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Achieving Sustainable Affordable Housing Scheme from the Perspective of Multi Eco-System

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Abstract. Sustainable development and affordable housing are some of the challenges Malaysia and many other developing countries are experiencing. Majority of the population which comes from the middle-income group found difficulties in purchasing an affordable house and living in sustainable communities. Hence, in response to the Malaysian government's effort in the Eleventh National Plan (2016-2020) for every Malaysian to have equal access to affordable housing with sustainable approaches, the drifts of integrating affordability criteria in sustainable housing development seems vital. It is essential to simultaneously tackle sustainability and affordability housing issues. Thus, the aim of this study is to determine the Critical Success Factors (CSFs) in achieving Sustainable Affordable Housing Scheme from the economic, environmental, and social perspectives for the middle-income group. This study examines issues based on a comprehensive review of journal articles and official reports. Relevant literature resources on the CSFs of sustainable affordable housing to meet the needs and ensure satisfaction of end users are reviewed. It is expected that the findings will elicit several strategies for the construction industry players to enhance the quality of life for sustainable communities via the Sustainable Affordable Housing Scheme.

1. Introduction

Housing is an essential element for the economic growth and development of a country. An effective and efficient housing provision would not only contribute to the rapid economic growth but also provide a link between the corporeal growths of a community-built environment and its social outcomes [1]. This is due to the fact that the socio-economic stability of a country is always dependent on the housing affordability of the residents in the country. Malaysia is of no exception when it comes to deal with housing development. Through the National Housing Policy, extensive laws covering sustainable development of physical, economic, environmental and social aspects in housing were created [2]. The housing policy in Malaysia has evolved over the years through a number of national development plans. The objectives of the policy are to provide affordable and adequate housing, mainly to the low-income group. Nevertheless, most of the citizens are excluded from the housing assistance programme as they are classified under the middle-income group [3].

The middle-income group, which accounts for 40% of the Malaysian population, has found difficulties in getting their own house due to the significant increment in the housing prices since most of the developers in Malaysia tend to build high-cost houses more than medium-cost houses [4]. In



this scenario, the developers played a vital role to realise the sustainable house concept by implementing sustainable aspects to the medium-cost housing. Although sustainable housing incorporates energy and water efficiency, better indoor environmental quality, and optimises material and resources used, the developers are bound to bear the extra cost of the new technologies involved [5]. Thus, redirecting the extra cost to consumers will increase the housing selling price [6].

1.1. Sustainable Affordable Housing and the Multi Eco-System

According to [7], sustainable affordable housing is a type of housing that is facilitated by the government via various housing programmes. The house needs to be built with environmental friendly criteria with the used of sustainable materials and able to sustain economically, environmentally and socially without escalating the life-cycle cost. The multi eco-system believes that many contemporary vital issues are directly or indirectly influenced by a comprehensive system consisting of economic development, natural environment, and social system [8]. The multi eco-system is composed of three subsystems: economic, environmental, and social which are accomplished through an integrated development among the subsystems on the basis of the sustainability of each subsystem. This is because the provision of sustainable affordable housing is always constrained by the need to consider economic, environmental and social implications [9]. [10] define sustainability as the observation of balancing between three concepts, namely, economic development, environmental protection and social equity. It needs an orderly operation of economic, environment, and social subsystems to guarantee the sustainable development of housing projects [11]. Considering the characteristics of sustainable affordable housing and the concept of multi eco-system, the sustainable affordable housing can be defined as a developmental level of sustainable housing project to meet the housing needs of present medium-low income group.

1.2. Research Methodology

An extensive literature review was conducted to explore the current scenario of Malaysian construction industry on sustainable affordable housing implementation. This paper specifically aims to emphasise the critical success factors (CSFs) in achieving the sustainable affordable housing schemes in many developed and developing countries. Various published sources such as journal articles, proceeding papers, and other related research materials were thoroughly examined to highlight the CSFs. The study starts with a review of the sustainable housing criteria and questions why sustainable house is not affordable, especially for the middle-income group of people. In that case, the CSFs of achieving sustainable and affordable housing scheme were gathered and selected based on the contribution of each factor to reduce the cost of a project, consequently assisting to increase the middle-income group's ability to own a sustainable affordable house. The CSFs were divided into multi eco-systems related to the aspects of sustainable development, which are economic, environmental and social. In order to achieve sustainable affordable housing scheme, all issues relating to the three subsystems need to be addressed holistically. In this paper, these issues are addressed using Critical Success Factors (CSFs) of sustainable affordable housing which are necessary to reach a project's goal [12].

1.3. Economic Critical Success Factors

Table 1.0 shows twenty-one (21) CSFs of sustainable affordable housing scheme as highlighted by various researchers. The CSFs were categorised under three subsystems; economic, environmental, and social. The economic CSFs were identified based on a review of literature consisting of eight (8) success factors, which illustrate the top three CSFs in high frequency of occurrence in reducing the cost of sustainable housing. These are; (i) **subsidising the cost of provision, initial purchase, operational, rent and mortgage loan rates**, (ii) **efficient management to minimise life-cycle cost, project risk management and problem-solving abilities**, and (iii) **effective housing policy and framework**.

TABLE 1. The Critical Success Factors (CSFs) for Sustainable Affordable Housing Scheme from the perspectives of economic, environmental and social

Critical Success Factors (CSFs)	Sources									
	Oyebanji et al. (2017)	Dave et al. (2017)	Said et al. (2016)	Copiello (2015)	Gan et al. (2015)	Xia et al. (2014)	Yates (2014)	Mc Murray et al. (2014)	Ihuah et al. (2014)	Wallbaum et al. (2012)
Economic										
Subsidising the cost of provision, initial purchase, operational, rent and mortgage loan rates etc.	√	√		√	√		√	√	√	√
Efficient management to minimise life-cycle cost, project risk management and problem-solving abilities	√	√			√	√	√	√	√	√
Effective housing policy and legal framework	√			√	√		√	√	√	√
Excellent governance in promoting economic growth	√			√	√			√	√	
Adequate funding to facilitate developers in providing sustainable affordable housing	√				√		√		√	
Economic design that leads to reducing upcoming maintenance and operation cost.	√	√				√	√			√
Appropriate technology to allocate for refurbishment	√	√		√	√					√
Great economic planning considering infrastructure services	√		√	√	√				√	√
Environmental										
Appropriate materials which are sustainable and environmental friendly	√	√		√	√	√		√	√	√
Appropriate land use plan for avoiding misuse of land and financial resources.	√		√	√					√	
Energy efficient fixtures, appliances, and equipment		√		√		√				√
Environmental protection by means of penalties to polluters.	√						√			
Whole building energy assessment		√				√				
Social										
Stakeholder's participation in the development process	√		√		√	√			√	
Enhance awareness of sustainable lifestyle	√				√			√	√	
Good quality social housing that creates the sense of place to live	√				√		√			√
Promote equity through equal distribution, social justice, gender equity, women empowerment and etc.	√									
Provides skills acquisition and job opportunities	√									√
Support community development and social services	√						√			√
Provide health and recreational facilities	√						√			√
Integration of supply chain								√		√

To ensure a successful implementation of sustainable affordable housing construction, the government should subsidise the cost of provision, initial purchase of the house, operational, rent and mortgage loan rates to ensure buyers from the middle-income group to meet their housing needs with ease [7]. For instance, the high value of house price, in particular, sustainable housing, in Malaysia causes buyers to either delay owning a house, forcing them to select a house other than their preference or suffer from high housing loan [13]. The initial investments are generally for the purpose of technology to protect the environment, noise barrier system, staff training, and human resources [14]. With the aid of government, the sustainable housing price is within the buyers' financial ability while meeting other essential basic living costs [15].

Apart from that, they also need to form an efficient management team, as they will have the best available information on the materials, method of construction, tools, and equipment to achieve sustainable affordable housing projects [16]. An efficient management should be concerned with the research and design process and pays higher attention to the resources, quality of product entering the market, absence of related standards, and certification to minimise life-cycle cost and risks [17]. It is notable that wastage of resources due to inefficient management processes causes an approximate increase of 12% in investment costs [18]. Support from industry players to the government will enable the creation of an effective housing policy relating to sustainable construction practices. Government agencies should embark on applicable policies that could provide critical support to ensure the

feasibility of sustainable housing [19; 3]. Effective housing policy and legal framework are vital in terms of sustainability cost cutting, ensuring standardisation of materials, specifications and construction techniques which benefits the residents and population. These include reducing greenhouse gas emission, durability, and resilience to climate change and health benefits [20].

1.4. Environmental Critical Success Factors

Another common aspect of sustainable affordable housing scheme is concerned for the environment. The environmental CSFs highlighted in the literature review include 5 variables. The top three CSFs are **(i) appropriate materials which sustainable and environmental friendly (ii) appropriate land use plan for avoiding misuse of land and financial resources, and (iii) energy efficient fixtures, appliances and equipment.** A study by [18] clearly indicates that highly industrialised construction techniques such as steel frames, polystyrene cladding, and metal panel do not represent optimal solutions for the sustainable affordable housing problem as compared to timber, bamboo, and other energy-efficient materials. The decreasing cost of energy-efficient materials and techniques will simultaneously decrease the overall cost of housing construction. In addition, the use of local and recyclable, supply energy from renewable sources like solar or wind will be able to facilitate sustainable affordable housing construction. Meanwhile, the system of modularisation and flexibility in floor plan changes need to be adapted according to the different needs of each location and culture [18]. Thus, a future expansion cost of a housing unit will be better satisfying the owner.

An appropriate land use plan cannot be overlooked if sustainable affordable housing provision is to be met. A proper plan and process of acquiring certificate of Occupancy of land will reduce the financial cost in an attempt to achieve the delivery of sustainable affordable housing [21]. Land conservation should be conducted in accordance with the construction plan, abandoned sites are in rational use, and cleaning up the construction waste must be completed in time [11]. The use of energy efficient fixtures, appliances and equipment also contributed to the success of sustainable affordable housing implementation. For instance, tighter building envelop leads to higher thermal performance and energy efficiency, hence, greater construction quality and cost control can be attained[20]. A survey by [11] on Public Rental Housing project in China suggests that the air-conditioning system is controlled by the owner and type of balcony wall and also solar water heaters provide centralised heat for individual heat storage. A timed lighting system was also used in the area with better daylighting such as halls and stairs for full use of renewable resources and reduce energy consumption.

1.5. Social Critical Success Factors

A total of 8 CSFs were highlighted in the social subsystem based on the literature review. The three most common CSFs are **(i) stakeholder's participation in the development process, (ii) enhancing public knowledge and awareness of sustainable lifestyle, and (iii) good quality social housing that creates the sense of place to live.** The impact of high awareness and knowledge on the success of sustainable construction among project stakeholders has been reported in the literature [22; 16]. The success of sustainable construction is highly dependent on the desire of stakeholders in the construction industry to be committed to change and working towards congruent goals and objectives which are focused on reducing unnecessary cost, avoid overdesign, and zero defect in a project.

Despite stakeholders' participation in sustainable affordable housing implementation, enhancing public knowledge and awareness is one of the CSFs discovered. The residents should be well-educated to accept and live in a sustainable lifestyle. The long-term social benefits of sustainable affordable house are improving welfare and quality of life of the residents as well as social integration, lower health cost, increased individuals performance and productivity [23]. Good quality of social housing that creates the sense of place to live is also one of the CSFs under the social subsystem. A livable social home has to cater the various needs of existing and future residents such as housing that is inclusive, well-planned, and offers equal opportunity and good services for all [15]. For instance, a housing area which have freedom for social interaction, save and secure environment, access for spiritual development, public health facilities, and natural resources assist the financial expenditure of

the family [24]. Hence, it creates satisfaction for the community members to live and work at present and in the future.

2. Conclusions

As an original contribution, the study focuses on CSFs of achieving sustainable affordable housing scheme from the perspectives of three subsystems, namely, economic, environmental, and social. There is a need to have an efficient management to minimise life-cycle cost, project risk management and problem-solving abilities, subsidising the cost of provision, initial purchase, operational, rent and mortgage loan rates and also effective housing policy and legal framework on the economic aspect. These factors made it evident that the government and housing authorities in Malaysia need to play a significant role in providing the scheme. From the environmental aspect, it can be clearly seen that the stakeholders including developer, designer, and contractor are responsible for using appropriate materials that are sustainable and environmentally friendly for reducing maintenance and life-cycle costs. They also need to ensure appropriate land use plan for avoiding misuse of land, human and financial resources and exploit energy efficient fixtures, appliances and equipment in delivering sustainable affordable housing. By successful adopting all the elements, it will reduce the cost of a project, hence, increasing the affordability of sustainable housing. As for the social context, the review confirmed that the stakeholder's participation in the development process, enhancing public knowledge and awareness of sustainable lifestyle, and good quality social housing that creates the sense of place to live are among the CSFs. The stakeholders need to be proactive in their decisions and work as a team in the provision of sustainable affordable housing. Meanwhile, professional and educational bodies could raise the level of understanding and awareness among Malaysians on the benefits of living in sustainable affordable housing. This paper has identified the pathway of future research which needs to execute an integrated sustainable affordable strategies for the used of industry players in achieving the goal of housing scheme that is both sustainable and affordable.

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