Smart Living Housing Development in Malaysia: Debunking the Additional Cost Components from the Gross Development Cost Standpoint

Chieng, K.F.; Mustapa, F.D.*

Department of Quantity Surveying, Faculty of Build Environment and Surveying,

Universiti Teknologi Malaysia, Malaysia

***Correspondence Author**

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ABSTRACT

The development of Smart Living housing in Malaysia necessitates a meticulous understanding of the Gross Development Cost (GDC) components to ensure project financial viability. Unlike conventional housing, Smart Living involves unique building elements such as polarised glass panels, occupancy sensors, wheelchair stair climbers, and rainwater harvesting systems. These features contribute to a holistically sustainable and convenient independent living environment but also present greater barriers with "extra work" that diverge from traditional houses. Given the nascent stage of Smart Living housing development in Malaysia, developers have often taken individual initiatives to constitute the concept due to the absence of established rules and regulations. This lack of standardisation has led to inconsistencies of cost and uncertainties in factual development cost components. Acknowledging these issues, this research necessitates an explanatory sequential mixed method approach; however, this paper presents only the initial phase of the research by exploring the perspectives of stakeholders. The study aims to clarify the additional cost components associated with the development, emphasizing their impact on the overall budgeting process through qualitative, semi-structured interviews with respondents selected through homogeneous purposive sampling. Findings from ten respondents were analysed narratively and revealed that the anticipated additional development cost components include one hard cost item for land acquisition, six soft cost items for social, environmental, and economic impact assessments, one soft cost item for the developer's concern, and eleven hard cost items related to regulatory compliance. This paper addresses the gap in research regarding the uncertainties in determining feasible capital costs due to possibilities such as overestimating Smart Living feature expenses and underestimating preparation costs. By systematically examining these anticipated additional development cost components, this paper provides foundational guidance for better accuracy in estimating, managing costs, and conducting feasibility studies, thereby supporting the effective planning and execution of Smart Living housing developments in Malaysia.

Keywords: Gross Development Cost (GDC), Hard Cost, Smart Living housing development, Soft Cost, Uncertainties

INTRODUCTION

Building Smart Living housing presents greater barriers with "extra-works" that diverge from conventional

housing practices as its unique building elements contribute to holistic sustainable living [1], [2]. Those distinctive building elements are polarised glass panels, occupancy sensors, wheelchair stair climbers, and rainwater harvesting. However, given the nascent stage of Smart Living housing development in Malaysia [3], [4], developers have previously taken individual initiatives to constitute the concept of Smart Living due to the absence of established rules and regulations [5]. This pioneering approach, while innovative, has led to a lack of standardisation across projects, resulting in inconsistencies and uncertainties in development cost components. Without a uniform framework, estimating and managing costs accurately becomes challenging, posing risks to the financial viability and overall success of these projects.

STATEMENT OF THE PROBLEM

Witnessing the rapid growth of Malaysian Smart City initiatives and market demand [5]–[7] for Smart Living housing, policymakers finally introduced guidelines by stages through levels of implementation to provide developers with direction concerning Smart City requirements, notably Smart Living housing. This shift has garnered support for new rules and institutions introduced by various stakeholders to streamline the procurement process. These “extra works” are classified as additional cost components in housing development [7], which may not align with conventional practices and might not be readily appreciated by stakeholders. For instance, Smart City initiatives necessitate the inclusion of external building elements like pedestrian walkways and streetlights, along with the addition of shielded fixtures to the exterior of Smart Living houses.

From the GDC perspective, the adoption of those building elements can be categorised into hard, soft, and land costs [8], [9]. Consequently, this introduces uncertainty during the prophase of Smart Living housing development, potentially increasing the GDC and adding to the already contentious expenses associated with conventional housing [2], [5], [7], [10]. Despite numerous studies affirming the societal benefits of promoting Smart Living housing, they are often perceived as having higher initial design and development costs compared to conventional housing. The procurement process introduces uncertainties, necessitating a high contingency sum in the project budget [7], [11].

The lack of a well-informed understanding of benefits and costs, along with the comparatively higher initial costs and soft cost components, including associated extra risks, remains a deterrent for potential stakeholders to voluntarily enter the Smart Living housing market. Hence, this study aims to comprehend and categorise the hard cost and soft cost items associated with Smart Living housing development compared to conventional housing. This paper focuses on gathering meticulous insights from Smart Living project stakeholders, such as project managers and various experts with experience in Smart Living housing development.

LITERATURE REVIEW

The review is structured into three main sections. The first section provides an overview of Smart Living housing, outlining its key components and the benefits it offers. The second section compares the development cost components of Smart Living housing with those of conventional housing, highlighting the unique cost components associated with Smart Living features. The third section examines the feasibility and cost implications of developing Smart Living housing, considering factors such as initial investment, operational savings, market demand, regulatory incentives, and risk management. By systematically exploring these areas, this literature review seeks to provide a comprehensive understanding of the cost dynamics involved in Smart Living housing projects. This understanding is essential for developers, policymakers, and stakeholders to make informed decisions, ensuring the successful implementation and financial viability of Smart Living housing in Malaysia.

Overview on Smart Living Housing

Smart Living housing represents an innovative approach to residential development, integrating advanced technologies to enhance sustainability, efficiency, and quality of life. It is a key element of Smart City initiatives, specifically focusing on residential needs [12], [13]. These developments often include distinctive features that cover all pillars of sustainability—environmental, social, and economic—on both the building and townscape scales. Unlike conventional housing, Smart Living housing is designed to accommodate occupants' well-being and provide convenient independence, offering a more comprehensive approach compared to the preceding green concept, which is primarily environmentally oriented [14]. Essentially, Smart Living housing combines the features of a conventional home with Smart Living features to create a more advanced and holistic living environment [15].

Numerous studies have demonstrated the viability of Smart Living housing and its benefits, particularly in supporting ageing populations and catering to the market of socially conscious consumers. Research has shown that the integration of Smart Living features can significantly enhance the quality of life for elderly residents by promoting independence, safety, and comfort [16]–[18]. For example, the use of occupancy sensors and automated systems can help manage daily activities and monitor health conditions, reducing the need for constant carer presence. Additionally, features such as wheelchair stair climbers and accessible design elements ensure that homes are adaptable to the changing mobility needs of ageing individuals. These studies highlight how Smart Living housing can address the specific challenges faced by elderly populations, such as mobility issues, health monitoring, and the desire to age in place. By providing a safer and more supportive living environment, Smart Living housing can reduce the physical and emotional stress associated with ageing, thereby improving overall well-being. The findings underscore the potential of Smart Living housing to meet the growing demand for senior-friendly residential options in Malaysia and beyond [19].

Moreover, the implementation of Smart Living housing can be achieved through retrofitting [20]–[22] existing homes or constructing new ones [23][24], both of which have shown positive outcomes. Retrofitting involves upgrading current housing with smart technologies and sustainable features, which offers several benefits. It can be more economical than building new structures, as it leverages existing infrastructure. Retrofitting also allows residents to continue living in their homes while improvements are made, minimising disruption. Upgrading old buildings can improve energy efficiency and reduce environmental impact. Homeowners can quickly experience the advantages of smart technologies, such as improved security and energy savings. Building new Smart Living homes from the ground up offers distinct advantages. New constructions can be designed specifically to incorporate smart technologies and sustainable features seamlessly. They can utilise the latest materials and construction techniques, ensuring the highest standards of efficiency and sustainability. New builds can be designed with scalability and adaptability in mind, accommodating future technological advancements and changes in resident needs.

In conclusion, Smart Living housing offers a promising solution to the challenges faced by ageing populations and accommodate to the need of socially conscious consumers. Its integration of advanced technologies and sustainable practices not only enhances the quality of life for residents but also supports broader societal goals Moreover, the implementation of Smart Living housing can be achieved through retrofitting existing homes or constructing new ones, both of which have shown positive outcomes As such, the continued research regarding development cost components for a more proactive implementation of Smart Living housing are essential for the future of residential development in Malaysia and beyond [25].

A. Comparing Development Cost Components for Smart Living Housing and Conventional Housing

The GDC for Smart Living housing encompasses a comprehensive framework that includes both

conventional building expenses and additional costs associated with integrating Smart Living features and technologies. This holistic approach is essential for developers aiming to ensure the economic viability and success of their projects. Understanding the key components of the GDC is fundamental to effective budgeting and financial planning.

Firstly, Land Cost forms a critical part of the GDC, representing the initial expenditure required to acquire suitable land for development [26], [27]. The variability in land prices is influenced by factors such as location, accessibility, and local zoning regulations [28]. Securing an appropriate site lays the foundation for the entire project, influencing subsequent costs and project feasibility assessments. Secondly, Hard Cost components encompass direct expenses directly related to physical construction. These include materials, labour, equipment, and contractor fees necessary to build the Smart Living housing units and associated infrastructure. Hard costs are typically the most substantial portion of the GDC and require meticulous cost estimation and management to stay within budgetary constraints while maintaining construction quality and timelines [9], [29]. Thirdly, Soft Cost considerations encompass indirect expenses that contribute to the overall development process but do not involve physical construction [9], [29]. This category includes expenses such as architectural and engineering design fees, legal fees, permitting costs, financing fees, insurance premiums, and marketing expenses. Soft costs are crucial for obtaining necessary approvals, ensuring legal compliance, and effectively promoting the project to potential buyers or tenants. Lastly, Profit Margin is incorporated into the GDC to provide developers with a return on investment for their efforts and risks. This component accounts for the financial reward expected by developers and investors, serving as a buffer against unforeseen costs and economic fluctuations. Profit margins also incentivize developers to undertake projects by ensuring financial viability and sustainability over the project lifecycle.

The integration of Smart Living features into housing developments significantly impacts both hard and soft cost components, which in turn can indirectly influence land use and land value [30]. Hard costs, involving tangible expenses of Smart Living features, directly shape the physical construction and infrastructure layout of the development. These investments may necessitate specific design adaptations and construction techniques that optimize space efficiency and functionality, thereby influencing how the land is utilized. Meanwhile, soft costs such as design fees, regulatory compliance, and certification expenses ensure that Smart Living features meet environmental standards and enhance market appeal. This strategic allocation of resources not only supports sustainable development practices but also enhances the perceived value of the property through improved energy efficiency and modern amenities, making it more attractive to socially conscious consumers and potentially increasing overall land value. The following Table 1 and 2 shows the integration of Smart Living features onto the conventional housing hard cost and soft cost components with their yardsticks deduced from preliminary findings.

Table 1. Hard Cost Components for Smart Living housing (Author's preliminary findings)

Hard Cost Components	**Yardsticks**
BUILDING COST/HOUSING SCALE	RM/m^2 @ RM/ft^2
Internet Connectivity	RM/Item
Video Monitoring System	RM/Item
Smart Security Lock System	RM/Nr
Security-to-Household Intercom System	RM/Item
Universal Design: Ramp & Assisted Washroom	RM/Item
Wheelchair Lift at Stairs	RM/Item
Occupancy, Motion & Sensory based Appliances System	RM/Item
Smart Sensor Cloth Dryer	RM/Nr

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Portable Parcel Box	RM/Nr
Fire Detector	RM/Nr
Safety Panic Button	RM/Item
Private Farming Proximity	RM/m^2
Refuse Disposal – Garbage & Recycling Bin/Chute	RM/Item
Remote Control Blinding/Shades	RM/m^2
Water Closet Items – Faucet Aerator	RM/Nr
Water Closet Items – Dual Flush Toilet	RM/Nr
Light-emitting Diode (LED) type Lighting System	RM/Nr
Solar Panel on Building Roof	RM/Kwp
Rainwater Harvesting System	RM/Nr
Grey Water System	RM/Item
Solid Waste Management System	RM/Item
Smart Thermostat	RM/Nr
Smart Siren	RM/Nr
Energy Management Sensor & Metre for Electrical Appliances	RM/Item
INFRASTRUCTURE COST/TOWNSHIP SCALE	
Site Preparation	RM/Acre
Earthwork	RM/Acre @ RM/m^2
Storm Water Drainage	RM/Acre @ RM/m^2
Sewerage Reticulation	RM/Acre @ RM/m^2
Water Reticulation & Hydrant	RM/Acre @ RM/m^2
Road Work	RM/Acre @ RM/m^2
TNB Substation (Single/Double Chamber)	RM//Nr
Mechanical & Engineering Work	RM/Acre @ RM/m^2
Recreational Facilities & Ancillaries	RM/Acre @ RM/m^2
Entrance Landscape	RM/Item
Security Provision – Gated Guarded Community	RM/Item
Public Transport Facilities	RM/Item
Pedestrian Friendly Street	RM/m
Cycling Friendly Street	RM/m
Universal Design: curb cut, curb ramp, depressed curb, dropped kerb, pram ramp, or kerb ramp with truncated dome tactile strip	RM/m^2
Drone/Unmanned Aerial Vehicle	RM/Nr
Garden Works & Landscaping	RM/m^2
Farming/Tree Cover/Tree Inventory	RM/m^2
Hill Slope Structure	RM/Acre @ RM/m^2
Flood Mitigation Structure/Facilities	RM/m^2
Solar Panel on Pedestrian Walkway Roof	RM/Kwp
PRELIMINARIES	5-10% from Construction Cost
CONTINGENCIES & DESIGN RESERVE	5-10% from Construction Cost

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Table 2. Soft Cost Components for Smart Living housing (Author's preliminary findings)

Soft Cost Components	**Yardsticks**
PRE-DEVELOPMENT COST	
CIDB Levy	0.125% from Construction Cost
Professional Fees	(8%-10%) from Construction Cost + 5% Tax
Plan & Approval Fee	RM/Acre @ RM/m^2
Capital Contribution	
Tenaga Nasional Berhad, Jabaran Bomba Awam, Jabatan Pengairan dan Saliran, Telekom Malaysia	RM/Acre @ RM/m^2
Indah Water Malaysia	1.65% of Profits
Survey Work (Boundary, Pre-computation, Strata)	RM/Acre @ RM/m^2
Soil Investigation	RM/Acre @ RM/m^2
Administration & Management Cost	1%-2% from Construction Cost
Sale & Marketing Legal Fees	1% Sales Income
ADDITIONAL ATTENTION	
Daylight-oriented Structure Consultation	% from Construction Cost
Acoustical Environmental Structure Consultation	% from Construction Cost
GROSS DEVELOPMENT VALUE	Sale (RM/m^2 /Nr) @ Rental (RM/m^2 /year)
PROFIT MARGIN	20% of Development

Understanding and effectively managing the cost components and the allocation of Smart Living features are essential for developers to navigate the complexities of Smart Living housing development. This strategic approach not only facilitates accurate budgeting and financial forecasting but also supports the integration of innovative Smart Living features that enhance sustainability, efficiency, and quality of life within residential communities. By aligning these components with project objectives and market demands, developers can optimize project outcomes while meeting the growing demand for technologically advanced and sustainable housing solutions.

However, while Table 1 and Table 2 detail the direct costs of hard and soft components involving Smart Living features, they do not account for the "extra work" that often leads to additional charges. This study aims to demystify these additional cost components associated with Smart Living housing developments, emphasizing their significant influence on the overall budgeting process. The following section will examine development costs from the perspective of feasibility studies, providing insights into how these additional costs impact project planning and financial viability. This sets the stage for a detailed exploration of how these additional costs affect feasibility and budgeting in Smart Living housing projects.

B. Feasibility Study and Cost Implication for Developing Smart Living Housing

Undertaking a comprehensive feasibility study is essential when considering the development of Smart

Living housing projects [25], [31]–[33]. This study aims to elucidate the additional cost components associated with integrating Smart Living features, beyond direct hard and soft costs documented in Tables 1 and 2. These additional costs often arise from "extra work," such as specialized installations, technological integrations, and compliance with stringent sustainability standards. Understanding these components is crucial for developers to accurately assess project budgets and ensure economic viability.

Moreover, the feasibility study evaluates the potential return on investment (ROI) [21], [25], [34]–[36], considering factors like market demand for sustainable housing solutions and the long-term operational efficiencies offered by Smart Living features. Smart Living developments can enhance market appeal through features like energy efficiency, advanced security systems, and integrated smart technologies, which appeal to environmentally conscious consumers and tech-savvy homeowners. The feasibility study assesses how these features impact market competitiveness and property valuation over time. Hence, detailed cost analysis is pivotal in this evaluation, encompassing not only upfront construction expenses but also lifecycle costs, maintenance requirements, and potential cost savings from energy-efficient technologies.

The strategic planning for Smart Living housing developments involves identifying and mitigating risks associated with integrating Smart Living features, adapting to regulatory changes, and meeting evolving market needs. Developers must align their projects with sustainable development goals and community needs to ensure they contribute positively to urban environments and enhance residents' quality of life, even amidst additional charges associated with these enhancements. By analysing these cost implications and conducting robust feasibility assessments, developers can mitigate risks, optimize resource allocation, and align their projects with evolving market trends and consumer preferences. This structured approach not only ensures financial feasibility but also positions Smart Living housing as a sustainable and desirable option in the competitive real estate market. The following section for methodology is to discuss this paper research approach in identifying the additional development cost components associated with the "extra-work".

METHODOLOGY

The paper adopted qualitative approach [37], [38], from the whole explanatory sequential mixed method approach, utilizing a combination of semi-structured interview and deductive narrative analysis as the primary step in further discovery. The sampling for respondents is selected by purposive and snowballing [39]–[42], considering the infancy of Smart Living housing development in Malaysia. The target respondents will be individuals with expertise and background in defining Smart City and building Smart Living projects with current or recent direct involvement. The experts are the individual widely recognized as a reliable source of technique or skill whose faculty for judging or deciding rightly, justly, or wisely is accorded authority and status by peers or the public in a specific well-distinguished domain [43]. He or she shall be familiar with Smart Living project delivery throughout pre and post contract stages and fluent in the matter of costing. The targeted respondents comprise stakeholders in positions like professional architects, site officers, project managers, quantity surveyors, local authorities, developers, state governments and master builders.

Narrative analysis [44]–[48] is a crucial qualitative method chosen for studying Smart Living housing development due to its ability to deeply explore stakeholders' lived experiences and perspectives. This approach is particularly valuable in understanding how individuals and communities navigate the integration of Smart Living features and sustainable practices in urban housing. By focusing on narratives, researchers uncover nuanced insights into the contextual factors influencing decision-making and project outcomes, encompassing technological innovation, environmental considerations, societal acceptance, and regulatory frameworks. This method not only captures diverse perspectives but also adapts to the dynamic nature of Smart Living initiatives, offering flexibility to explore emerging themes and unexpected insights crucial for

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advancing sustainable urban development.

FINDINGS

The researcher conducted interviews with eight public and private practitioners, along with two neutral body assessors, to explore the additional development costs and "extra-work" incurred from implementing Smart Living features that influence the GDC of Smart Living houses. The insights provided by these ten respondents were categorised into three major GDC components: land costs, hard costs, and soft costs. In total, there are one additional land cost component, seven soft cost components, and eleven hard cost components, as detailed in Table 3. According to the respondents, these additional cost items could serve as a foundational reference for governments and professionals, guiding policy formation and advancing practices within the Smart Living housing market. By optimizing societal value through informed decision-making, stakeholders aim to foster sustainable and economically viable Smart Living developments.

Table 3. Findings Regarding the "Extra-work" as the Additional Development Cost Components for Smart Living housing Development

1 Land Cost Item	7 Soft Cost Items		11 Hard Cost Items
Land Work	Social, Environmental and Economic Impact Assessment	Developer's Concerns	Authorities Requirements
i. The compliance to local authorities involving land work consist of flood mitigation planning, allocation for erosion and silt areas, with the work of cut and fill for land.	i. Study zone goes up to five (5) kilometres with interval of two hundred fifty (25) meters from the centre of proposed housing, covering the existing environment that might be used throughout the construction and residents' vacancy. ii. Particular emphasis is placed on regions with environmental sensitivity and those holding special or distinctive scientific, socio-economic, or cultural significance. iii. Furnish evidence demonstrating the commitment to implementing all suggested pollution prevention and mitigation measures. iv. Merging legal pledge of commitment to implement pollution prevention and mitigation measures.	vii. Allocation on sustainable consultancy services.	Proposed 11 additional Smart Living features as the compulsory items: i. Digital board with LED display ii. Religious buildings iii. Smart pole with panic button iv. Telemetering waste collection system v. Real-time water quality checker vi. Real-time air quality checker vii. Streetlight with solar panel viii. Streetlight pollution filter/reflector/shield/fixture

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	v. Cost Effectiveness – pollution prevention and mitigating measures, follow up surveillance and monitoring, and compliance audit. vi. Suggested a raise in minimal 5% to 10% of service fee.		ix. Polarized glass panel x. EV charging port xi. Inverter energy saving air conditioner

According to Table 3, in addressing land work requirements, Smart Living housing developers are mandated to adhere to stringent guidelines set forth by local authorities. This includes comprehensive flood mitigation planning, meticulous allocation for erosion and silt-prone areas, and employing cut and fill techniques to optimize land use efficiency and environmental sustainability. These measures are crucial to mitigate risks and ensure the long-term viability of Smart Living housing projects in urban settings. Furthermore, the Social, Environmental, and Economic Impact Assessment for Smart Living developments introduces six additional criteria compared to conventional assessments. These expanded assessments encompass a broader scope, focusing on aspects such as community engagement, socio-economic impacts, and the integration of advanced technologies. Next, developers must allocate substantial resources to consultancy services to fulfil these requirements, categorizing these costs under the soft cost components of the GDC. Besides, in response to advancing Smart Living principles, local authorities have proposed integrating eleven additional Smart Living features as compulsory elements in housing projects. These features include innovative technologies such as digital infrastructure with LED displays, smart poles equipped with panic buttons, telemetering waste collection systems, real-time environmental quality monitoring, and energy-efficient solutions like solar-powered streetlights and polarized glass panels. These additions represent a concerted effort to promote sustainability, enhance urban living standards, and meet stringent regulatory mandates.

DISCUSSION

Regarding land work, precise implementation of techniques such as cut and fill not only optimizes land use efficiency but also facilitates the seamless integration of Smart Living amenities into urban environments. Unlike conventional housing, where land work typically focuses on regulating residential unit density, Smart Living housing requires a paradigm shift towards accommodating integrated townscape elements like pedestrian walkways and cycling tracks. This approach not only supports accessibility but also promotes safety for pedestrians and cyclists, thereby enhancing overall urban mobility and contributing to a more vibrant and sustainable urban environment. The integration of Smart Living features as integral townscape elements, including pedestrian walkways and cycling-friendly streets, underscores the importance of efficient land levelling. These features occupy significant land areas and necessitate meticulous land preparation to ensure optimal functionality, usability and most importantly community accessibility. By prioritizing these infrastructure elements during land work, developers can create environments that seamlessly blend technological innovation with urban design, enhancing the liveability and attractiveness of Smart Living developments.

Moreover, the social, environmental, and economic impact assessment work for Smart Living developments involves a meticulous approach tailored to evaluate the comprehensive impacts of integrating Smart Living feature and sustainable practices. The study area is mandated to extend up to five kilometres with intervals of 250 meters from the proposed housing development centre, encompassing the surrounding environment that will be impacted by construction activities and subsequent residency. This spatial scope underscores the necessity for robust assessments that encompass social, environmental, and economic dimensions. Particular

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emphasis is placed on regions with environmental sensitivity and those of special or distinctive scientific, socio-economic, or cultural significance within the study zone. These areas require thorough assessment to understand potential impacts and implement appropriate mitigation measures on well-being, environmentally friendly and economically efficient. Unlike conventional housing, which tends to focus primarily on marketability, Smart Living projects integrate advanced technologies and sustainable practices to create holistic urban environments.

Stakeholders are required to furnish evidence demonstrating their commitment to implementing all suggested pollution prevention and mitigation measures, including proactive strategies to minimize environmental impact and enhance sustainability throughout the project lifecycle. There is a legal pledge of commitment to implement pollution prevention and mitigation measures, ensuring adherence to regulatory requirements and environmental standards. This commitment is essential for maintaining compliance and fostering responsible environmental stewardship. Cost-effectiveness assessments focus on pollution prevention and mitigation measures, encompassing follow-up surveillance, monitoring programs, and compliance audits to efficiently achieve environmental objectives while managing project costs effectively. Most importantly, stakeholders have suggested a minimal 5% to 10% raise in service fees to accommodate the implementation of comprehensive pollution prevention and mitigation measures. This adjustment reflects the investment required to uphold environmental sustainability and regulatory compliance within Smart Living housing developments.

Furthermore, developers have expressed significant concerns regarding the economic feasibility of integrating Smart Living features into residential projects. These features, which include advanced technologies and sustainable practices aimed at enhancing quality of life and environmental sustainability, often come with additional costs and complexities. To address these challenges effectively, developers are proposing to increase service fees by an anticipated 5% to 10%. This adjustment is intended to accommodate the costs associated with engaging sustainable consulting services during the feasibility and planning phases. The inclusion of sustainable consulting services is crucial for conducting comprehensive assessments of environmental impacts, regulatory requirements, and overall project sustainability. These services play a pivotal role in ensuring that Smart Living developments not only meet regulatory standards but also maximise their environmental and economic benefits over the long term. By allocating additional resources to sustainable consultancy, developers aim to mitigate risks, optimise resource allocation, and enhance the overall feasibility and success of Smart Living housing projects.

Lastly, regulatory compliance with local authorities has become pivotal in shaping the development trajectory of Smart Living housing projects. Local authorities mandate these initiatives to integrate advanced features that align with stringent sustainability benchmarks and community well-being goals. The proposed 11 additional Smart Living features, identified as compulsory items, are part of the mandate. These include a digital board with LED display, facilities for religious buildings, smart poles equipped with panic buttons, telemetering waste collection systems, real-time water and air quality checkers, streetlights with solar panels, pollution filters or reflectors, polarised glass panels, EV charging ports, and energy-saving air conditioners with inverters. Each of these features plays a critical role in enhancing energy efficiency, environmental sustainability, and the overall quality of life within Smart Living developments. They not only meet regulatory standards but also contribute to the resilience and future-readiness of urban housing initiatives. By embracing these innovative technologies and sustainable practices, developers aim to create communities that prioritise environmental stewardship while meeting the evolving needs of residents and regulatory frameworks. This approach not only ensures compliance with current standards but also positions Smart Living housing as a model for sustainable urban living, capable of adapting to future environmental and societal challenges.

In summary, this narrative analysis deduced a structured framework for stakeholders involved in urban

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development and policy formulation to navigate the complexities of Smart Living housing projects. By systematically addressing these categories—land work, impact assessments, developer concerns, and regulatory requirements—stakeholders can collaborate effectively to optimise project feasibility, promote sustainable urban development practices, and enhance the quality of living environments for future residents. These "extra-work" components, which incur additional development costs in Smart Living housing development, may appear similar to those in conventional housing projects. However, their implementation takes on a new perspective when viewed through the lens of Smart Living principles, significantly impacting the project's outcomes. The strategic incorporation of these elements not only aligns with evolving societal expectations and regulatory standards but also positions Smart Living housing as a progressive solution to contemporary urban challenges. While the upfront costs of integrating these features may appear comparable to those of traditional projects, their holistic impact and long-term benefits highlight their crucial role in shaping the future of urban living. By prioritising innovation and sustainability, Smart Living developments not only meet current needs but also anticipate future demands, ensuring resilience, efficiency, and enhanced quality of life for residents. Thus, while these additional costs represent an initial investment, they ultimately contribute to creating vibrant, resilient communities equipped to thrive in a rapidly changing world.

CONCLUSION

Smart Living housing represents a transformative approach to residential development, integrating advanced technologies to enhance sustainability, efficiency, and quality of life. This study set out to explore the additional development costs associated with implementing Smart Living features, which significantly influence the Gross Development Cost (GDC) of such housing projects. Through qualitative research methods including semi-structured interviews and narrative analysis, insights were gathered from a diverse group of stakeholders, comprising public and private practitioners, as well as neutral body assessors. The findings underscored that Smart Living initiatives introduce distinct cost components across land, hard, and soft cost categories. Specifically, respondents identified one additional land cost component, seven soft cost components, and eleven hard cost components, each contributing to the overall GDC. These additional costs reflect investments in technological integration, sustainability certifications, and regulatory compliance, which are essential for creating modern, environmentally friendly living environments. Importantly, the study highlighted the role of these additional cost items as potential benchmarks for policymakers and professionals in shaping future Smart Living housing policies and practices. By optimising these investments, stakeholders can enhance the societal value of Smart Living developments, fostering resilience and quality of life benefits for residents. In conclusion, while Smart Living housing presents upfront challenges in cost management, the long-term benefits in energy efficiency, liveability, and market competitiveness are clear. Moving forward, leveraging these findings to inform strategic planning and policy formulation will be crucial for advancing sustainable urban development and meeting the evolving needs of communities in the years to come.

RECOMMENDATIONS

The nature of the entire research approach addressing this practical knowledge gap necessitates an explanatory sequential mixed method approach. However, this paper only presents the foundation for further findings by examining the supply-side qualitatively. Based on the insights gleaned from the study on additional development costs in Smart Living housing, several recommendations can enhance project feasibility and societal impact. Firstly, there is a need to enhance transparency in cost estimation and reporting, supported by standardized guidelines for assessing Smart Living feature costs. Secondly, stakeholders should strategically invest in technological integrations that enhance efficiency and resident well-being, possibly incentivized through subsidies. Thirdly, fostering collaboration among architects,

developers, and local authorities can accelerate knowledge sharing and innovation. Fourthly, supportive policies should incentivize Smart Living developments while balancing economic feasibility and sustainability. Fifth, educating stakeholders on cost implications and technological advancements is critical for informed decision-making. Lastly, continuous monitoring and evaluation will ensure projects meet sustainability goals and societal needs, fostering a resilient and sustainable urban environment. In summary, while supply-side stakeholders have been thoroughly considered, the following steps in the explanatory sequential mixed method can explore the inclusion of demand-side perspectives.

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