and emotions that the servicescape evokes in individuals. A warm and welcoming surrounding environment, for instance, can trigger positive emotions, making customers feel comfortable and inclined to stay longer, interact with staff, and make purchases. Conversely, a cold and unwelcoming environment can lead to negative emotions, discouraging customers and potentially driving them away. Additionally, it's important to recognize that these emotional responses also extend to employees who work within this environment, affecting their morale, and job satisfaction. According to [14], the servicescape has a significant impact on individual emotions.

Physiological responses encompass the physical reactions individuals have in response to the servicescape. These might include changes in their heart rate, blood pressure, or even stress levels. For instance, a noisy and chaotic environment can induce stress in customers, making them more likely to hurriedly complete their transactions or avoid the place altogether. Furthermore, it's crucial to acknowledge that these physiological responses also extend to employees, as they, too, experience the effects of the servicescape on their performance and job satisfaction. The servicescape can evoke cognitive, emotional, and physiological responses, subsequently shaping the behavior of both customers and employees [19][2][64][32].

Table 3 highlights the sub-major intangible impacts of the servicescape, which are pleasure, arousal, and dominance. The pleasure dimension encompasses feelings of happiness, enjoyment, delight, and satisfaction. When individuals experience in a service environment, it means that the ambiance and tangible elements of the servicescape contribute positively to their emotional states. Arousal refers to the level of excitement or stimulation that the servicescape generates. It can range from relaxation and calmness to moments of frenzy or high energy. It reflects how the servicescape influences people's emotional and psychological states. The dominance dimension relates to how individuals perceive their influence or control within a particular service environment. It's about feeling in charge or having a sense of authority in that space. However, [94] contends that dominance should be disregarded as it demonstrated little significance in its association with a person's emotions.

These impacts play a pivotal role in enhancing productivity, profitability, and overall performance in the business environment. Notably, the pleasure and arousal dimensions exhibit particularly high significance, while the dominance dimension elicits relatively lower responses, suggesting it may be more suited to specific environments, such as casinos or karaoke bars. In such places, a sense of dominance, control, or opulence aligns with the desired atmosphere. For example, in a casino, it could evoke a feeling of 'winning the situation' and 'being in control', while in a karaoke bar, it might encourage patrons to take center stage and perform confidently. Pleasure, arousal, and dominance are regarded as three basic dimensions of emotional responses that reflect an individual's emotional state [57][11].

These intangible impacts and sub-major intangible impacts of servicescape are crucial for both customers and employees within a given service environment. Positive responses, in turn, contribute to increased productivity and overall business performance within the business environment.

5. Conclusion

In the decision-making process for upgrading a business environment, facilities managers play a pivotal role. They are tasked with the intricate responsibility of overseeing the physical aspects of workplace, ensuring it aligns with the organisation's goals and objectives. Facilities managers must go beyond the visible, tangible elements of the servicescape and delve into its realm of intangible impacts. It is crucial for them to consider both the tangible elements such as space, energy use, luminosity, and noise level as well as the intangible impacts, encompassing cognitive, emotional, psychological responses, pleasure, arousal and dominance. These intangible impacts and sub-major intangible impacts significantly influence the behavior of both customers and employees, making them a critical factor in facilities management. For instance, a well-designed, pleasant, and welcoming servicescape can positively affect employees' job satisfaction and productivity, while also enticing customers to stay longer, engage with staff, and make repeat visits.

Recognizing and effectively harnessing these responses can provide facilities managers with a strategic advantage. By optimizing the servicescape to create a positive experience in these dimensions, they can enhance customer satisfaction, foster employee morale, and ultimately achieve greater success for the business. This holistic approach, integrating tangible elements and intangible impacts, is vital in the decision-making process for facilities managers as it not only enhances the overall business experience but also contributes to the organisation's profitability, productivity, and reputation.

This article embarks on a comprehensive journey to unveil the intangible impacts of the servicescape in the modern business environment. Through a blend of theoretical insights and practical examples, this paper provides valuable information and perspectives that help organisations, especially facility managers, leverage the power of the servicescape to enhance their performance and elevate the customer experience, ultimately boosting profitability, productivity, and reputation.

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Transition Toward Sustainable Housing Construction in Iraq

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Abstract. Adopting sustainable approach in production processes and activities in the construction industry is considered one of the best strategies that support the direction of sustainability and promote the development of the green approach in this industry and contribute effectively to providing an environmentally friendly construction products that has high reliability and credibility that gives the product the ability to compete efficiently in the market and facilitate the consumers' purchase options. Iraq is facing a large urban expansion with the increase in the population with increase in the demand for electricity and water and the increase in the percentage of pollution in the environment, the construction sector has become one of the largest polluters of the environment in Iraq due to the absence of any sustainable approach. The aim of this study is to find a viable approach to the transition toward sustainable housing construction in Iraq, as this study includes identifying the current problems that Iraq suffers from in terms of the construction sector, environmental pollution. The research proposes adopting the concept of sustainability in the construction sector as a sustainable solution through converting conventional construction into sustainable housing construction in Iraq. In this research, the obstacles that obstruct the converting process with the potential that elements that support the process will be identified, with appropriate strategy to overcome them, and develop an applicable approach by all stakeholders in the construction sector, as the application of this approach will lead to the development of the construction sector in general, develop and enhance the performance of all stakeholders in the construction sector, environmental protection and pollution reduction in addition to the others economic, social and environmental benefits that can be obtained when applying this approach. This study proposes 15 reliable strategies through which migration towards sustainable housing construction can be achieved.

1. Introduction

The construction sector is one of the largest sectors that cause greenhouse gas emissions and waste generation accordingly, and with the aim of reducing the carbon footprint, saving natural resources and protecting the environment from pollution, many countries of the world have developed strategies to adopt a sustainable building approach through enacting sustainable building laws and adopting global sustainable building specifications and standards, in addition to developing national building specifications and standards while integrating all sustainable construction concepts in the construction industry, while the construction industry in Iraq has not adopted any sustainable construction approach yet in this important industry and has not kept pace with sustainable development, as the construction industry in Iraq is one of the largest polluters of the environment and the largest consumer of energy and water, despite That the construction industry in Iraq is one of the largest vital industries that constitute a major axis of development due to the volume of business and investment in this important

sector In addition to the large expansion of the population with an acute shortage of housing and residential buildings, where the shift towards sustainable construction has become an environmental, economic and social necessity that requires adoption in the construction industry. This study examines the development of applicable strategies for transition toward sustainable housing construction in Iraq.

2. Definition of Terms

a. Conventional Construction

[21] identified the conventional construction as the traditional technique of production where the construction knowledge is passed from one generation to the other and where new technologies and materials are barely utilized is known as conventional building construction.

b. Sustainable Development

According to [19] sustainable development is the process of meeting the needs of current and future generations without diminishing the flexibility of life-supporting characteristics or the cohesion and integration of social systems. Sustainability consists of four dimensions, including:

- Economic systems and other activities.
- Ecosystem.
- Institutional performance and capabilities.
- Governance and political activism.

c. Sustainable Construction

The goal of sustainable construction is to create and operate a healthy built environment based on resource efficiency and ecological design with an emphasis on seven core principles across the building's life cycle: reducing resource consumption, reusing resources, using recyclable resources, protecting nature, eliminating toxics, applying life cycle costing, and focusing on quality [27].

d. Sustainable Homes

UN-Habitat report provided an ideal description of the characteristics of sustainable homes that must be provided to ensure adequate housing that meets the requirements of the population and achieves healthy and comfortable housing for them, as these characteristics included:

- Healthy, durable, safe and secure.
- Affordable for the whole spectrum of incomes.
- Using ecological low-energy and affordable building materials and technology.
- Resilient to sustain potential natural disasters and climatic impacts.
- Connected to decent, safe and affordable energy, water, sanitation and recycling facilities.
- Connected to decent, safe and affordable energy, water, sanitation and recycling facilities.
- Using energy and water most efficiently and equipped with certain on-site renewable energy generation and water recycling capabilities.
- Not polluting the environment and protected from external pollutions.
- Well connected to jobs, shops, health- and child-care, education and other services.
- Properly integrated into, and enhancing, the social, cultural and economic fabric of the local neighbourhood and the wider urban areas.
- Properly run and maintained, timely renovated and retrofitted [42].

3. Research Methodology

This study was conducted through a systematic literature review, where data was collected and analysed through reviewing published research on sustainable construction, where an eight-step research process was adopted, according to [45], which included formulating a research problem, developing a review protocol, validating it, searching the literature, screening for inclusion, and quality assessment, data extraction, data analysis and compilation, and reporting of results.

The study was started with a discussion of the problems caused by the conventional construction approach which is applied in the construction industry in Iraq, followed by a process of reviewing the literature related to the subjects of the study, which helped in a deep understanding of the subject of this study, where the literature was collected. And then analyse it with the aim of determining the importance of the transition towards sustainable housing construction, the obstacles that hinder the transformation process, and the elements that can help in overcoming these obstacles, and adopting them as a basis for determining effective strategies that can be used through which achieving the transition toward sustainable housing construction in Iraq. The study concluded with conclusion. Figure 1 is showing the systematic literature review procedures.

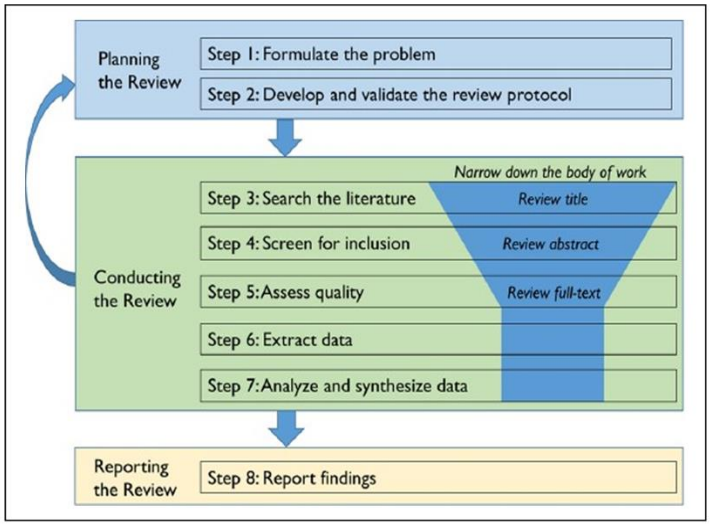

Figure 1 systematic literature review adopted from [45]

4. Problem Statement

The increase in population, huge urban expansion, environmental pollution, a severe shortage of housing units, a shortage of energy and water supplies, a lack of capacity and old infrastructure in Iraq. This is the current situation in Iraq in general, while the construction industry has not adopted any sustainable approach and is still adopting a conventional construction approach in an attempt to meet the lack of housing and the large population and urban expansion, causing an increase in pollution and environmental deterioration, with an increase in energy and water shortages as a result of increased.

Official statistics and many researchers have pointed to these, where the Iraqi national housing policy of the year 2010 which is prepared by ministry of Housing and Construction with the support of UN - Habitat indicated that one of the challenges facing housing in Iraq is the huge unmet demand for housing as the supply side, as current estimates indicate that about 2 million homes are needed in urban areas in Iraq by 2016. This represents 200,000 homes annually over the next ten years [30]. The housing sector in Iraq faces many challenges, including severe housing shortages, poor planning and design, lack of basic services, and inability to afford costs, especially among low-income groups, as for energy consumption and carbon emissions Iraq has been facing an acute energy crisis since 2003 and the residential sector represents the highest energy consumer on the demand side, while the World Bank estimates that the annual discharge of carbon dioxide in Iraq has increased from 84,540,890 tons in 2000 to 162,646,160 tons in 2016 of fossil fuels. [24].

[41] discussed that there are many problems related to the construction of residential complexes in Iraq, such as pollution, increased energy consumption, an increase in completion time, and the absence of human resources management and relying on traditional methods of construction cannot solve the problem. [3] discussed that the population and economic growth in Iraq will lead to an increase in the demand for energy. Whereas [9] argued that the missing of government regulations regarding

sustainable homes is an obstacle to implementing sustainable approach. Where [23] discussed that the construction sector in Iraq did not implement the concept of sustainable construction, as the construction sector suffers from the dominance of conventional methods that negatively affect the environment and consume a lot of natural resources and unsustainable building materials that do not meet environmental and climatic requirements. While [11] argued that the construction sector in Iraq is still uses materials and techniques that are not suitable for the local environment and Iraq has not adopted any of the global sustainability assessment systems. [31] discussed that there is no system applied in construction projects in Iraq for waste management. The construction industry in Iraq faces serious difficulties in the form of construction waste generation and requires serious study to solve this problem. The percentage of construction and demolition waste for the year 2021 was 33.3% out of the total waste raised by municipal institutions, which is a high percentage [13].
According to [13] The percentages of electric energy sales according to consumption categories for the year indicate that the domestic sector is the highest consumer of electricity in Iraq by a percentage of 60.70%, followed by commercial with 6%, industrial 12%, governmental 12.40%, agricultural1.60% and surpassing 7.20%. Figure 2 showing the Percentages of electric energy sales according to consumption categories for the year 2020.where the relative distribution of produced and distributed water for the year 2020 indicates that the domestic sector is the highest consumer of water, 84.6%, followed by the rest of the sectors with a percentage of 8.1%, then the government sector with a percentage of 7.3%. Figure 2 Showing the percentage electric energy sales according to consumption categories for the year 2020. Figure 3 showing the percentage distribution of produced and distributed water for the year 2020.

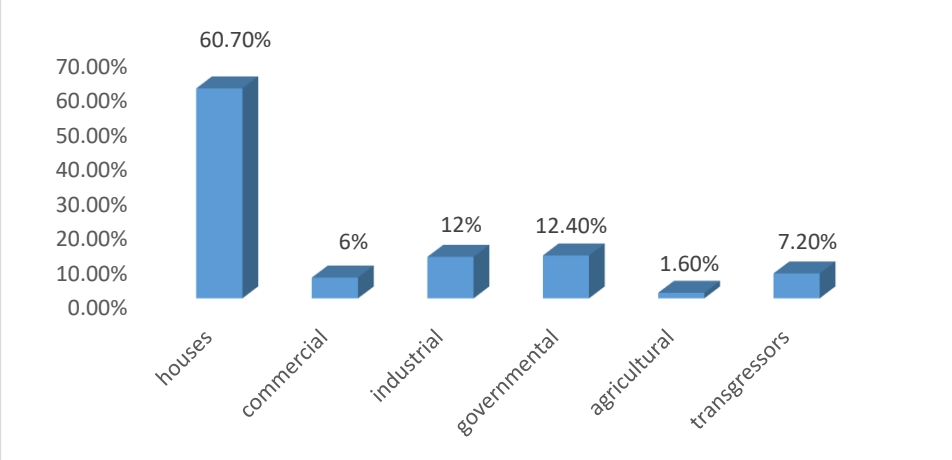

Figure 2 Percentages of electric energy sales according to consumption categories for the year 2020.

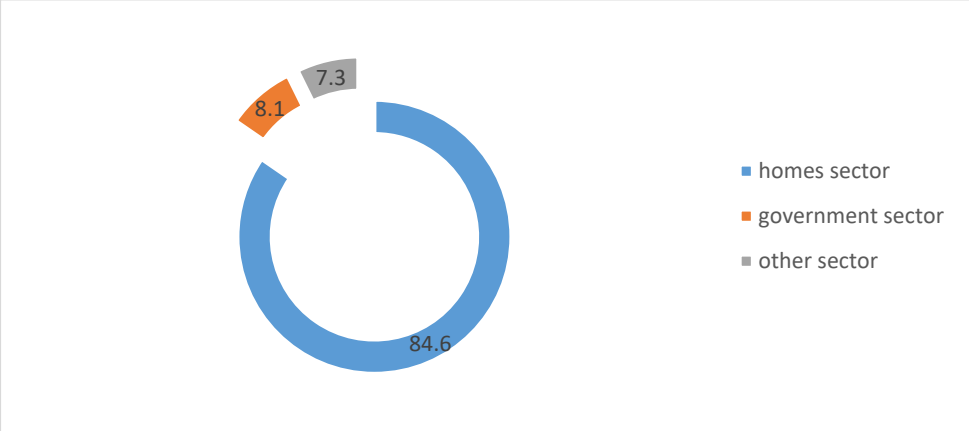

Figure 3 Percentage distribution of produced and distributed water for the year 2020.

The focus in this study was on housing construction. Where according to the statistics of the Ministry of Planning, the construction of residential buildings constitutes the largest percentage in Iraq, as the construction of this type of buildings causes significant environmental pollution during their implementation. Government Statistics prove it show that homes are the largest consumers of energy and water and a major source of environmental pollution.

5. Obstacles and Enablers of Sustainable Construction

The process of converting the conventional construction industry into a sustainable construction industry requires the efforts and the cooperation of various stakeholders to achieve this goal. This study presents effective strategies for bringing about a shift towards sustainable housing construction in the construction industry in Iraq. This appropriate strategy for the transition process to sustainable housing construction was identified by examining the relevant literature and identifying obstacles and facilitating elements for the transition process.

5.1. Obstacles to Sustainable Construction

By reviewing the relevant literature, this study identified several obstacles to the application of the sustainable construction approach, as identifying the obstacles to sustainable construction is necessary, which contributes to the development of appropriate strategies that help overcome these obstacles and achieve the adoption and application of the sustainable housing construction approach to replace the conventional construction approach that It no longer meets environmental, economic and social requirements. Where these obstacles are included lack of legislation on Sustainable building laws, financial and cost issues, lack of incentives, lack of investment, lack of awareness, planning and management issues, lack of demand and interest, sustainable designs issues, lack of sustainable construction materials, lack of capabilities and experience, lack of training, social challenges, technical issues and waste management. Table 1 show the obstacles to sustainable construction.

Table 1**.** Obstacles to sustainable construction

Element	Reference
Lack of legislation on sustainable building laws	[2], [32], [29]
Financial and cost issues	[26], [17], [43]
Lack of incentives	[14], [32], [17]

Lack of investment	[16], [14], [32]
Lack of awareness	[2], [43], [6]
Planning and management issues	[14], [26], [35]
Lack of demand and interest	[2], [17], [35]
Sustainable designs issues	[14], [26], [35]
Lack of sustainable construction materials	[17], [29], [35]
Lack of capabilities and experience	[14], [2], [6]
Lack of training	[26], [32], [17]
Social challenges	[17], [32], [2]
Technical issues	[14], [32], [43]
Waste management	[26], [46], [16]

5.2. Sustainable Construction Strategies

The aim of this study was to identify the enabling strategies that can be adopted to achieve the transition toward sustainable housing construction in Iraq, where the literature on sustainable construction and official publications of Iraqi ministries and agencies were reviewed. The literature review listed 15 credible strategies that included institutional and technological enablers and evaluation tools, in addition to financial support, incentives and investment through which migration towards sustainable housing construction can be achieved. As shown in the explanation below, in addition to the Table3.

5.2.1. Enhance the Awareness: [22] discussed that there is need to educate and raise awareness of the community through conferences, seminars and all the media as it should. It also requires the seriousness of the goals and means for the success of any plan. [34], [47] and [32] discussed that enhancing the awareness an important enabler that supports the trend towards applying the sustainable building approach.

5.2.2. Incentives: where [1] argued that the government should introduce more incentive-like schemes to attract developers and information about incentives and discounts should be readily available to the public. [33] discussed that the government needs to provide incentives to SC project owners as a means of encouraging others.

*5.2.3. Investment: c*reating the interest of investors, developers and owners regarding the adoption of a sustainable building strategy that contributes to spreading the sustainable building approach in the construction industry, which results in the construction of residential buildings that meet environmental, economic and social standards. [2] argued that it is necessary to alienate the client's fear of increasing the investment cost and create an appropriate for the benefits inherent in it.

*5.2.4. Financial Support: w*here [1] discussed that the financial institution usually engages with the industry in terms of providing a good financial scheme for buyers and builders as actions taken by the government to set up new regulations or rating systems are usually supported by professional bodies.

*5.2.5. Enhance Sustainable Construction Training: w*here [1] discussed that more local practitioners should be trained in knowledge and practical experience backed by more research on new green technology. While [20] discussed that training senior management and decision makers to adopt a sustainable methodology and make it part of the company's traditions for the foreseeable future. [2] argued that the improving sustainable construction and then changing from the base to adopting new ideas is necessary, in addition to that there is a need for appropriate enlightenment for clients and construction professionals with regard to sustainable construction, and this can be achieved through Increasing the education and training of construction specialists on the principles and concepts of the sustainable construction. The concerned professional bodies can also assist by conducting training for their members in sustainable construction areas.

*5.2.6. Develop Sustainable Construction Legislations and Regulations: w*ith regard to institutional enablers, [1] discussed that the government is one of the main institutions that has a significant impact on the development of any industry, as the government's role in improving and enforcing regulations related to sustainability leads to changes at the national level. Incentives and rebates are among several ways the government can do as a regulator to boost the industry. These roles will drive construction players to research new technology, systems and knowledge with government support. While [20] discussed that developing appropriate legislation and regulations is required to start the transition towards comprehensive sustainability. [33] discussed that building regulations and policies that will help in the development of sustainable building must be put in place.

*5.2.7. Sustainable Construction Standards and Specifications: w*here [1] discussed that Government, professional bodies and academia must work together to revisit existing standards and norms and incorporate sustainable needs.

*5.2.8. Develop Sustainable Assessment Tools and Indicators: s*tandardization of KPIs and benchmarking programs that enforce sustainable construction practices is required so that construction companies are required to not only monitor practices but also to effectively compare with each other and set benchmarks for best practices. Key performance indicators related to measuring the potential social, environmental and economic impacts of construction are critical to this approach. For example, social KPIs include passenger comfort, access to facilities, job creation, urbanization, etc.; While economic KPIs include cost of capital, running cost, material cost, etc.; Environmental KPIs target consumption of water, energy, waste, materials, components, etc [4]. [34] identified sustainability assessment as drivers of sustainable construction. The adoption of sustainability indicators and tools is one of the important strategies for measuring the sustainability performance of buildings. This calls for the adoption of international sustainability indicators, in addition to the development of national sustainability indicators that support progress in the sustainability of buildings. [29], [28] and [6] identified sustainability assessment as drivers of sustainable construction.

5.2.9. Develop Construction Waste Management and Recycling Facilities: [10] discussed that strengthening and clarifying legislation so that the largest part of construction and demolition waste is reused or recycling in the construction sector through collaboration between regulators, legislators, researchers and industry to develop a specific and feasible legal framework. [31] discussed that the authorities should design a waste management plan suitable for the implementation environment in Iraqi construction sites and develop a waste disposal data system due to the severe deficiency in the construction waste database at the local level. [16], [38] and [44] argued that develop construction waste management as important enablers to sustainable construction.

5.2.10. Integrate the Sustainable Construction in the Education: [1] discussed that valuable knowledge obtained through (academic) research should be effectively disseminated to industry (to reduce the gap between theory and practical application). [2] argued that the increasing the teaching of the concept of

sustainability in higher education institutes is important to prepare construction graduates to be experts in sustainable construction. [34] and [14] mentioned that integrate the sustainable construction in the education an enabler to the sustainable construction.

5.2.11. Adopt Sustainable Buildings Design: the concept of sustainable design focuses on adopting new methods for design and construction that take into account the environmental and economic challenges faced by the construction sector and the rest of the sectors in society, as sustainable buildings that are designed, implemented and operated by advanced methods and techniques contribute to reducing the environmental impact and reducing costs, especially operating and maintenance costs, in addition, in addition to providing a safe and comfortable urban environment. There is great importance to the trend towards adopting sustainable building designs in Iraq in the development of the construction sector, through which all stakeholders are involved in the implementation of sustainable building designs, as it leads to the promotion and dissemination of sustainable culture and knowledge in this sector and the development of sustainable performance. Therefore, sustainable designs provide many benefits that include saving energy and water consumption, preserving the environment and improving the health and well-being of the occupants of these buildings, and these in themselves are considered solutions to chronic problems that Iraq suffers from. Where Iraq lacks the infrastructure for water supply, energy and sanitation, in addition to the high rates of environmental pollution In addition to the large population growth, and this exacerbates the crisis and causes an increase in the burden on energy, water and sanitation supplies, as sustainable buildings that have been efficiently designed contribute to reducing the excessive burden on energy and water systems, in addition to alleviating the environmental impact caused by population growth and urban expansion. [14] and [39] discussed that the sustainable design enhancing the sustainable construction.

5.2.12. Enhance Sustainable Materials and Technology: the concept of sustainable building integrates a variety of strategies during the design, construction and operation of construction projects. The use of green building materials and products is an important strategy in building design [25]. [12] argued sustainable construction takes into account the use of environmentally friendly materials that resist weather factors to preserve the building's heat in winter and contribute to its ventilation in summer, which reduces heat absorption. Double glazing also provides good insulation for the environment inside the building and the external environment, as well as the use of renewable energy such as solar and wind energy and the use of more systems. Efficiency of water as well as its reuse, thus helping sustainable or green buildings reduce energy consumption and reduce costs. Where [13] discussed that more local suppliers should be encouraged to produce green products. [43], [37] and [29] agreed that sustainable materials and technology.

5.2.13. Compulsory of Sustainable Construction: [48] argued that legislation that would compel clients to build sustainably should be created so that the economic needs and cost of sustainable construction become secondary to environmental sustainability. [20] discussed that the legislation and instructions accompanying the sustainable development movement in construction work must be supported. [38], [5] discussed that compulsory of sustainable construction contributes to strengthening the implementation of the sustainable construction approach.

5.2.14. Develop Government Authorities Mechanisms: [32] discussed that achieving sustainability in the comprehensive construction process requires major societal changes and restructuring of institutions and management approaches. It requires appropriate political will based on the conviction of the government's responsibility towards its citizens and the need to create a humane and decent environment for decent living. While [20] discussed that the organizational structure must be updated and developed to keep pace with modern technologies on the Internet, which are fully compatible with the new organizational departments. [2] argued that the government needs to be actively involved in promoting sustainable construction by creating policies and providing the means to enforce them. In addition,

government can support sustainable construction by reviewing and enforcing legislation and policies and by introducing building codes. [35] discussed that the government must implement and monitor existing laws and regulations to deter defaulters. [28], [6], [38], [5] discussed that develop the government authorities' mechanisms as important enhancing the implementation of sustainable construction approach.

5.2.15. Support and Cooperate Stakeholders: the principles of sustainable building can be implemented smoothly and successfully when all stakeholders in the construction industry are involved, collaborative, and supportive, including government agencies, designers, owners, contractors, materials suppliers, manufacturers, and occupants of sustainable buildings. [18] discussed that the sustainability in the construction sector can only be achieved through partnership between society, government and the sector. [34] identified cooperation, partnership, and participation as drivers of sustainable construction. [38], [5], [48] and [20] agreed the cooperate and support all stakeholders as important to achieve the goals of sustainable construction.

6. Discussion

The current situation of the construction industry in Iraq requires long-term structural change by adopting a sustainable approach and achieving the transition towards sustainable housing construction Whereas, in this study, sustainable strategies were identified, through which they can be adopted to achieve the transition towards the establishment of sustainable housing. These strategies included enhance the awareness, incentives , encouraging investment in the sustainable construction projects, financial support, develop sustainable construction legislations and regulations, sustainable construction standards and specifications, develop sustainable assessment tools and indicators, develop construction waste management and recycling facilities, Integrate the sustainable construction in the education enhance sustainable construction training to building sustainable capabilities that support sustainable implementation and enhancing the sustainable performance, adopt sustainable buildings design, enhance sustainable materials and technology, compulsory of sustainable construction, develop government authorities mechanism and making them able to lead the process of transformation towards a sustainable building approach through sustainable and advanced methods in terms of management, supervision, control and monitoring and support cooperate stakeholders at all stages of construction starting From planning, design, construction and operation to the demolition stage. Figure 4 was developed in accordance with research findings shows sustainable construction strategies.

Figure 4 Sustainable construction strategies

7. Conclusion

Continuing to adopt the traditional approach prevailing in the construction of housing in Iraq is currently an approach that does not meet the environmental, economic and social requirements in Iraq because of the large consumption of energy and water, environmental pollution and deterioration resulting from construction work and consumption of resources. Therefore, the shift towards sustainable construction in the construction industry in Iraq contributes It greatly contributes to a development that works to reduce the consumption of resources, energy and water, and enhances the preservation of the environment through the development of sustainable performance for all stakeholders and the dissemination of sustainable culture in the construction industry. This study focused on the construction of housing, as this type of buildings constitutes the largest percentage compared to commercial and industrial buildings, where the construction of residential buildings causes significant environmental pollution during implementation, as it is done in the traditional way in which environmental standards are not taken into account, and the long-term use of these buildings It causes more energy and water consumption. The study revealed the current situation of the building and construction industry in Iraq, and several strategies were identified that can be applied through their application to contribute effectively to adopting a sustainable housing construction approach in the construction sector in Iraq. As the shift towards building sustainable housing in Iraq will lead to beneficial results, including achieving sustainability in the construction sector, in addition to contributing to the sustainability of other sectors, including the energy and water sector, in addition to reducing pollution, protecting the environment and promoting sustainable development plans, In addition to providing suitable sustainable housing for the population, providing comfort and well-being, improving indoor air quality, and improving health. The results of this study are important for policy makers and stakeholders in the construction industry in Iraq because it provides a strategy for shifting towards sustainable housing

construction that can be a roadmap for migration towards sustainable construction in a country that has not adopted sustainable construction.

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Unraveling The Dynamics of Social Construction of Nature and Its Influence on Pro-Environmental Behaviour in Ecotourism Sites

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Abstract. Social construction of nature is a concept that can be defined as peoples' perception of nature which are influenced by their social interaction. Meanwhile pro-environmental behaviour (PEB) is described as visitors' actions that are conducted willingly to minimise the negative implications on natural environment and local communities. Scholars predicted that social construction of nature may influence people's thoughts and action towards nature. Hence, it is clear that individuals' social construction of nature may reflects their PEB in ecotourism sites. However, there are limited literatures that try to discuss the relationship between social construction of nature and tourists' PEB. Therefore, this article aims to provide comprehensive literature review, propose conceptual framework and suggests suitable empirical methodology to evaluate the relationship between social construction of nature and tourists' PEB in ecotourism sites. A narrative literature review was conducted on a wide range of publications. The first result illustrates few variables that can be used to measure people's social construction of nature and tourists' PEB. The second result shows the possible relationship between social construction of nature and tourists's PEB in ecotourism sites before proceeds to propose a conceptual framework that will be able to assess the relationship. The third result suggests few methodological aspects that are fitting to be applied when conducting empirical studies using the proposed conceptual framework. This article is significance as it has few contributions. First, it provides appropriate variables that can be used to measure social construction of nature and tourists' PEB. Second, it provides sustain framework in assessing how individuals' social construction of nature influence their behaviour towards environment, especially in ecotourism destinations. Third, it suggests methodological technique that is suitable to be applied when conducting empirical research using the proposed framework, so that high quality findings can be gained. In conclusion, this article will extend the knowledge related to behavioural, environmental and tourism studies.

1. Introduction

Common ecotourism sites may include forest reserves, sanctuaries or protected areas. As these sites are publicly open, they slowly become prominent destinations for tourists that seek natural authenticity. Due to the aggressive marketing, huge influx of tourists to ecotourism sites occurs. Unfortunately, majority of visitors do not practice pro-environmental behaviour (PEB) in these ecotourism sites thus lead to serious environmental damage such as littering [1-3]. Therefore, the reasons why certain individuals could or could not commit towards PEB in ecotourism sites remain as a significant topic that is crucial to be studied.

Several scholars try to assess various factors that may influence tourists' PEB in ecotourism sites [4-6]. However, there are limited literatures that discuss social construction of nature as the factor that shape tourists' PEB. Interestingly, social construction of nature may play a role in shaping tourists' PEB as scholars believed that the concept can influence people's thoughts and action towards nature [7-9]. Therefore, due to the rise of irresponsible behaviour conducted by tourists in ecotourism sites, it is beneficial that people's social construction of nature be studied to better understand their behaviour in these areas.

2. Literature review

2.1. Social construction of nature

Social construction of nature can be referred as people's perception of nature which are externally influenced by their daily interaction within the society. There are various social construction of nature and it may differ among people living in different countries. For instance, people in Sweden view nature as either robust or sensitive [7],[8]. People in China refer nature as strongly connected to human, while societies in India associate nature with sacredness, whereas people in Thailand associate nature with the concept of spirituality and animist [26]. In Malaysia, society commonly view nature as either fun or horrifying [27],[28].

Regardless, scholars tried to investigate social construction of nature in tourism context. For instance, Fälton [29] studied the social construction of Swedish nature among tourists. Bakker [30] studied how social construction of nature can help national park's gatekeepers to communicate and limit visitors' impact. Cui and Xu [9] studied the social construction of nature among Chinese citizens that comment on the incompetencies of management in an ecotourism site.

2.2.Pro-environmental behaviour (PEB) in ecotourism sites

The term pro-environmental behaviour (PEB) can be described as visitors' actions that are conducted willingly to minimise the negative implications on natural environment and local communities [31]. In short, PEB is any behaviour that safeguard or minimise bad impacts on the environment. Without people noticing, they actually practice some of PEB in their daily life such as saving water and electricity, using public transportation, recycling waste, reusing plastic bottles, buying local and organic products, avoid using plastic bags and avoid disturbing wildlife [13],[32-34].

PEB in ecotourism sites are commonly studied. For example, Amornwitthawat and Phongkhieo [38] investigated the factors that may affect PEB of visitors in Thailand's national parks. Esfandiar et al. [39] studied low-cost PEB of binning behaviour in Australian national park. Sharma and Gupta [40] measured PEB among tourists visiting Jim Corbett National Park in India. Zarei et al. [41] assessed PEB among mountain hikers of Mount Damavand National Park in Iran.2.3*Connecting social construction of nature with tourists' pro-environmental behaviour (PEB) in ecotourism sites*

In order to connect social construction of nature and tourists' PEB, model of goal-directed behaviour (MGB) can be used. MGB is a framework that is widely used in behavioural studies and commonly utilised to evaluate people's PEB. Many scholars had also extended MGB by adding additional variables to the model and named it extended model of goal-directed behaviour (EMGB). This was done to increase the explaining ability of the model in measuring tourists' behaviour.

EMGB had been utilised few times to assess tourists' PEB. For example, Han et al. [4] extend MGB to explain US cruise travelers' pro-environmental decision-making process in an environmentally responsible context. Kim et al. [5] also extend MGB to examine the decision-making process for responsible tourism in Korea. Meanwhile Qu et al. [6] extend MGB and use it to measure PEB intention of mass tourists in China.

3. Methodology

A narrative review methodology was performed. There are few steps in conducting this review. First, potentially selected literatures were searched in various e-databases such as JSTOR, ProQuest, SAGE,

ScienceDirect, Scopus, Web of Science, Google Scholar and Google Search. The search syntax 'social construction of reality', 'social construction of nature', 'model of goal-directed behaviour' and 'pro-environmental behaviour' was entered separately at one time in the search field of each database thus managed to yield several pages of potentially selected literatures. After screening the abstracts of the potentially selected literatures in each database, the final included literatures consist of 51 documents published from the year 1949 to 2021. As this article chose to conduct narrative review, it is not necessary to perform an extensive method of screening similar to the systematic review which need to include all articles that adhere to any inclusion or exclusion criteria, instead, it is fair to only include few articles that are considered helpful in discussing the topic brought up by this article. Table 1 shows the list of literatures that were reviewed for each topic.

Table 1. List of literatures that were reviewed for each topic.

Topic	List of Literatures Reviewed	Focus
Social Construction of Nature	[9–30]	Identify the variables that can measure people's social construction of nature
Pro-Environmental Behaviour	[13],[31–41]	Identify the variables that can measure tourists' pro-environmental behaviour in ecotourism sites
Connecting Both Concept	[4–9],[39],[42-46]	Identify the connection between social construction of nature and tourists' pro-environmental behaviour in ecotourism sites in order to propose conceptual framework
Method to Measure Both Concept	[6],[35–37],[42],[47-51]	Identify the best method to conduct empirical study using the proposed conceptual framework

4. Findings

4.1 Variables that can be used to measure social construction of nature and tourists' pro-environmental behaviour

Based on the performed literature review, theory of social constructionism can be used to understand how social construction of nature is formed. In the first process, externalisation refers to the process by which meanings are projected by human to the outside world [10]. Hence, there are probably 5 meanings of nature that human may externalise which include ecological worldview, nature relatedness, environmental attitude, nature quality and environmental identity [11–15].

In the second process, objectification refers to the process of converting the externalised products into objective beliefs [10]. Hence, objectification of nature involves people objectifying their subjective worldview by processing any nature-related opinions and activities which are expressed by anyone. In simpler terms, this process explains how people treat nature as an object that has no intrinsic values. There are 5 objectified beliefs that explain how humans treat nature as an object which include resource extraction, anthropocentrism, economic prioritisation, commodification and instrumental evaluation [16–20].

In the final process, internalisation refers to the process of committedly accepting the objective beliefs as a part of consciousness [10]. Therefore, internalisation of nature involves people continue to accept the nature-related belief and incorporate it into their character. In short, the beliefs regarding nature are absorbed by a person deeply until it shapes the person's personality. There are 5 personalities that may represent how people's objectified beliefs of nature are internalised within themselves which

include ecological consciousness, nature connectedness, sustainable lifestyle, ecological empathy and environmental ethics [21–25]. Therefore, figure 1 shows the 15 variables that can measure social construction of nature [11–25].

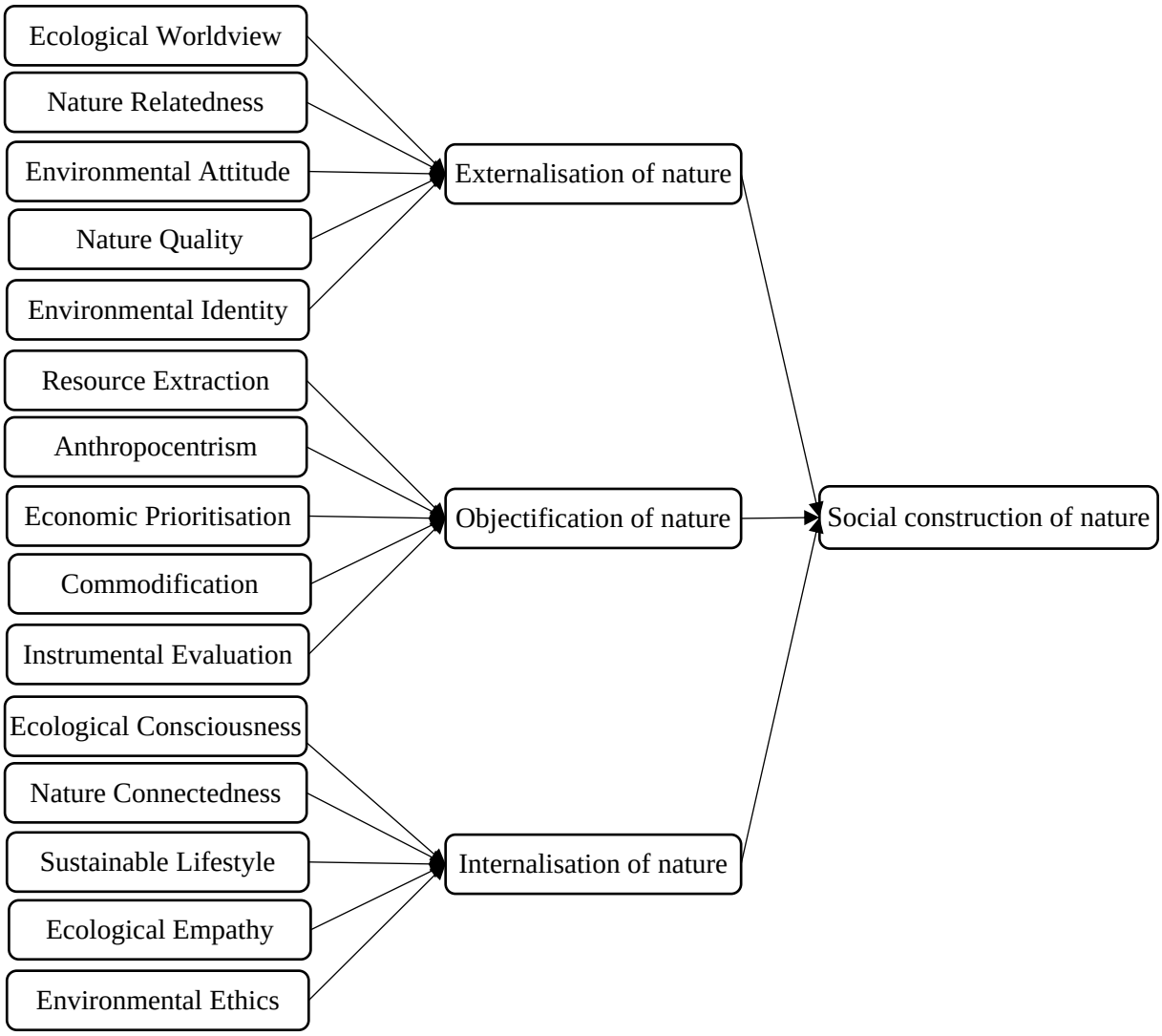

Figure 1. The variables that can measure people's social construction of nature.

Next, it was found through the literature review that PEB in ecotourism sites can be categorised into four types [35–37]. First is "green consumption behaviour" (e.g., avoid using disposable packaging). Second is "environmentally responsible behaviour" (e.g., avoid littering and always obey regulations). Third is "learning behaviour about environmental and socio-cultural features" (e.g., search information of natural attractions pre-visits and learn about issues faced by the sites). Fourth is "environmental behaviour in the common interest" (e.g., volunteering, give donations and sign petitions). Therefore, figure 2 shows the 4 variables that can measure tourists' PEB in ecotourism sites [35–37].

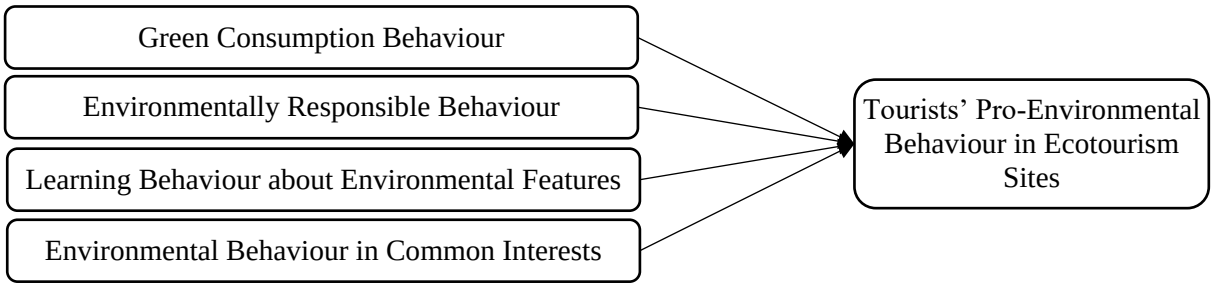

Figure 2. The variables that can measure tourists' pro-environmental behaviour in ecotourism sites.

4.2 Connecting social construction of nature and tourists' pro-environmental behaviour through the proposed conceptual framework

Based on the literature review, prior scholars predicted that social construction of nature may positively influence a person's thoughts and action towards nature. For example, [7] revealed that environmental meanings, social structure and political actions may actually connected to each other. Willadsen [8] stated that symbols and words associated to nature may influence human thoughts and action. Even recently, Cui and Xu [9] commented that people's social construction of nature may influence their thoughts and comments on social media regarding an accident that happened in an ecotourism site Therefore, figure 3 reveals that social construction of nature will proceed to shape a person's thoughts before ultimately affects a person's action towards nature [7–9].

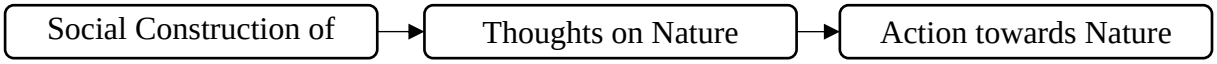

Figure 3. The relationship between social construction of nature, thoughts on nature and action towards nature.

However, those studies were not extensive enough as they do not involve any correlational analysis that clearly proved the relationship between social construction of nature, thoughts on nature and action towards nature. In order to find correlations between these 3 concepts, model of goal-directed behaviour (MGB) can be used to represent thoughts on nature while pro-environmental behaviour (PEB) represents action towards nature. There are 9 variables within the original MGB that are used to evaluate people's behaviour. However, scholars found that only 8 variables are capable to directly or indirectly influence a person's PEB which include frequency of past behaviour, attitude, subjective norm, positive anticipated emotion, negative anticipated emotion, perceived behavioural control, desire and intention [4–6],[39],[42],[43]. Therefore, figure 4 shows the variables within MGB are found to be able directly or indirectly influence a person's PEB [4–6],[36],[39],[40].

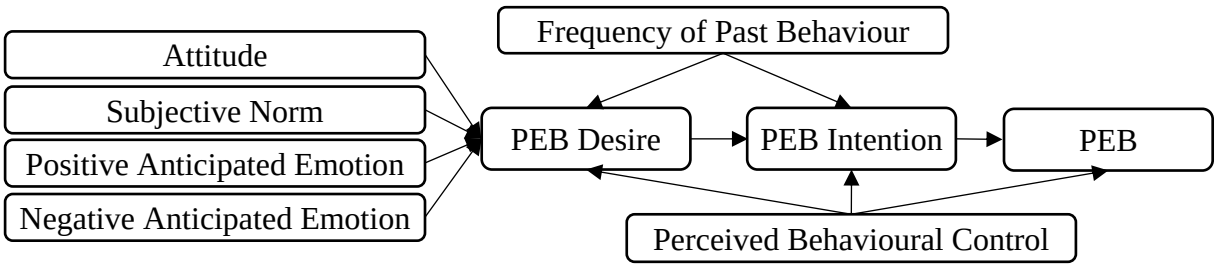

Figure 4. Variables within model of goal-directed behaviour (MGB) that are found to be directly or indirectly influencing a person's pro-environmental behaviour (PEB).

However, after extensive studies utilised MGB to assess people's PEB, various extended version of this model had been proposed which is called as extended model of goal-directed behaviour (EMGB).

EMGB was developed by adding additional variables to MGB thus increasing its predictive ability. EMGB also has stronger explanatory ability than MGB [44–46]. Some of the variables added to extend MGB include norm activation model, perceived ethics, value orientation and place attachment [4–6]. Therefore, figure 5 shows the example of how previous scholars extend MGB with additional variables in order to assess tourists' PEB in ecotourism sites [4–6].

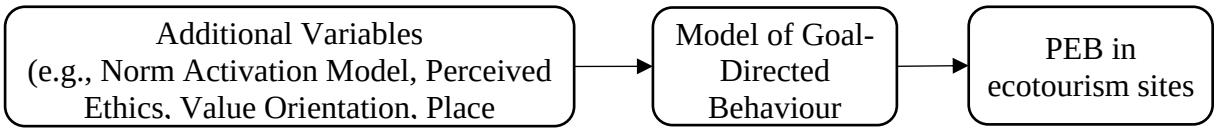

Figure 5. Examples of extended model of goal-directed behaviour (EMGB) that assess tourists' pro-environmental behaviour (PEB) in ecotourism sites.

Therefore, after adapting previous theoretical frameworks, a conceptual framework is constructed. Based on figure 6, this article proceeds to propose a conceptual framework that illustrates how social construction of nature, MGB and PEB in ecotourism sites may create causal network among them.

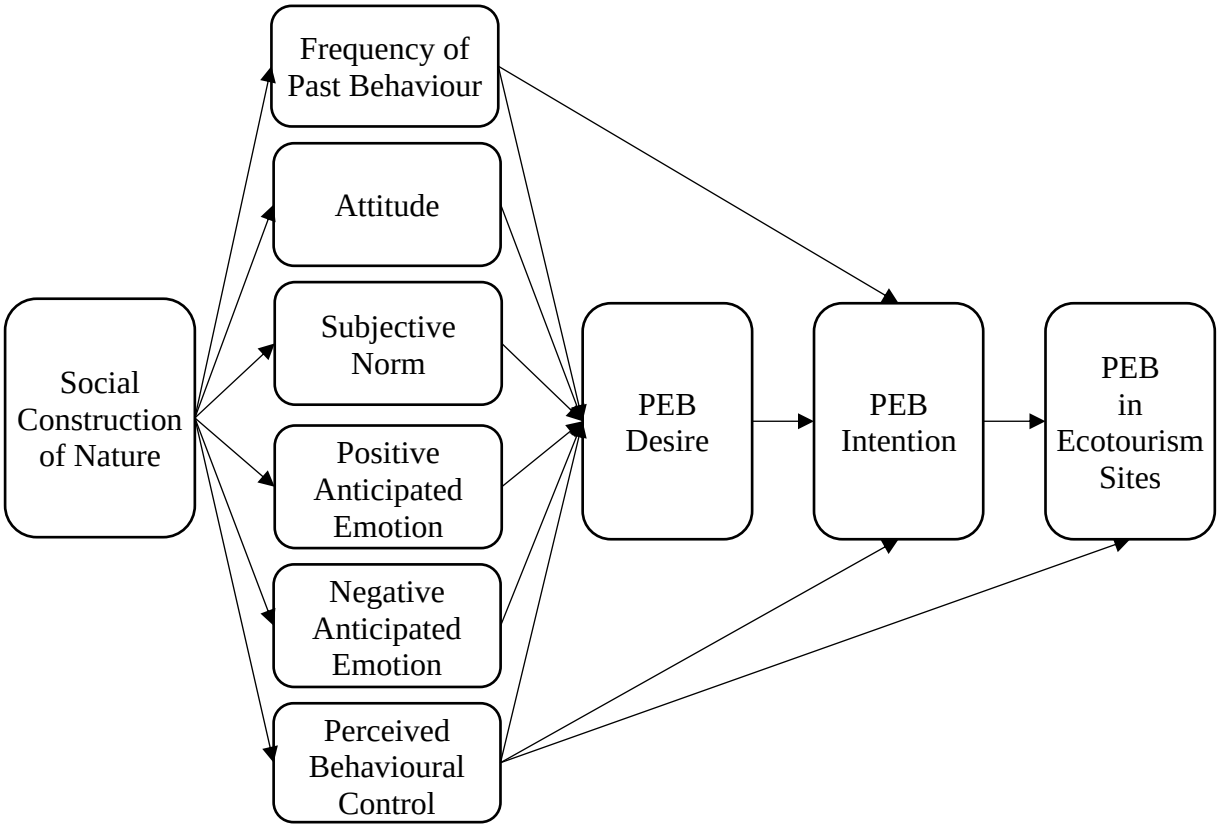

Figure 6. Proposed conceptual framework to explain the relationship between social construction of nature and tourists' PEB in ecotourism sites.

4.3 Suggesting appropriate methodological aspects for conducting empirical studies using the proposed conceptual framework

Based on the proposed conceptual framework, this article proceeds to suggest suitable methodological technique that may be more fitting when conducting empirical assessments using the proposed conceptual framework in the future. There are few methodological aspects that can be suggested.

4.3.1 *Research design.*
Two sequential designs can be applied which starts with exploratory research design and followed by correlational research design. Exploratory research needs to be conducted first before proceeds to correlational research. This is because even the conceptual framework has been proposed which includes 10 latent variables, not all of the latent variables have an established set of observable variables. Only perceived behavioural control, attitude, subjective norm, positive anticipated emotion, negative anticipated emotion, frequency of past behaviour, PEB desire, PEB intention and PEB have their own set of observable variables that can be adapted from prior scholars [6],[35–37],[42],[47–51]. This happens because social construction of nature is different for societies living in different countries, thus the observable variables that are suited to measure it may differs too due to geographical factor. Hence, exploratory research needs to be performed first by measuring a particular country's social construction of nature using the 15 variables found in literature review. The result from this phase can then be used to determine which variables can best be used as observable variables that measure the social construction of nature of people in the specific country. After all of the latent variables have their own observable variables, correlational research design can then be adapted to investigate the relationship between social construction of nature and tourists' PEB in ecotourism sites.

4.3.2 Research procedure.
There are 4 phases that should be followed. Within the exploratory phase, primary research questions are firstly identified. The question will be how social construction of nature is formed by the people of a particular country. Data collection will then begin. When the data are successfully collected, analysis will be performed to answer the research question. Then, secondary research question and hypotheses are identified. The question will be whether it is true that tourists' social construction of nature has a role in shaping their PEB in ecotourism sites. In order to answer the question and test the hypothesis, this study needs to conduct correlational analysis which demands all the latent variables in the proposed conceptual framework have their own sets of established observable variables. Hence, the integration phase will use the findings from the exploratory phase to develop suitable observable variables that can represent the social construction of nature of people in a specific country. After all of the latent variables in the conceptual framework have their own sets of observable variables, questionnaire can then be built that acts as an instrument for the data collection of the next phase. Within the correlational phase, the newly developed instrument will be used to collect data. When the data is successfully collected, correlational analysis will be performed to answer the secondary research question and proposed hypothesis. Finally, in interpretation phase, the findings from both exploratory and correlational phase will be interpreted and discussed extensively. Discussion will be made about how the findings from exploratory phase affect the findings from correlational phase.

4.3.3 Data collection.
For the exploratory phase, online questionnaires can be used as an instrument to investigate the process of forming social construction of nature. The questionnaires can be distributed using social media, online ads or websites. This data collection method is different from the common data collection methods used by previous studies to investigate social construction of nature which usually include interviews or focus group discussions. This method of collecting data is chosen due to few reasons. First, collecting data by distributing online questionnaires can eliminate the possibility of dishonest response from respondents. Respondents may lie and tend to give positive social construction of nature such as always caring and appreciating nature, as they have a feeling of being judged by the interviewer. By distributing online questionnaires, respondents can give an honest answer regarding their social construction of nature as they have more privacy. Second, this phase intends to investigate social construction of nature within the general society of a country thus does not require any target population. Hence online questionnaires that are posted publicly are convenient as they are widely accessible to the general populations. For the correlational phase, physical questionnaires can be used as an instrument to assess the relationship between tourists' social construction of nature and their PEB in ecotourism sites. The questionnaires

shall be distributed to the respondents face-to-face on selected study area. This method of collecting data shall be conducted physically and different from the exploratory phase due to few reasons. First, this phase intends to investigate the relationship between tourists' social construction of nature and their PEB in ecotourism sites, therefore it is more relevant to collect data from the target population (actual tourists) on any ecotourism sites. Second, in-person survey can increase data quality by avoiding falsification of demographic information thus dismissing any false respondents that do not meet the intended target population.

4.3.4 *Sampling method.*

For the data collection of exploratory phase, the sampling method that is suitable to be used with the online questionnaire is non-probability sampling method, specifically the voluntary response sampling. This method involves selecting sample that voluntarily agree to take part in a survey after they had been invited through advertisements that asked any people who meet any specific requirements to sign up. Respondents will be recruited for survey until a predetermined sample size is reached. There is a reason why non-probability sampling method is fitting for the data collection of exploratory phase. As the exploratory phase aims to investigate social construction of nature of a country's general population, it is impossible to conduct probability sampling that needs a list of every person who exist in a particular country. Hence, a non-probability sampling method is more convenient due to a country's population having a sampling frame that is huge in nature. Meanwhile, the data collection of correlational phase will use another non-probability sampling method, specifically the purposive sampling. Purposive sampling involves selecting sample based on a researcher's judgement on which sample will facilitate the investigation. Hence, data collection of correlational phase will only focus on domestic tourists which visit ecotourism sites. There is also a reason why non-probability sampling method is better suited for the data collection of correlational phase. Basically, it is impossible to obtain a fixed sampling frame as the number of tourists visiting ecotourism sites every day is unpredictable. Hence, it is unfeasible to use a probability sampling method that requires researcher to randomly pick samples from an already established list of sampling frame. Moreover, even when the fixed sampling frame is obtained, it will be hard to approach the randomly selected samples as they probably had departed due to tight schedule organised by travel agents. Therefore, a non-probability sampling method is more feasible due to the constraint of fieldwork area and nature of tourism locations that forbid an established list of sampling frame.

4.3.5 Analysis.

For the collected data of exploratory phase, descriptive statistics analysis can be conducted to investigate which observable variables are most significant in explaining the three processes of forming Malaysians' social construction of nature which include externalisation, objectification and internalisation. The software that can be used for this analysis is SPSS. Within the software, central tendency measurement will be generated. The results of this analysis will be presented in the form of bar charts. For the collected data of correlational phase, correlational analysis using structural equation modelling (SEM) can be conducted to investigate the relationship of the latent variables proposed in the conceptual framework. The software that can be used for this analysis is SPSS. Within the software, whether parametric statistical test (CB-SEM) or non-parametric statistical test (PLS-SEM) will be applied depending on the normality of tabulated data. Among other types of correlational analysis, SEM is chosen due to few reasons. First, SEM is suitable to assess frameworks that possess abundant number of latent variables. Second, SEM recognise the flaws of the assigned observable variables as it requires researchers to specify errors scale for each observable variable. Third, SEM is more comprehensive as it evaluates the model fit of a framework using multiple tests. In the end, the results of this analysis that showed the correlational score for each latent variables shall be presented in the form of tables and figures.

5. Discussions

5.1 Identified research gap from literature review

Based on the literature review, there are few discussions can be made. First, social construction of nature can be considered majorly understudied when compared to MGB or PEB. Only 136 literatures that discussed the topic can be found online from the year 1987 to 2023. Moreover, majority of the literatures are article reviews and book reviews while only a minority are considered empirical studies. Second, it was identified that there are limited literatures that discuss the connection between social construction of nature and people's behaviour towards environment. Most of the literatures that assess social construction of nature only aim to assess the concept without trying to extend or utilise it to further assess other concepts.

5.2 Theoretical and practical implications of this article

It was uncovered that social construction of nature may be possible to be linked with tourists' PEB in ecotourism sites. This provides theoretical implication by facilitating on building a conceptual framework that may be key in connecting social construction of nature and tourists' PEB in ecotourism sites. However, the proposed framework has not been tested yet. Hence, it may contribute towards practical implication by encouraging scholars to conduct empirical studies by using or extending the proposed conceptual framework.

5.3 Limitations and future research directions

The limitation of this article is it utilised a more open narrative review approach which has few disadvantages. First, the results are not replicable as it does not discuss any selection methods such as inclusion and exclusion criteria. Second, the results are more prone to selection bias due to literatures are picked to fit the needs of topics being focused. Third, the results obtained in this article are not allowed for any direct comparison between other studies as they were no pooled analysis being involved.

Few future research can be suggested. First, more literature reviews that utilise systematic review or meta-analysis can be conducted to conceptualise the relationship between social construction of nature and tourists' PEB in ecotourism sites. Second, more empirical research needs to be done with a scope of investigating people's social construction and assess the implication brought by it onto their PEB in ecotourism sites.

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