Modeling Relationship between Success Factors (Policies) and Critical Success Criteria (Goals) for Sustainable Housing in Developing Countries

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Abstract

Policymakers worldwide seek to adopt sustainable housing strategies/policies to achieve sustainable development in cities and beyond. Securing such policies is more exigent in most developing economies especially in sub-Saharan Africa, considering rampant urbanization, frequent power outages, the housing unaffordability crisis and a proliferation of slum in cities. However, empirical studies on investigating the impact of policies on goals for sustainable housing are sparse. This study models the relationship between success factors and critical success criteria for sustainable housing development in Ghanaian cities. A positivist philosophical stance and deductive reasoning were adopted to conduct deterministic modelling of primary questionnaire data collected via a cross sectional time horizon. Questionnaire data was garnered from respondents employed by regulated institutions responsible for the Ghanaian housing market. Subsequent analysis utilized partial least squares structural equation modeling (PLS-SEM). Findings revealed that 'developers enabling' factors and 'mixed-use development' factors had significant impacts on sustainable housing. 'Household-enabling'

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factors, though not significant, have high performance/index value on sustainable housing. Aside their insignificant impact, land-use planning factors had low performance value. Essentially, while pointing out the crucial factors for sustainable housing, the findings also caution policymakers on possible counterproductive policies and serve to engender wider polemic debate and discussion.

Keywords: Critical Success factors; success criteria; model; sustainable housing

1. Introduction

Cities constitute a considerable opportunity for humanity to curtail the anthropogenic impact of sprawling urbanization globally. Approximately 3.5 billion of the world's population lived in cities in 2007 but by 2030, this figure will increase to circa 5 billion (Dhakal & Shrestha, 2010). Within Africa, estimates suggest that urbanization will grow at a rate of 3.31% per annum and moreover, by 2030 the projected urban population in Africa (748 million) will exceed the entire population of Europe (685 million) (Obeng-Odoom, 2010). Population growth in African cities has stimulated increasing demand for energy-related services and housing facilities. However, inadequate power generating plant and the unaffordable housing crisis (caused by a supply deficit), doggedly inhibits sustainable city development in Africa. Instead, the energy crisis (evinced in intermittent supply and power outages at worse), social inequality and urban sprawl are common in most African cities (Eberhard & Shkaratan, 2012).

Prominent amongst Africa's beleaguered cities is Accra, the administrative capital of Ghana. Accra is the most urbanized city in Ghana with an urbanization rate at a staggering 90.5% in 2010 (Ghana Statistical Service, 2013 cited in Gaisie et al., 2019). Increasing burden on the national grid (partly due to rapid economic development) has resulted in a supply-demand imbalance of electricity generation and distribution. In 2014-2015, an estimated 25% shortage in peak power was recorded and although annual energy demand is expected to grow by 10% per annum, Ghana's installed capacity has grown by only 7% to create an increasing power deficient (Gyamfi et al., 2018; Debrah et al., 2021). Consequently, the country has resorted to 'stopgaps' such as intermittent power supply (load shedding) to meet households' energy needs which consume 54% of electricity produced in Ghana (Asumadu-Sarkodie & Owusu, 2016).

Moreover, despite national efforts to create affordable homes, Ghana's Accra-city region resides at the epicentre of an unaffordable housing crisis (Awanyo et al., 2016). State supply in the post-independence era since 1990 and commercial market delivery have catastrophically failed to provide affordable residential facilities to the urban poor. The UN-Habitat (2003) report states that the house price-to-income ratio is 14:1 – far exceeding the standard 3:1 for affordable housing, making Accra one of the most inequitable housing environments in Africa (Gillespie, 2018). The unaffordable housing crisis has culminated in a bifurcated housing supply system between self-builders and real estate developers. At one end of the system are adequate residential facilities that are self-built or bought from developers by most high-income earners. These developers and other housing-supply institutions (e.g. Tema Development Corporation and State Housing Corporation) constitute the regulated institutions/formal sector of the Ghanaian housing market. At the other end of the system is a high number of poorly serviced informal facilities (slums) owned by low-income self-builders who mostly constitute the informal sector (Gaisie et al., 2019). In 2011, about 45% of Accra's population, that is almost 1.7 million residents, resided in 78 densely populated informal settlements including makeshifts.

Sustainable housing could assuage both the energy and unaffordable housing crises in Accra. For the purposes of this present research, sustainable housing is defined as a habitable domicile, positioned within proximity to services, amenities and places of work (i.e. social infrastructure), and provides safe, sustainable and affordable shelter for a whole range of households (Adabre & Chan, 2019). However, various factors have been identified as barriers to the attainment of sustainable housing development. Some of these barriers include: inadequate incentives for developers (Ebekozien et al., 2020; Adabre et al., 2020; Chileshe et al., 2021); inadequate policies on land-use planning (Agyemang & Morrison 2018); and insufficient policies for reducing income inequality (Adabre & Chan, 2019).

Governments have intervened in the energy and housing crisis through stipulated policies for sustainable housing, for example via the launch of the new National Housing Policy (NHP) in 2015. Indeed, a constant evolution of housing policies has occurred since the 1980s. However, empirical investigations that measure the impact of sustainable housing policies are inadequate – consequent, the success or otherwise of such policies remains largely untested (Cserháti & Szabó, 2014). Therefore, this study aims to bridge this knowledge gap by modelling the impact of success factors (policies) on critical success criteria (CSC) or goals of sustainable housing. Establishing a causal relationship between various housing policies and goals of sustainable housing could help to shape future policies so that they are more targeted towards a viable solution for sustainable housing. This could obviate adoption of counterproductive strategies for sustainable housing in the Accra-city region and beyond.

2. Sustainable Housing Development

2.1 Sustainable Housing Goals

The global pursuit of sustainable housing is evinced in the United Nations (UN) policy goal. Target 11.1 of the Sustainable Development Goal (SDGs) II states: "By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums." Moreover, sustainable housing facilities are properly integrated into and enriching the cultural, social and economic fabric of a local community and the wider urban areas but are also adequately operated, maintained and timely refurbished and retrofitted (UN-Habitat, 2012). These SDGs are also called critical success criteria (CSC) while the policies required to achieve them are termed success factors (Adabre & Chan, 2019; Chan & Adabre, 2019; Adabre & Chan, 2020; Kineber et al., 2021; Oppong et al., 2021; Ekanayake et al., 2021).

2.2 A Global Perspective of Success Factors

Debates abound in the literature on the relevance of some of the strategies for sustainable housing. For instance, increasing income inequality because of sprawling urbanization has been observed in most sub-Saharan African countries (Suleman et al., 2019). Reactively, government's interventions via redistributive policies (such as taxes and large public housing projects) have been suggested as strategies for providing housing to low-income earners (Agyemang & Morrison, 2018). However, Alesina & Angeletos (2005) cautioned that such redistributive policies could exacerbate corruption and income inequality. Furthermore, the effectiveness of subsidies for reducing energy poverty and ensuring low-income earners have adequate access to housing has been questioned. For example, Kaygusuz (2012) argued that energy-related subsidies could negatively impact on sustainable development and Ganiyu et al. (2017) revealed contradictory outcomes of subsidies on the proliferation of slums among low-income earners in South Africa. In addition, policy on privatization of public rental housing facilities was implemented worldwide for redistribution of housing wealth and effective maintenance of aged and dilapidated facilities. The prominent EU Housing Policy guidelines for example, upheld this policy. However, Nuuter et al. (2015) stated that this policy's outcomes were destructive because it led to bad loans and the global financial instability that caused the 2007-2008 financial crisis. Similar problems have been highlighted about policies on privatization of existing rental facilities in parts of Asia (Zheng et al., 2017), North America (Field & Uffer, 2014) and sub-Saharan Africa (Taruvinga & Mooya, 2018). Therefore, Adabre & Chan (2019) concluded that some policies could have a 'rebound effect' on sustainable housing; where positive gains made in some policies could be annihilated by backsliding in others – the net impact globally therefore was negligible. Thus, extant literature reveals that from the wider perspective, contradictions in some success factors are apparent.

2.2.1 Success Factors in Ghana and Other African Countries

Various policies have been stipulated to achieve sustainable housing. However, doubts have been expressed on the implementation and efficacy of sustainable housing policies among developing countries. Detailed reports on such misgivings are presented in Adabre & Chan (2019). In post-colonial Ghana and since the 1980s, housing was directly provided by governments to meet the needs of civil servants in urban areas. With at least 6.5% of government's expenditure on housing, some institutions were tasked to provide housing facilities for government workers mainly in cities. However, subsequent direct housing supply was affected by financial problems and consequently, state funding for housing reduced to 1-2% in 1990 (Arku, 2009a). This transition was triggered by many institutional challenges within the public sector such as: the failure of government housing programmes; and declining State's resources. Currently, the state mostly provides facilitative roles while the private sector provides housing facilities for rentals and ownership. Multinational organizations such as the World Bank and UN also provide support to augment governments' efforts in Ghana and most sub-Saharan African countries (Keivani & Werna, 2001). By devolving responsibilities (via a neoliberal approach) to the private sector, the government in Ghana and other sub-Saharan African countries believed housing supply could be improved (Croese et al., 2016).

At the inception of the neoliberal approach, governments have initiated policies to incentivize the private sector on housing supply. Aside the reduction of corporate tax from 55% to 45%, a five-year tax holiday and Stamp Duty exemption on the sales of houses were provided to Ghanaian developers to stimulate their participation in the housing market. However, Arku (2009, p. 268) noted that, "the rise of private developers has led to housing units being produced by profit-oriented developers, and prices are extremely high for middle- and low-income earners, especially in urban areas such as Accra." Therefore, while few high-income earners are the target of most developers, most middle- and low-income earners could meet their shelter needs through self-build. Government's interventions through redistributive policies (i.e. taxes) have also been suggested for controlling income inequality in urban areas and for providing housing to low-income earners. According to Stilwell (2011) "increasing urbanization leads to widespread use of land for roads and for other infrastructure development that are provided by the state or public." Therefore, using the UK as a quintessential case, Agyemang & Morrison (2018) recommended that Ghana and other sub-Saharan African countries could adopt tax policies to capture increases in land values attributed to infrastructure supply. It was averred that revenues from such policies could be deployed to augment housing supply in most cities. Despite the significant contributions of their study, it is worth noting that the land tenure system in Ghana is different from that of the UK. In fact, land ownership structure in Ghana (and most sub-Saharan African countries) is dominated by the customary system although the state, through eminent domain, can compulsorily acquire land for public use. Therefore, recommending land-use policies for Ghana begs the question: how significant are such policies for sustainable housing?

Self-build housing has been a major form of housing supply in Ghana and other sub-Saharan African countries and so consequently, government policies have focused on enabling households to achieve sustainable housing. To ensure affordable energy, subsidy is provided to all residential consumers for the first 50kWh of electricity and to further conserve energy, the Ghanaian government replaced all incandescent bulbs with compact fluorescent lamps. Furthermore, through the refrigerator rebate scheme, all households' second-inefficient refrigerators were to be replaced with new energy efficient models (Kumi, 2017). For affordable housing supply, collective self-help approaches have been facilitated. Gillespie (2018) stated that as part of the country's commitment for upgrading slums and providing shelter for low-income households, policymakers provided expedited permit approval for the Amui Dzor Housing Cooperative within Ashaiman in Accra. However, while some self-build facilities are adequately constructed and well-serviced, others are poorly constructed and lack supplementary facilities. Thus, the effectiveness and adequacy of policies for enabling households to access sustainable housing has been questioned as Kumi (2017) impugned the relevance of the utility subsidies for sustainable housing.

In reaction to uncoordinated urban sprawl, policies channelled towards mixed-use development (i.e. housing and commercial facilities) have been established in some cities to provide accommodation to more households. Elsewhere, planning authorities have initiated a standard minimum building height of four storey within the Central Business District of Kumasi to accommodate more households and businesses (Agyemang et al., 2018). Similar policies (such as appropriately siting public housing facilities within cities) have also been considered as important for reducing loss of peri-urban land and vehicular emissions (Cobbinah & Amoako, 2012). Some of these policies (such as 'high-rise housing facilities' and 'mixed-use development) have proven as successful policy for sustainable housing in most Asian economies such as Singapore and Hong Kong. However, considering the cultural difference of low-rise, single-family housing on peripheries of Ghanaian cities, the question worth asking is: how impactful are mixed development policies in Ghana?

Whilst reviewing housing policies in other African countries (viz: Ethiopia, Kenya and Nigeria), Croese et al. (2016) showed that Ghanaian policies have been implemented in different ways, different scales and in different urban condition when compared to other mentioned African countries; albeit, some commonalities were apparent and in all cases, palpable doubts on their efficacy to achieve sustainable housing worldwide (and specifically Ghana) exist. Current policies can be categorised into four thematic 'inveterate' groups, namely: 'developers' enabling'; 'household enabling'; 'mixed-used development' and 'land-use planning' (refer to Table 1 and cf. Adabre & Chan, 2019). Considering the evolution of various policies, this study seeks to empirically investigate their impacts on sustainable housing in Ghana.

3. Research Methodology

3.1 Theoretical Model

Extant literature provides the fundamentals for developing a theoretical model between sustainable housing (measured by the CSC) and success factors. Collectively, five constructs constitute the theoretical model (refer to Figure 1) from which four hypotheses were derived, viz:

Hypothesis 1: 'Developers' enabling success factors' have a positive influence on sustainable housing.

Hypothesis 2: ‘Household enabling success factors’ have a positive influence on sustainable housing.

Hypothesis 3: ‘Mixed-use development success factors’ have a positive influence on sustainable housing.

Hypothesis 4: ‘Land-use planning success factors’ have a positive influence on sustainable housing.

[Insert **Figure 1:** Theoretical Model between Success Factors and CSC of Sustainable Housing]

3.2 Research Method

This research adopted a positivist philosophical stance (Edwards et al., 2019) and deductive reasoning to test hypothesis posed and conduct deterministic modelling of primary questionnaire data collected via a cross sectional time horizon. Such an approach has been widely utilized in construction and civil engineering literature and is therefore deemed appropriate for the present study (Newman et al., 2020). The research process which entails the research methods at various stages of the study is summarized in Figure 2.

[Insert, **Figure 2:** Overall Research Method Framework]

Data Collection

A questionnaire was designed and finalized for primary data collection using a pilot study consisting of four experts. For the main survey, respondents were requested to rate the success factors and the CSC for sustainable housing using a 5-point Likert scale (1=not important and 5=very important). The questionnaire administration was restricted to professionally qualified practitioners from the formal sector to ensure consensus. Due to lack of population frame, non-probability purposive sampling and snowballing techniques were deployed. Private real estate developers were initially identified from membership lists provided by the Ghana Real Estate Developers Association (GREDA) and were subsequently contacted via telephone calls and emails to book an appointment with them or distribute the questionnaire via email. Other potential respondents were then identified and contacted through snowballing. Moreover, professionals from other pertinent institutions were contacted personally and given a hard copy of the questionnaire. These institutions were: State Housing Corporation (SHC); Tema Development Cooperation (TDC); Social Security and National Insurance Trust (SSNIT); Public Works Department (PWD); Building and Road Research Institute (BRRI); and Architectural and Engineering Service Limited (AESL). Within a three-month duration, a total of 49 questionnaires were received from 110 administered but two questionnaires were considered invalid due to incompleteness and therefore, 47 returned questionnaires were deemed valid (forming a 42.7% response rate).

3.4 Data Analysis Technique – PLS-SEM

Prior study established relationships between efficient energy parameters and three dimensions of sustainable development (i.e. economic, social and environmental) using multiple regression analysis (MRA), a first-generation technique (Roufechaei et al., 2014). MRA is based on some assumptions. First, a relationship can be established between one dependent variable and several independent variables. Second, all variables for regression analysis are considered observable or directly measured without errors. These assumptions limit the applicability of MRA for analyzing complex and real situations. On the latter conjecture, not all variables are observable. Sustainable housing as a construct is appropriately assessed by inferring from other observable variables such as energy efficiency, price or rental affordability (as listed in Table 1). Besides, in measuring the observable variables using a questionnaire survey, it is possible that errors attributed to respondent fatigue or order of the variables (random errors) and errors due to the measurement approach of the variables (systematic errors) could occur (Haenlein & Kaplan, 2004). Since these errors are not rare problems in reality, MRA is not suitable for this study. However, structural equation modelling (SEM) is a more robust technique that could overcome most of the limitations in MRA.

SEM is a second-generation multivariate technique that integrates principal component analysis and regression analysis (Hair et al., 2012). It is used for testing and developing theories of an underlying reality involving constructs that are measured with multiple observable variables. Developing and testing models could be conducted using covariance-based SEM

(CB-SEM) or variance based partial least squares (PLS) path modelling also known as PLS-SEM. Like all multivariate analysis techniques, CB-SEM and PLS-SEM have strengths and weaknesses that influence their applicability under certain conditions. PLS-SEM is preferred to CB-SEM because of its advantages over CB-SEM under frequently encountered circumstances (i.e. non-normally distributed data, prediction, excessively large number of observable variables and small sample size).

This study adopts the partial least squares structural equation modelling (PLS-SEM) for data analysis due to the relatively small sample size. However, the following two fundamental statistical requirements were met to guarantee adequate sample size for statistical analysis: 1) minimum sample size for fulfilling the central limit theorem (Ott & Longnecker, 2015); and 2) the sample should not be <10 times the maximum number of relationships between a latent construct and other latent constructs (Hair et al., 2012; Adabre et al., 2021b; Adabre & Chan, 2021). On the first requirement, a minimum sample size of 30 is needed to fulfil the central limit theorem requirement. Therefore, since the study sample size is 47, the central limit theorem is achieved. Concerning the second requirement, from Figure 1, there are five constructs. A construct can form a maximum of four relationships between itself and the other constructs. Thus, the sample size based on this requirement should not be <40 (4 times 10). Since the study sample size is 47 (i.e. > 40) the second requirement was fulfilled.

4. Data Analysis & Results

4.1 Respondents' Profile

Most of participants (47.9%) are in the public sector or department followed by academic/research institutions (35.4%) and private developers or contractors (16.7%). Regards profession, most are quantity surveyors (55.3%) followed by architects (19.2%), construction managers (12.8%) and then planners and engineers (12.7%). Most respondents (52.2%) have handled more than two Ghanaian housing projects of which 55.1% are public housing projects. Most respondents (63.9%) have more than five years of relevant work experience. In summarising the respondents' demographic profile, it can be concluded that they are abreast of the phenomena under investigation and therefore provide valid data for modelling the relationship between success factors and CSC of sustainable housing.

4.2 Descriptive & Reliability Analysis

The mean scores (refer to Table 1) revealed that respondents considered all 20 CSC of sustainable housing as important since they were rated above the scale category of *less important* (<2). Besides, most variables have relatively low standard deviations (<1), which depicts a relatively high consistency in their ratings. Moreover, the overall Cronbach's alpha (CA) (0.878) for the 20 CSC is satisfactory (Adabre & Chan, 2019). On the success factors, the mean scores vary from 4.511 (for '*political will and commitment to low-cost housing by land-use strategy*') to 3.149 (for '*increase tax to discourage long holding period on vacant land*'). Other variables such as '*access to low interest housing loans for developers*' and '*improved supply of low cost developed land by government*' were among the top success factors. On reliability, the relatively low values (<1) of the standard deviations of most observable variables suggest a relatively high consistency level among the different respondents who ranked the variables. Overall, the CA (0.897) for the 26 observable variables of the success factors is above the recommended 0.70, which shows a satisfactory internal consistency of the success factors scale.

[Insert **Table 1:** Descriptive Statistics of Constructs and Observable Variables]

4.3 Results of PLS-SEM: Measurement Model

The factor loadings of all observable variables and average variance extracted (AVEs) of the constructs were above the recommended 0.50 for internal consistency (refer to Table 2). Moreover, the composite reliability (CR) and the CA of all constructs are above 0.70 thus confirming a satisfactory level of convergent validity (Hair et al., 2012).

[Insert **Table 2:** Measurement Model Results]

4.3.1 Discriminant Validity (Cross Loadings & Fornell and Lacker Criterion)

The discriminant validity was also estimated using the cross-loading values of the observable variables. Except for one indicator LPSF1, all the other observable variables had the highest factor loadings on the constructs they were theoretically identified to measure as compared to their loadings in other constructs - this implies satisfactory discriminant validity. The discriminant validity was also assessed using the Fornell and Lacker criterion which states that a construct should share more variance with its measures or with itself than it shares with other modelled constructs. Table 3 shows that the highest correlation for a construct is the correlation between a construct and itself. These correlations, indicated diagonally in Table 3, are the square root of the AVE of the latent variable and indicate the highest in any column or row. Besides, no correlation between any two constructs exceeded the square roots of their AVEs, which justifies the constructs' discriminant validity (Hair et al., 2012).

[Insert **Table 3:** Discriminant Validity (Fornell and Lacker Criterion)**]**

4.4 Structural Model Estimation and Assessments

Figure 3 reports upon the structural model. The structural model was checked for multicollinearity, predictive accuracy and data normality. The inner variance inflation factor (VIF) values were used to assess multicollinearity of the structural model. If the calculated VIF values are all below 5, then there is no multicollinearity. From the analysis, all the VIF values were below 5, which indicates no multicollinearity with the structural model. Furthermore, the model was assessed based on its coefficient of determination (R^2) which is a measure of the total effect size and variance explained in the sustainable housing construct by the success factor constructs. The R^2 measures the structural model's overall predictive accuracy and with a value of 0.558 (refer to Figure 3 on bootstrapping analysis) it was deemed to be satisfactory (Hair et al., 2012). This finding implies that the four categories of success factors adequately explain 55.8% of the variance (or change) in sustainable housing. Data normality was then checked using the Mardia's multivariate skewness and kurtosis and 5.722 and 35.722 values were obtained, respectively. These values were then compared with the cut off points viz. Mardia multivariate skewness ±1 and kurtosis ±20. Because the computed skewness value and kurtosis value are higher than the cut offs, the data are not normally distributed. Therefore, bootstrapping analysis was conducted to examine the significance of the structural model. Figure 3 reports upon the results of bootstrapping together with the t-values. Generally, if t-values are above 1.96 for a 2-tailed test, then the hypotheses are supported at 0.05 ($t_{0.05} > 1.96$), and if t-values are above 2.58, hypotheses are supported at 0.01 ($t_{0.01} > 2.58$) (Hair et al., 2012). From Figure 3, the path linking '*developers' enabling success factors*' to '*sustainable housing*' had a t-value (2.640) > 2.58 which implies a significant path. Therefore, *hypothesis 1* was supported and likewise *hypothesis 4* since its t-value (3.478) > 2.58. However, with t-values of 0.609 and 0.117, respectively, *hypotheses 2* and *3* were not supported.

4.5 Importance-Performance Analysis (IPMA)

Prioritizing the constructs is useful to identify those that are critical for the attention of policymakers and practitioners. Critical constructs or factors could be identified by using Importance-Performance Analysis (IPMA) which provides a broader view of the PLS-SEM results by considering the performance of each construct. Consequently, the constructs are prioritized based on two dimensions i.e., both importance and performance (refer to Figure 3) using IPMA which is an advanced statistical analysis in PLS-SEM (cf. Ringle & Sarstedt, 2016). The x-axis represents the success factor constructs' importance for explaining the sustainable housing construct while the y-axis depicts the success factors' performance in terms of their average rescaled scores (Hair et al., 2012). IPMA results show those constructs with high importance (high total effect) but which also have a relatively low performance (low score on sustainable housing). Generally, attention should be given to the constructs that show high importance but at the same time have relatively low performance regarding their explanation of the latent construct – 'sustainable housing'. Therefore, the lower right section of the IPMA results reveals that '*mixed-use development factors*' have a high importance for sustainable housing but at the same time show a relatively low performance. '*Developers enabling factors*' show a high importance and performance for 'sustainable housing'. However, '*household enabling factors*' have relatively low importance but a relatively high performance on sustainable housing (refer to Figure 3). On '*land use planning factors*', both its importance-performance values were low.

[Insert **Figure 3:** Structural Model and IPMA of Success Factors and Sustainable Housing**]**

5. Results Discussion on the Measurement and Structural Model

From the measurement model, seven observable variables (CSC) were significantly and reflectively loaded onto the 'sustainable housing' construct, namely: '*end user's satisfaction'* (CSC5); '*reduced lifecycle cost*' (CSC8); '*energy efficient housing'* (CSC10); '*technology transfer/innovation'* (CSC19); '*rental affordability of housing facility'* (CSC16); '*safety performance or crime prevention'* (CSC4) and '*reduced commuting cost/distance from the location of housing to public facilities'* (CSC17) - refer to Figure 3 on bootstrapping analysis. Therefore, sustainable housing in the Accra-city region and other cities in Ghana could be achieved if policymakers focus more attention on achieving these seven CSC/sustainable development goals (SDGs).

5.1 Developers' enabling factors

This construct has a t-value of 2.640 and four main variables, namely: '*use of environmentally friendly materials for construction*' (DESF7); '*water efficient design and installation*' (DESF6); '*energy efficient installations and designs* (DESF5); and '*effective private sector participation*' (DESF8). This category of success factors or policies has a significant impact on sustainable housing (refer to Figure 3 on bootstrapping analysis). Moreover, from the IPMA results, this construct has the highest performance/index value (81.00) and a higher importance/total effect (0.462) on sustainable housing (refer to Figure 3 on IMPA).

Effective private sector (i.e. developers or property owners) participation in housing supply is essential to achieve sustainable housing development by providing affordable rental facilities. Over three-quarters of Ghana's urban population rely on rental accommodation (Asante et al., 2018). However, most rental facilities in urban centers are unaffordable with minimum rent advance to income ratios estimated at 209% and 132% for Kumasi and Tamale respectively, while the ratio for Accra is speculated to be the highest. This is often attributed to high rent advances demanded by property owners who distrust the financial stability of tenants (Arku et al., 2012). On this, Asante et al. (2018, p. 1235) averred that: “the lax in the enforcement of the rent control law has been the bane of Ghana’s rental market.” Therefore, policymakers could ensure effective private sector participation in affordable rental facilities through legislation and incentive-backed policies. Enforcement of the existing Rent Act, 1963 would alleviate market pressures because it stipulates that landlords shall not demand more than six months of advance rent. For incentive-backed policies, subsidies for refurbishment would encourage property owners to comply with the Rent Act or augment supply of affordable rental facilities. Besides, since rental affordability was significantly loaded as a CSC for sustainable housing while price affordability was not, the finding implies that in public-private partnership housing projects, the government could focus on providing more rental facilities than owner-occupied facilities or part ownership schemes as adopted in the UK. Moreover, privatization through sales of existing public housing facilities could be minimized. This will ensure adequate availability of public rental facilities, which could be affordable in perpetuity.

Water had become ‘blue gold’ in African society and politics. Enhancing water efficient design and installation among developers or property owners is essential for sustainable housing. Though access to water is plentiful in certain areas in the Accra metro (such as Tema metro and the Ashaiman municipal), alternative water supply through rainwater harvesting would reduce national demand of pipe-borne water for non-potable uses (e.g. water closets (WCs), and agriculture/gardening). Besides, installation of rainwater harvesting technology in cities will ensure effective management of surface water and mitigate the common occurrence of flooding in Accra. Education is key to engendering social change and media broadcasts would augment sustainable lifestyle (and the technologies that accompany it) uptake. Such programmes could focus on raising awareness on the socioeconomic (as well as environmental) benefits of rainwater harvesting technology. Furthermore, financial incentives such as subsidies on rainwater harvesting technology, low-flow toilets, faucets aerators and showerheads could enhance demand for these technologies among developers.

Other viable technologies include photovoltaic solar panels given a wealth of solar radiation harvesting opportunities in Ghana's tropical climate to augment electricity generation. Currently, Ghana's electricity sector is plagued by electrical generation and distribution problems – much to the despair in industry and the public. Gyamfi et al. (2018) attributed this problem to fuel supply constraints and uncertainty in the rainfall patterns and water inflow into hydroelectric plants. However, solar energy generation using photovoltaics is an environmentally and economically feasible alternative for electricity generation (Kumi, 2017) because it does not require fuel input. Developers who incorporate solar panels (as an integral part of roof design) could lessen grid dependency and provide social benefits such as job creation. Successful implementation of solar technology requires robust policies for collaboration between the public sector and private sector. Subsidies and public demonstrations could motivate up-scaling of solar technology adoption among developers and members of GREDA (supply side generation). Such subsidies could manifest as soft loans and/or tax incentives to members of the public also (demand side usage). Additionally, awareness creation and nation-wide training of artisans (including workers of VRA and Electricity Company of Ghana (ECG)) on technology installation, and power generation, storage and distribution is vital to wide scale implementation. Such training could be complemented via the establishment of information centers for promoting accessibility to solar technology expertise. These strategies would ensure efficient energy which was significantly loaded as a CSC for sustainable housing in Ghana.

5.2 Mixed-use development factors

Mixed-use development factors have a high t-value of 3.478 with four variables reflectively loaded as '*adequate accessibility to social amenities*' (MDSF1); '*linking commercial development approval to funding for housing*' (LPSF1); *'sitting/locating housing projects within cities and town*' (MDSF2); '*mixed development of housing and commercial facilities*' (MDSF3) (refer to Figure 3 on bootstrapping analysis). Furthermore, from the IPMA results (refer to Figure 3 on IPMA), '*mixed-use development factors*' have the highest importance/total effect (0.582) and a relatively low performance/index value (76.489) on sustainable housing. Notably, one of the variables '*high rise housing development within cities & town*' was not significantly loaded under the '*mixed-use development factors*'. This is unsurprising since high-rise residential facilities have low social acceptability in Ghana (Agyefi-Mensah et al., 2015). Institutional challenges concerning evacuation service provided by Ghana National Fire Service (GNFS) to households beyond six storeys and low pressure for water supply services by the Ghana Water Company Limited (GWCL) above two storeys are prominent amongst reasons cited for the low acceptability of high-rise housing facilities (Agyemang et al., 2018). Consequently, high rise facilities attract relatively low rents. This contradicts cities in Asia where rooms and penthouses on upper floors have higher rental values than rooms on lower floors. In Ghana, rooms on the lower floors are preferred by households as: a precautionary measure against falls among children; and local dishes such as *fufu* and *konkonte* requires pounding which could cause noise and vibration pollution for other residents if prepared on upper floors. Therefore, to encourage uptake, innovative building design measures (e.g. sound and vibration insulation) are required to address these cultural issues for ensuring households' satisfaction.

For mixed commercial-residential development, ancillary amenities and facilities (such as shops, offices, healthcare facilities and kindergartens) are important within residential facilities/community. This form of 'socially-integrated development' lowers the cost of providing additional services to households, improves accessibility through reduced commuting time and cost of households, lowers greenhouse gas emissions and abates inefficient energy consumption by vehicular transportation (Cobbinah & Amoako, 2012). Thus, housing location is pivotal for engendering improved development in cities. Smart growth is key for commercial-residential development because it seeks to revitalize already-built-up environment (such as underutilised spaces/brownfield sites) to ensure compact city development as an antidote to urban sprawl (Arku, 2009b). Establishing firm policies on urban growth boundaries is essential in smart growth for compact urban development. For instance, policies could encourage partnership between developers/government and landlords of low-rise, dilapidated housing facilities in urban areas. Such facilities could be demolished for the construction of relatively higher-rise facilities with an increased number of rooms. These rooms could be shared between the parties based on contractual arrangement or the developers/government could build, operate and transfer the entire facility to the landlord on contractual arrangement. A similar partnership approach (between developers and the government) could be adopted for existing older public facilities in urban areas.

'*Linking commercial development approval to funding for housing*' could be an innovative strategy to promote affordable housing and commercial development in cities. Without this strategy, urban housing development could be unsustainable for most low and middle-income earners. Commercial development brings with it an effect on price or rental unaffordability of housing facilities (Alawadi et al., 2018). Therefore, considering the increasing number of real estate developers and commercial projects in Accra, developers could be charged an impact mitigation fee. Implementing this strategy could provide an additional source of government revenue for augmenting infrastructure supply to enhance residential development.

5.3 Household-enabling factors

The '*household-enabling factors*' were loaded by three observable variables, namely, 'monitoring housing conditions/performance for retrofitting' (HESF1); 'government provision of subsidies to households' (HESF2) and 'adaptable design of housing facility' (HESF5) (refer to Figure 3 on bootstrapping analysis). Ghana's housing supply is dominated by self-help housing. Consequently, a whole panoply of subsidies has been developed to enhance self-build housing and to upgrade pre-existing housing facilities (e.g. subsidies for toilets and bio-digesters in the Accra-Tema city region). Moreover, utility bills of households are often subsidized to reduce the cost burden. Notwithstanding the essence of these policies, the ‘household-enabling’ construct does not have a significant impact on sustainable housing (refer to Figure 3 on IPMA). This finding concurs with the assertion of Di Muzio (2008) cited in Gillespie (2018, p.74) that: “small-scale project-based approach to self-help upgrading has failed to make a significant impact on the housing crisis in the cities of the Global South.”

The insignificant impact of the ‘*household-enabling factors*’ could be attributed to challenges faced by self-build households in Ghana. Delays in land registration process, inadequate availability of mortgage packages, the colossal cost of land in urban areas and building materials have negatively affected most low-income earners. Indeed, it is estimated that low- and middle-income earners who build incrementally could spend more than five years to complete a basic facility for their families (most of which are low-quality and unsafe). Besides, proliferation of slums is common in Accra since most low-income households resort to the informal housing supply which are invariably erected on waterways, which leads to flooding. Moreover, lack of regulation on the drilling of wells for groundwater is a major problem in both Accra-Tema City Region (ATCR) and Kumasi Metropolis; where some households sell groundwater to other households that cannot afford to drill. Ostensibly, households compete for the same resource – groundwater – for domestic and commercial uses, which leads to overexploitation (Adabre et al., 2021a). Overall, these challenges negatively affect social, economic and environmental sustainability and could provide reasons for the insignificant impact of household-enabling factors on sustainable housing in cities.

Furthermore, the importance (total effect) of ‘*household enabling construct*’ on sustainable housing is negative (-0.076) (refer to Figure 3 on IPMA). This implies that some policies of ‘*household enabling factors*’ could be counterproductive to sustainable housing (e.g. the allocation of utility subsidies among households). All residential households in Ghana are offered utility subsidies for the first 50kwh electricity consumed. However, utility subsidies have been identified as one of the reasons for revenue shortfall in ECG. At the end of 2015, the Government of Ghana owed the ECG GHS 950 million in subsidies and non-payment of bills by state institutions including ministries. Shortfall in revenue is rarely covered through timely monetary transfer (Eberhard & Shkaratan, 2012) which makes it difficult for utility companies to recover the cost of electricity production (Kumi, 2017). Besides, the frequencies of maintenance operations and investment activities for expansion and improvement in quality of service are often reduced. These lead to inefficient or obsolete major equipment in electricity distribution – Kumi (2017, p. 18) states that: "About 21.7% of gross electricity generation over the last decade has been loss annually in transmission distribution because of inefficiency of equipment." Additionally, subsidies could encourage higher electricity consumption among households since they may purchase additional electrical appliances without considering the appliances' energy efficiency when energy is abundant (Kaygusuz, 2012). Therefore, utility subsidies could be reallocated to energy poor households only whilst simultaneously diverting surplus subsidies to reducing the cost of energy efficient technologies to incentivize their adoption amongst self-builders.

Despite its insignificant impact and negative total effect, the household enabling construct has the second highest performance/index value (76.720) on sustainable housing (refer to Figure 3 on IPMA). This indicates that through significant improvement and scale-up of household-enabling policies (i.e., self-help housing cooperative and public housing supply), sustainable development could be achieved. In both supply forms, co-production and co-design should be conducted to ensure the views of potential households are incorporated into housing facilities design to meet their spatial demands. Besides, permit approval for self-builders should "encourage proscriptive than prescriptive housing standards, as well as new housing designs that take account of the likely expansion of housing on the site over decades" (Awanyo et al., 2016, p. 36). Adaptable housing design will ensure housing extension for reducing overcrowding and illegal and unsafe building appendages, and improve privacy. Moreover, drilling of wells for ground water among households, should be regulated to ensure its availability for current and future generations. The state needs to establish and enforce licensing and permitting policies on the drilling of wells for groundwater. Households' participation in drilling of groundwater within a community is essential for sustainable groundwater management strategy that would be egalitarian and adaptable to climate change.

5.4 Land-Use Planning Factors

'*Land-use planning factors*' have a t-value of 0.117 and it is reflectively loaded by three factors, namely, '*increase tax to discourage long holding periods of vacant land*' (LPSF2), '*taxation on property or capital gains for housing facilities*' (LPSF4); *'sufficient financial and human resources for public housing/planning agencies*' (LPSF5). Results of the structural model revealed that '*land-use planning factors*' do not have a significant impact on sustainable housing (refer to Figure 3 on bootstrapping analysis). This is further buttressed by the results of the importance-performance map analysis (IPMA). From the IPMA results (refer to Figure 3 on IPMA), *'land-use planning factors'* have a low total effect (0.012) and the lowest performance/index value (59.998) on sustainable housing.

The insignificant impact and the low IPMA output of '*land use planning factors*' on sustainable housing could be attributed to problems on ownership and planning of land in Ghana. Though land policies have proven effective for providing affordable housing facilities in the UK (Whitehead, 2007), deploying similar strategies may not yield significant outcome on sustainable housing in Ghana for the following reasons. In major cities such as Accra-Tema City Region, land is allocated by family heads, chiefs and Wulomei (chief priest); in Kumasi, it is by family heads and chiefs, and in Northern Ghana by family heads and skins ('chiefs'). These authorities oversee land allocation, whereas the Land Use and Spatial Planning Authority manage the planning for land use or development. Yet, upon allocating land, many landowners/authorities usurp land use rights by specifying the development on allocated land without consultation with the planning authorities, which results in conflicts over land use and haphazard planning in most Ghanaian cities (Agyemang & Morrison 2018). Another reason for the insignificant impact of land-use planning factors is the high level of corruption in the Ghanaian construction industry. Similarly, Alesina & Angeletos (2005) cautioned that redistributive policies such as '*taxations on property or capital gains for housing development*' that are intended to correct income inequality (such as equitable supply of housing facilities) could rather lead to high level of corruption and income inequality.

Therefore, land-use planning policy transfer from developed countries such as the UK to developing countries such as Ghana first requires regulation to manage the delivery of land by customary authorities. This would minimize haphazard development on land and could be achieved through the implementation of effective anti-corruption measures and adequate financial and human resources for the Land Use and Spatial Planning Authority, where the latter would enforce effective compliance with regulations for land delivery and planning for land use.

6. Conclusions

This study modelled the relationships between success factors and critical success criteria for sustainable housing in Ghana by assessing the impact of the former on the latter. Questionnaire data were analysed using PLS-EM. The findings revealed that for sustainable housing in Ghanaian cities (i.e. Accra), housing ought to be: rental affordable; energy efficient; meet end-user's satisfaction; sited to reduce commuting cost; reduce lifecycle cost; meet safety performance; and embrace technology transfers (innovation) in design and construction. To achieve these goals, policymakers and practitioners should focus more on '*mixed-used development success factors*', *'developers' enabling factors'* and '*household-enabling factors*'. Due to its insignificance and low performance, sustainable housing through *'land-use planning factors'* could be achieved if the delivery of land among family heads, chiefs, skins and Wulomei is regulated while the planning authorities are adequately provided with financial and human resources to strictly ensure compliance with land development. On '*household enabling factors*', essential policies include: monitoring housing conditions/performance for retrofitting; efficient allocation of subsidies and adaptable housing design. Policies targeting utility subsidies could be pro-poor. On the theoretical contribution, further study on the impact of success factors on sustainable housing from the views of the informal sector (households) of the Ghanaian housing market is needed. In conclusion, this work represents an invaluable opportunity for humanity to understand the anthropogenic impact of sprawling urbanization upon the natural environment and how it could be better managed to ensure sustainable development in Ghana and other similar developing countries. Pollution and environmental degradation does not differentiate between geo-political boundaries on a map and so global efforts are needed today to ensure that past mistakes are not repeated to ensure a sustainable future for future generations of humanity.

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Table 1: Descriptive Statistics of Constructs and Observable Variables

Constructs	Code	Observable Variables	Mean Score	Standard Deviation	Rank	Corrected Item-total correlation	Cronbach's Alpha if Item Deleted	Overall Cronbach's Alpha
Sustainable Housing (Measured by CSC)								
CSC	CSC1	Timely completion of project	4.340	0.815	3	0.378	0.875	0.878
	CSC2	Construction cost performance	4.468	0.584	1	0.231	0.878	
	CSC3	Quality performance	4.343	0.644	2	0.496	0.872	
	CSC4	Safety performance (crime prevention)	4.085	0.803	10	0.654	0.867	
	CSC5	End user's satisfaction	4.319	0.980	4	0.646	0.866	
	CSC6	Stakeholders' satisfaction	3.957	0.833	12	0.385	0.875	
	CSC7	Environmental-friendly (Eco-friendly)	4.085	0.803	10	0.380	0.875	
	CSC8	Reduced lifecycle cost	3.933	0.918	14	0.502	0.872	
	CSC9	Maintainability of housing facility	4.283	0.851	6	0.566	0.869	
	CSC10	Energy efficient housing	3.915	0.880	16	0.547	0.870	
	CSC11	Reduced disputes and litigation	3.660	1.027	19	0.469	0.873	
	CSC12	Reduced public expenditure on housing management	3.851	0.932	17	0.377	0.876	
	CSC13	Technical specification	4.128	0.824	9	0.563	0.870	
	CSC14	Aesthetic view of housing facility	3.913	0.717	15	0.363	0.876	
	CSC15	Price affordability of housing facility	4.298	0.749	5	0.393	0.875	
	CSC16	Rent affordability of housing facility	4.196	0.824	7	0.472	0.872	
	CSC17	Commuting cost of household to facility	3.787	0.999	18	0.582	0.869	
	CSC18	Functionality of housing facility	4.174	0.789	8	0.567	0.870	
	CSC19	Technology transfer/innovation	3.468	0.856	20	0.621	0.868	
	CSC20	Take up rate of housing facility	3.936	0.818	13	0.264	0.879	
Success Factors for Sustainable Housing								
DESF	DESF1	Mandatory inclusion of affordable unit in developer's projects	3.915	0.952	21	0.526	0.894	0.897
	DESF2	Access to low interest housing loans to developers	4.404	0.712	2	0.366	0.897	
	DESF3	Incentives for developers to include sustainable low-cost housing	4.277	0.743	9	0.517	0.895	
	DESF4	Improved supply of low cost developed land by government	4.383	0.739	3	0.369	0.897	
	DESF5	Energy efficient installations and designs	4.085	0.855	16	0.396	0.897	
	DESF6	Water efficient design and installations	4.277	0.579	8	0.475	0.896	
	DESF7	Use of environmentally friendly materials for construction	4.370	0.671	4	0.529	0.895	
	DESF8	Effective private sector participation	4.064	0.845	17	0.382	0.897	
	DESF9	Stable macro-economic system	4.174	0.601	11	0.325	0.898	

	DESF10	Stable political system	4.319	0.783	7	0.270	0.899
HESF	HESF1	Monitoring housing conditions/performance for retrofitting	4.149	0.834	13	0.680	0.891
	HESF2	Government provision of subsidies to households	3.979	1.073	20	0.412	0.897
	HESF3	Adequate maintenance of existing houses	4.149	0.780	12	0.431	0.896
	HESF4	Adequate infrastructure supply by government	4.192	0.770	10	0.509	0.895
	HESF5	Adaptable housing design	4.044	0.833	18	0.581	0.893
	HESF6	Transparency in allocation of houses	4.000	0.860	19	0.461	0.896
	HESF7	Compliance with quality targets	4.128	0.711	14	0.488	0.895
MDSF	MDSF1	Adequate accessibility to social amenities	4.340	0.668	6	0.404	0.897
	MDSF2	Sitting/locating housing projects within cities and town	4.362	0.705	5	0.379	0.897
	MDSF3	Mixed development of housing and commercial buildings	3.809	0.770	22	0.463	0.896
	MDSF4	High-rise housing developments within cities and town	4.085	0.803	15	0.500	0.895
LPSF	LPSF1	Linking commercial development approval to funding for housing	3.723	0.902	23	0.514	0.895
	LPSF2	Increase tax to discourage long holding periods of vacant land	3.149	1.063	26	0.361	0.898
	LPSF3	Political will and commitment to low-cost housing by land-use strategy	4.511	0.621	1	0.322	0.898
	LPSF4	Taxation on property or capital gains for housing facilities	3.362	1.112	25	0.387	0.898
	LPSF5	Sufficient financial and human resources for public housing/planning agencies	3.575	0.773	24	0.527	0.898

Table 2: Measurement Model Results

Constructs	Observable Variable	Factor Loadings	AVE	CR	CA
Critical Success Criteria (CSC)	CSC10	0.746	0.504	0.875	0.850
	CSC17	0.537	–	–	–
	CSC16	0.689	–	–	–
	CSC19	0.724	–	–	–
	CSC4	0.682	–	–	–
	CSC5	0.811	–	–	–
	CSC8	0.749	–	–	–
Developers' Enabling Factors (DESF)	DESF5	0.707	0.536	0.819	0.762
	DESF6	0.751	–	–	–
	DESF7	0.867	–	–	–
	DESF8	0.574	–	–	–
Households' Enabling Factors (HESF)	HESF1	0.853	0.643	0.843	0.744
	HESF2	0.727	–	–	–
	HESF5	0.820	–	–	–
Mixed-use Development Factors (MDSF)	LPSF1	0.736	0.558	0.834	0.744
	MDSF1	0.836	–	–	–
	MDSF2	0.732	–	–	–
	MDSF3	0.673	–	–	–
Land-Use Planning Factors (LPSF)	LPSF2	0.868	0.712	0.881	0.805
	LPSF4	0.855	–	–	–
	LPSF5	0.806	–	–	–

Table 3: Discriminant Validity (Fornell and Larcker Criterion)

Constructs	CSC	DESF	HESF	MDSF	LPSF
CSC	**0.710**	–	–	–	–
DESF	0.621	**0.732**	–	–	–
HESF	0.462	0.477	**0.802**	–	–
MDSF	0.674	0.521	0.681	**0.747**	–
LPSF	0.211	0.289	0.223	0.199	**0.844**

*The diagonal are the square root of the AVE of the Constructs and items and are the highest in any column or row

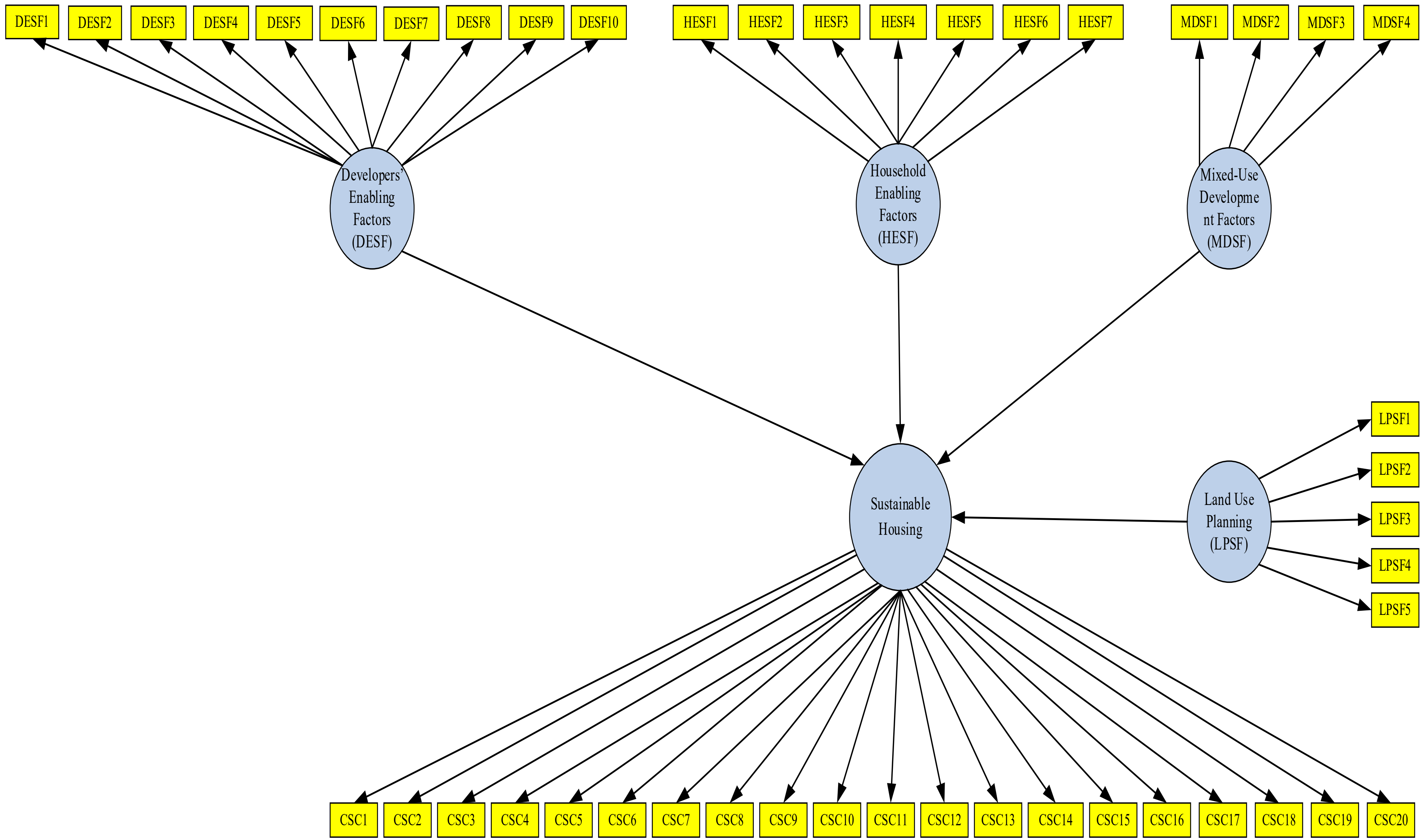


Figure 1: Theoretical Model between Success Factors and CSC of Sustainable Housing

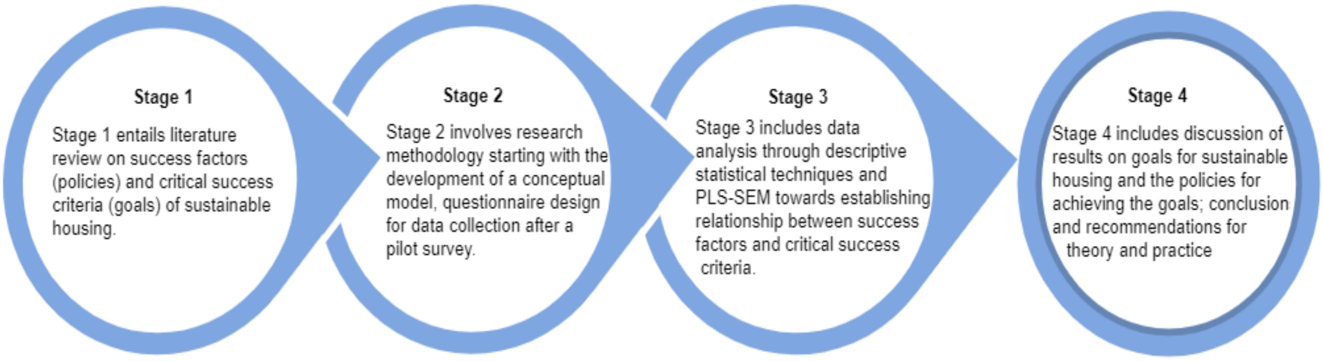
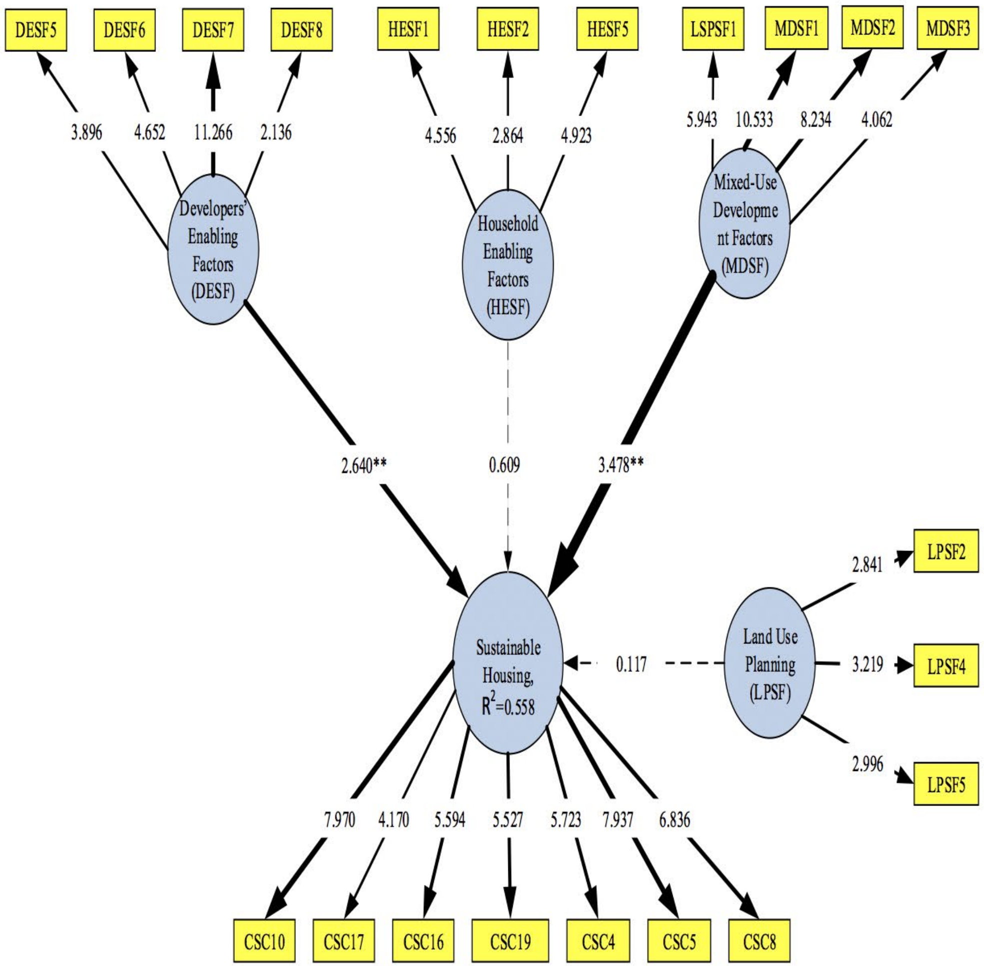
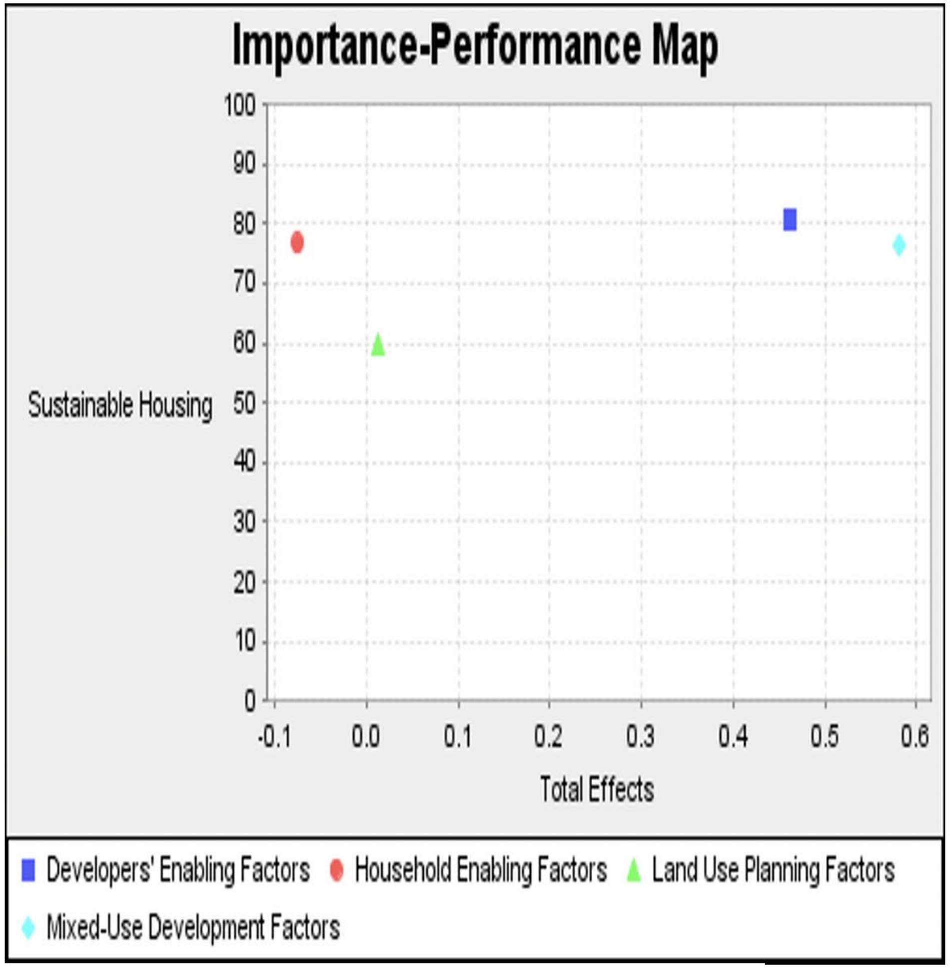


Figure 2: Overall Research Method Framework for the Study



Bootstrapping Analysis of Success Factors and Sustainable housing



IPMA of Success Factors and Sustainable Housing

Figure 3: Structural Model and IPMA of Success Factors and Sustainable Housing

Figures Captions

1. Theoretical Model between Success Factors and CSC of Sustainable Housing
2. Overall Research Method Framework
3. Structural Model and IPMA of Success Factors and Sustainable Housing