https://doi.org/10.1016/j.buildenv.2019.04.030

Critical Success Factors (CSFs) for Sustainable Affordable Housing

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Abstract

Interventions for sustainability attainment in affordable housing have received increasing attention from policy makers globally. However, policy-makers' interventions for sustainable affordable housing markets can be inefficient and even counterproductive. As such, among the diverse interventions available, a vital question is what are the potential efficient interventions? To address this question, the views of affordable housing experts (also knowledgeable in sustainable housing) around the world were solicited via a questionnaire survey to identify critical success factors (CSFs) for sustainable affordable housing. Relative significance analysis of the data led to the identification of 13 CSFs. Furthermore, agreement analysis revealed that there is no good agreement between respondents from the academic sector and those from the industrial sector on the ranking of the 13 CSFs. Moreover, through factor analysis, the CSFs were grouped into four underlying components: developer's enabling CSFs; household-demand enabling CSFs; mixed land use CSFs; land use planning CSFs. The research findings seek to inform policy-makers on the CSFs for efficient resource utilization for sustainable affordable housing market. Future study would establish a relationship between the CSFs and success criteria for sustainable affordable housing.

Keywords: Success Factors; Affordable Housing; Critical Factors; Sustainable Housing; Affordability

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1. Introduction

Housing cost is a noted family outlay whether housing is rented or bought and consequently has a key effect on household's living standards (Clapman, 2018). Households who are overburdened by housing cost may cut back on other important needs such as health care and diet. Besides, in the medium term, households may trade-off costs for lower quality housing such as smaller size of rooms and housing in poorer locations which lack better access to education and other social amenities. The latter has often been cited as the cause of residential segregation (Salvi Del Pero et al., 2016). Conversely, access to adequate affordable housing ensures poverty prevention, labour inclusion and avoidance of social exclusion (Salvi Del Pero et al., 2016). Besides, a house can appreciate in value, as such it represents a high fraction of most households' wealth (Lin et al., 2014). Thus, housing could be an essential influencing factor in the distribution of both societal income and wealth since it is both a consumption good and an investment. Accordingly, policy-makers who have an interest in intervention in the income and wealth distribution mostly focus on housing as an essential means to achieve societal goals (Clapman, 2018). However, there is a chronic undersupply of affordable housing – about 5.5 years as waiting time for housing allocation among potential households in Hong Kong – making it difficult to realize some of these benefits of housing (Hong Kong Housing Authority, 2018).

There is a global housing stress on low-income earners. Among some Organization for Economic Co-operation and Development (OECD) countries, 0.471% of the population were recorded homeless in Australia in the year 2011. In the same year, the homeless population for Canada, Chile, Denmark and Ireland were 0.435%, 0.071%, 0.095% and 0.083%, respectively. In 2012, 0.200%, 0.357%, 0.222% and 0.347% share of the total population were homeless as recorded in the United States, Sweden, France and Germany, respectively (Golubchikov & Badyina, 2012). Similar affordability crises have been reported among developing countries such as India, Malaysia, China and some African countries (Ram and Needham, 2016; Teck-Hong, 2012; Zhang et al., 2016; Keivani and Werna, 2001). Currently, the proliferation of slums is a direct result of the inadequate affordable housing supply to meet the rapid pace of urban growth (Buckley et al., 2016). For instance, urban slums in developing countries in 2010 was estimated at 199.5 million in Sub-Saharan Africa; 190.7 million in Southern Asia; 189.6 million in Eastern Asia; 110.8 million in Latin America and the Caribbean. In South-Eastern Asia, Western Asia, North Africa and Oceania, the statistics were estimated at 88.9, 36, 11.8 and 0.6 million, respectively (Golubchikov & Badyina, 2012). Speculations are that the world's population growth will increase from 3.6 billion to 6.3 billion in 2050 with high urbanization in both developed and developing countries (Obeng-Odoom, 2010). Regardless of its economic benefits, high urbanization is also a disruption process that has often been followed by slum formation (Annez and Buckley, 2009; Buckley et al., 2016). Therefore, policies for sustainable affordable housing remain a pressing goal.

Appropriately, there has often been a renewed interest among governments and other policy-makers such as UN and World Bank to address the growing housing deficits in these times of rapid urban growth (Buckley et al., 2016). In pursuit of the objective of access to sustainable affordable housing, these policy makers employ various sets of success factors (interventions) in their housing policies (Salvi Del Pero et al., 2016). However, some of the success factors might lead to "contrasting objectives and goals, with loss of efficiency and potentially wider negative effects on the economy" (Salvi Del Pero et al., 2016 p. 11). Evidently, there are controversies on the criticality of success factors with regard to the identification of a list of critical success factors (CSFs) for aspects of sustainable affordable housing markets (Hui, 2004; Huang et al., 2015; Deakin, 1989; Pendall, 2002). According to Rockart (1980 p. 4),

"CSFs are the few key areas of an activity in which favorable results are absolutely necessary for a particular manager to reach his or her goals". Similarly, Boynton and Zmud (1984) defined CSFs as those few things that must go well to ensure success for a manager or organization and so, they represent those managerial or enterprise areas that must be given special and continual attention to bring about high-performance. Although there are controversies in the literature on the criticality of success factors for attaining aspects of sustainable affordable housing, limited empirical studies exist to identify the CSFs for a holistic sustainable affordable housing for both developing and developed countries. This is because the major constraint when focusing on housing sustainability is affordability. Consequently, studies on sustainable housing have often focused on high-income residential facilities to the neglect of low-income housing facilities. However, "if significant and meaningful inroads into achieving more sustainable housing are to be achieved, it will be necessary to figure out ways of making "green" and other applications more accessible to low-income earners" (Sullivan and Ward, 2012, p. 313).

Given the above background, the aim of this study is to investigate the CSFs for sustainable affordable housing from the views of affordable housing experts around the world. By focusing on the CSFs identified in this study, it is expected that policymakers can be informed on the CSFs for a better chance of sustainable affordable housing market. The findings of the study will also offer some CSFs which can be the main suggestive policies options to both developers and policymakers worldwide for efficient utilization of resources so that both stakeholders – households and developers – can be better served. Moreover, the findings of the study provide the CSFs for future study on establishing a relationship between the CSFs and success criteria for sustainable affordable housing. In this study, a systematic approach has been adopted to investigate CSFs for sustainable affordable housing market. First, a literature review was conducted to identify the success factors. This forms Section Two of the study. Second, a questionnaire survey was conducted to elicit the views of experts on the criticalities of the success factors. Subsequently, the rationale for the adopted methodology and expatiation on the questionnaire design are provided in Section Three of this paper. Furthermore, the results are presented in Section Four of the paper. Finally, Section Five is dedicated to the conclusions drawn from the study.

2.1 Literature Review

The concept of project success is still evolving. Based on the iron triangle, a project is successful if it is completed on time, within budget and the desired quality. However, Yan et al. (2018) argued that these goals are only sufficient for assessing smaller projects that are not complex, have precise scope with fairly accurate schedule and cost estimates. Accordingly, a project can be a success even though there are time and cost overruns because of conditions beyond the control of the project team. Using the flood control project on the River Thames for example, Yan et al. (2018) stated that the project was commercially successful although it exceeded its budget and duration. The commercial value of success is mostly captured as profit making. For illustration, according to Pocock et al. (1996) and Wuellner (1990), a project is successful if it is completed as scheduled and within budget with an acceptable profit margin and quality design. Yet, other researchers have extended the concept of success to include stakeholders' satisfaction ranging from client, contractor and other stakeholders (Pinto and Slevin, 1987; Li et al., 2018). In Pinto and Slevin (1987), a project is successful if it fulfills four main criteria such as time, cost, client satisfaction and effectiveness (i.e. profit making). Similarly, Ashley et al. (1987) portrayed success as attainment of outcomes that are better than expected or normally observed in terms of cost, schedule, quality, safety and satisfaction of project participants. Extending the concept of success from project based (cost, time, quality,

profit making, stakeholders satisfaction) to organizational based (recommendation, market share), a project is successful if it is completed on time, within budget, desired quality, acceptable to customer and if customer allows contractor to use them as a reference (Kerzner, 1987; Yan et al. 2018). Though these measures of success are applicable to most projects, there are other additional measures with regard to affordable housing projects (Adabre and Chan, 2018).

In affordable housing projects, sustainable development is the main measure of success (Ibem and Azuh, 2011; Chan and Adabre, 2019). Sustainable development is the attainment of a better quality of life through the efficient use of resources, which realizes continued social progress whilst maintaining stable economic growth and caring for the environment (Oyebanji et al., 2017). Sustainable development in affordable housing seeks to achieve the following three main goals: economic, environmental and social goals. Integrating sustainability and affordability into housing, Pullen et al. (2009, p.13) defined sustainable affordable housing as "housing that meets the needs and demands of the present generation without compromising the ability of future generation to meet their housing needs and demands". Pullen et al. (2009) provided a list of the success criteria concerning the three sustainability factors. For economic sustainability, the rent or mortgage payment of a housing facility should not exceed 30% of household income for the bottom 40% of income groups, the facility should be suitably located, it should be of appropriate size and quality for its residents and should not increase the rate of housing stress over the operation of the house. For social sustainability, it was stated that both individual and government should be able to meet their financial obligations regularly and the housing facility should be socially acceptable and should not increase social exclusion or segregation. On environmental sustainability, a product should be appropriately located to reduce biodiversity losses; it should be sited to maximize low-energy transportation choices and other environmental protection features. Arising from these success criteria for sustainable affordable housing is often the question of what policy framework and interventions can better support these outcomes of success (Gurran et al., 2015)?

Generally, the achievement of project success involves the interaction of several success factors. Lists of success factors have been proliferated in the literature, however, no general agreement can be made. With the abundance of different success factors for projects, Rockart (1980) believed that there were some success factors among the many factors, which were most important for the attainment of project success. Using the information system and through extensive interviews with nine reputable companies, Rockart (1980) felt that by zeroing in on those areas of an activity perceived by the executives to be most important for the organization well-being, the pertinent issues and tasks to be dealt with by managers could be targeted. From this perception, the concept of "critical success factors (CSF)" emerged.

After its introduction by Rockart (1980), the concept of CSFs has been widely adopted in many scopes of general construction industry and with, however, an altered meaning. In previous studies (Rockart, 1980; Boynton and Zmud, 1984), CSFs were applied to managerial or enterprise areas which required special attention. However, in many construction project studies, CSFs refer to the selected few factors from the many factors, which are extremely important for project success. For instance, Sanvido et al. (1992) concluded that among seven factors for project success, four were deemed critical. These included: a cohesive team to direct, organize, design and manage the project; a series of contracts that permit and support the various specialists to work as a team without conflicts of interest; experience in design, planning and managing construction and operation; well-timed, valuable information from the user, designer and contract. For budget performance of construction projects, Chua et al. (1997)

stated that out of 27 success factors, eight were critical. Furthermore, using neural network analysis on 27 success factors, Kog et al. (1999) asserted that five success factors were critical for project schedule performance. On critical success factors for various sections of construction projects, Kog and Loh (2011) identified 10 CSFs from 67 success factors. The concept of CSFs has also been applied in PPP (Li et al., 2005; Zhang, 2005; Chan et al., 2010), knowledge management in small and medium enterprises (Yew Wong, 2005) and affordable housing projects (Kwofie et al., 2016; Oyebanji et al., 2017; Mukhtar et al., 2017).

Studies on success factors for affordable housing projects are prolific with controversies on the criticalities of these factors being very common. In Hong Kong for example, due to housing shortage, the government initiated a plan to increase the supply of residential land in order to increase the housing supply. A study by Hui (2004) argued that such a policy is an efficient strategy to ameliorate the housing deficit. However, by analyzing time-series data, Huang et al. (2015) concluded that new housing supply in Hong Kong is independent of the land supply by the government. Thus, the policy of increasing land supply to increase housing supply may be inefficient. Accordingly, decreased internal rate of return attributed to high land price led to reduction in housing supply by developers (Huang et al., 2015). Besides, while some studies have concluded that urban containment policies (such as increasing densities for affordable housing development) have an incremental effect on housing prices and are therefore inefficient governmental policies and controls (Pollakowski and Wachter, 1990; Fischel, 1989; Dawkins and Nelson, 2002), a review study by Deakin (1989) stated that the price increment on housing is caused by other inefficiencies. Besides, Pendall (2002) stated that urban containment policies prevent urban sprawl, preserve agricultural land and encourage higher density affordable housing development. Furthermore, the impact of financial subsidies on housing supply has not been left unquestioned. For instance, in South Africa, the government adopted subsidy payment as a method of financing affordable housing to ensure that houses are allocated to beneficiaries. However, a study by Ganiyu et al. (2017) revealed that this subsidy system was ill-treated by beneficiaries through the illegal sales of houses below market value. This led to an incessant building of sheds and an enlarged number of people on the waiting list. Similarly, Angel (2000: 110) notes, "the most important aspect of subsidies is that they can modify and sometimes inadvertently distort the behavior of consumers and producers by affecting the prices of housing inputs, units and services". Similarly, Guran et al. (2015) stated that though government grants, subsidies and taxes could be aimed at improving housing affordability, they could rather inflate prices or rents. Moreover, the importance of infrastructure supply to affordable housing has been acknowledged in Hui (2004), however, infrastructure supply without regulations could rather be capitalised in land and housing values making housing unaffordable (Guran et al., 2015; Agyemang and Morrison, 2017; Obeng-Odoom, 2010). Other policies such as land planning policies, mandatory inclusion or incentives for inclusion of affordable housing have received varied opinions on their effectiveness in ensuring the provision of affordable housing (Paris, 2007; Lerman, 2006).

Though the varied opinions reflect variations among countries, it is worth noting that even within a country, differences in opinions are expressed on the effectiveness of some of these policies in ensuring affordable housing market (Hui, 2004; Huang et al., 2015). Therefore, surveys have been conducted to find out consensus among affordable housing experts on some of these policies. Typical surveys have been conducted in England (Oyebanji et al., 2017), Ghana (Kwofie et al., 2016) and Nigeria (Mukhtar et al., 2017). However, these studies are country-specific and findings cannot be generalized in the broader perspective. A study by Paris (2007) on an international view of affordable housing experts focused only on planning policies. Yet, it is worth noting that the effectiveness and efficiency of affordable housing

policies are not achieved in isolation but are dependent on the interaction of one or more policies. Besides, most of the polemics in the literature on the criticality of the success factors are focused mostly on price affordability in the housing market with little regard to how these factors could generally improve on the sustainability of affordable housing. Moreover, concerning sustainable affordable housing development, both the developed and developing countries are in the infancy stage (Choi, 2010). Since international policy makers often seek to implement worldwide affordable housing policies (Keivani and Werna, 2001), it is important to find out the opinion of affordable housing experts around the world on the criticalities and categorization of these success factors for a sustainable affordable housing market. Therefore, this study will provide policy options from which local and international policy makers could select the appropriate policies for efficient sustainable affordable housing market.

3. Research Methodology

3.1 Identification of CSFs for Sustainable Affordable Housing

To identify the CSFs apposite for sustainable affordable housing market, a comprehensive review of the literature on success factors and critical success factors was first conducted. Consequently, a list of 30 potential critical success factors for sustainable affordable housing was established. These success factors were derived mostly from peer reviewed articles. Prior to the main questionnaire design, a pilot study was conducted on the list of success factors for sustainable affordable housing. The purpose of this pilot study was to test the significance and comprehensiveness of the success factors (Li et al., 2011). Four participants were involved in the pilot study: two professors, one postdoctoral student and one final year PhD student, who are all knowledgeable in the research topic. The participants were requested to evaluate whether the set of factors contained a suitable number of success factors and whether other potential critical success factors could be added or eliminated from the list. The relevance and completeness of the factors were confirmed and finalized after the pilot study. Table 1 is a list of the success factors together with their respective references.

Table 1: List of Success Factors (SFs) for Sustainable Affordable Housing Market

Code	Success Factors	References
SF01	Access to low interest housing loan to developers	Kwofie et al. (2016); Boamah (2010)
SF02	Mixed land development	Gan et al. (2017)
SF03	Linking commercial development approval to funding for affordable housing	Alawadi et al. (2018); Agyemang and Morrison (2017)
SF04	Stable macro-economic system	Kwofie et al. (2016)
SF05	Effective private sector participation	Kwofie et al. (2016); Whitehead (2007)
SF06	Incentives for developers to include affordable housing / sustainable designs	Klug et al. (2013); Ponce (2010); Morrison and Burgess (2014)
SF07	Governments providing guarantees to developers	Kwofie et al. (2016)
SF08	Improved supply of low cost developed land by government	Huang et al. (2015); Balmer and Gerber (2017)
SF09	Political will and commitment to affordable housing	Oyebanji et al. (2017); Mukhtar et al. (2017)
SF10	Stable political system	Kwofie et al. (2016); Cao and Keivani (2013)
SF11	Formulation of sound housing policies	Whitehead (2007)
SF12	Governments' provision of housing subsidies to households	Ganiyu et al. (2017); Whitehead (2007)
SF13	Good location for housing projects	Mukhtar et al. (2017)
SF14	Adequate accessibility to social amenities	Gan et al. (2017); Oyebanji et al. (2017)
SF15	Mandatory inclusion of affordable unit policy in developer's projects	Klug et al. (2013)
SF16	Adaptable housing design and construction	Adinyira and Anokye (2013)
SF17	Transparency in housing allocation	Mukhtar et al. (2017)
SF18	Adequate maintenance of existing houses	Gan et al. (2017)
SF19	Monitoring conditions / performance of completed houses	Winston (2010)
SF20	High density affordable housing development	Gan et al. (2017); Massyn et al. (2015)
SF21	Increase tax rate to discourage long holding period of vacant land	Obeng-Odoom (2010)
SF22	Adequate infrastructure supply by government	Oyebanji et al. (2017)
SF23	Compliance with quality targets	Oyebanji et al. (2017)
SF24	Adherence to project schedule	Mukhtar et al. (2017)
SF25	Compliance with project budget	Mukhtar et al. (2017)
SF26	Good coordination among project participants	Sanvido et al. (1992)
SF27	Sufficient staffing of public housing agencies	Mukhtar et al. (2017); Agyemang and Morrison (2017)
SF28	Speculative measures on property sales through taxes	Mohd Thas Thaker and Chandra Sakaran (2016)
SF29	Taxation on property or capital gains for housing supply	Agyemang and Morrison (2017); Obeng-Odoom (2010)
SF30	Time limited planning approval / bonuses on land development	Gurran et al. (2015)

3.2 Data Collection

A questionnaire was developed containing the 30 success factors identified from the literature with the objectives of first determining the criticalities of the success factors, then, finding out the agreement level between respondents from the academic sector and those from the industrial sector on the ranking of the identified CSFs and finally, categorizing the identified CSFs into underlying groups. Section A of the questionnaire requested for the background data of the respondents. This is necessary to determine the reliability of the responses before conducting further analysis on subsequent data. Section "B" of the questionnaire contained the success factors expressed on a 5-point Likert scale from 1 (not important) to 5 (very important). This scale was adopted because of its relative brevity. Thoughtfully, spaces were provided at the end of the 30th success factor for respondents to list and rate the criticality of other success factors for sustainable affordable housing. To provide a common background for respondents to answer appropriately on the CSFs, an immediate question prior to the question on CSFs focused on a set of performance outcomes or goals (therein refer to as critical success criteria) for sustainable affordable housing. The set of performance outcomes for sustainable affordable housing sought to pre-inform potential respondents on the goals for sustainable affordable housing and to solicit their opinion on the rating of these outcomes (please, data on the performance outcome have been published in *Building and Environment.* Please, see Chan and Adabre, 2019 for more details). Then, based on the rating on the performance outcomes, respondents could appropriately rate the criticality of the factors for attaining the sustainable affordable housing outcomes.

As such, the questionnaire was designed, pilot surveyed and administered to affordable housing experts in both the academic sector and industrial sector, who have extensive research and / or industrial experience in affordable housing (Chan and Adabre, 2019). These experts are also knowledgeable in sustainable housing in order to provide a meaning survey. The experts were traced and identified from sustainable and affordable housing-related publications in top tier journals and databases (member directories) (Chan and Adabre, 2019). Experts in both sustainable and affordable housing were easily identified based on the titles and content of their publications. Most of their titles contained two or more of the following terms "sustainable" or "adequate" and "affordable" or "low-income" housing. Personalized emails together with a web link created using survey monkey were sent to potential respondents. These options of the questionnaire administrations were employed to enhance the response rate. In a humble appeal, potential participants were requested to forward the questionnaire to experts whom they deemed appropriate to provide the required information as demanded in the questionnaire. A framework of the various stages of the research study is shown in Fig. 1.

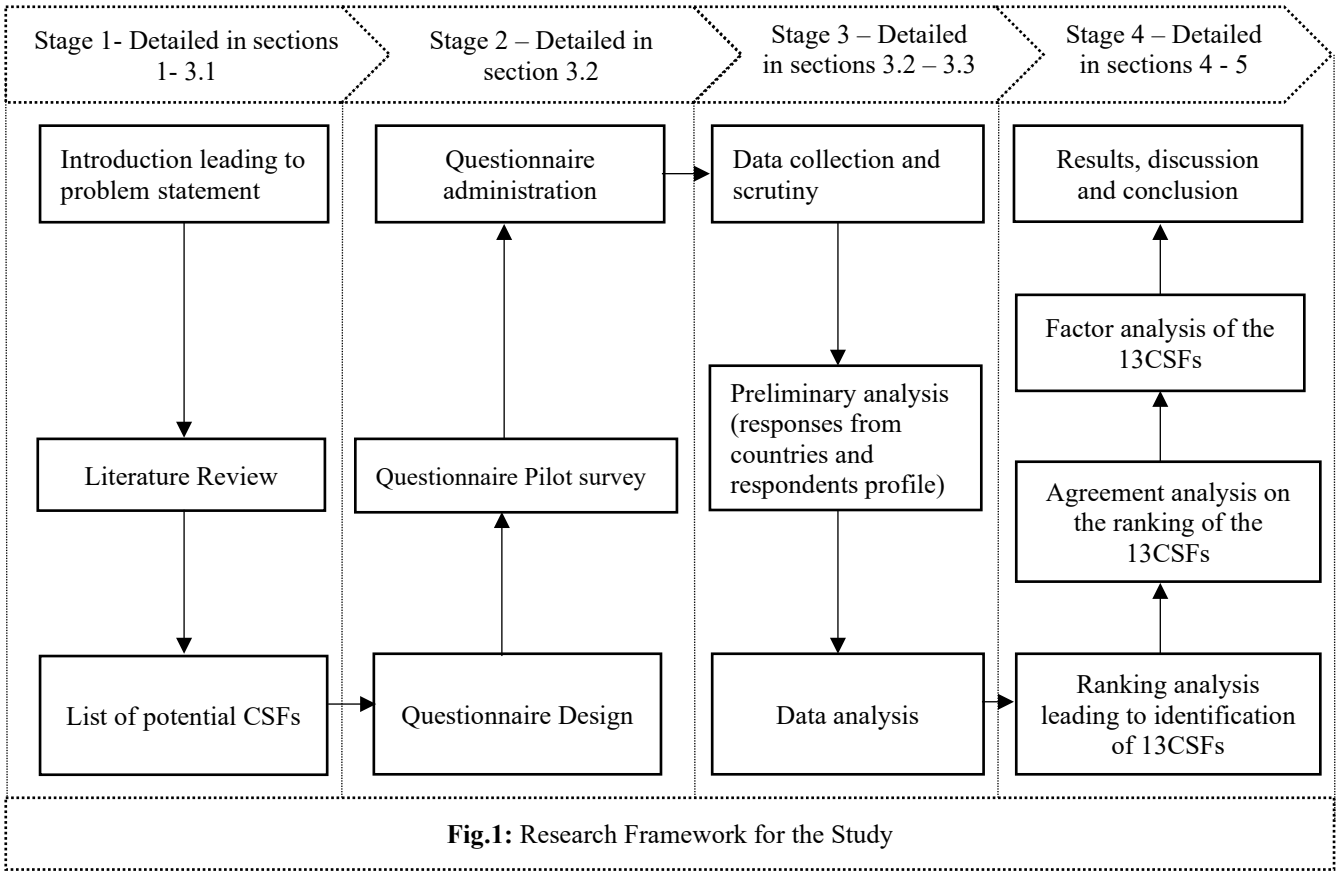

Fig.1: Research Framework for the Study

Out of about 200 questionnaires that were administered, a total of 51 valid responses were received. Since potential respondents were requested to forward the questionnaire to other experts they know might participate in the survey, the total number of questionnaires sent out cannot actually be determined. However, using the 200 as the approximate number of questionnaires sent out, the response rate is determined as 26%. Considering the difficulty in soliciting experts' opinion due to their busy schedule, the 51 responses could be regarded as representative and acceptable. Besides, this response rate is higher than previous response rate obtained from similar international survey (Osei-Kyei and Chan, 2017). Moreover, the number of responses is above the minimum number of sample size of 30 deemed representative of any group (Sproull, 1995; Ott and Longnecker, 2015). Table 2 displays the responses received from various countries. It shows that most of the responses were obtained from the United States of America, Australia and Malaysia.

Table 2: Responses from Various Countries

Countries	Number of Responses
USA	12
Australia	5
Malaysia	5
Italy	4
Hong Kong	3
Sweden	3
China	3
Canada	3
Ghana	2
New Zealand	2
Singapore	2
Brazil	1
India	1
Spain	1
South Africa	1
Japan	1
Norway	1
Papua New Guinea	1
Total	51

(Also cited in Chan and Adabre, 2019)

3.3 Respondents' Profile

Fig. 2 summarizes the professions of the participants in the survey. It shows that the major group of the respondents are from the academic sector 28 (55%). Respondents from the industry including architects, quantity surveyors, project / construction managers and developers accounted for 23 (45%) of the respondents. About 21 (41%) of the respondents had above 20 years of experience (as shown in Fig. 3). Six (12%) respondents had 11-15 years of experience in affordable housing projects either through research and / or industry experience. As shown in Fig. 4, all the respondents have been involved in affordable housing projects. About 37 (40%) of the respondents have been involved in social housing projects and 35 (38%) respondents have been involved in public housing projects. Considering the many years of experience of the respondents in the different forms of affordable housing projects, the respondents' profiles illustrate that the data collected from these respondents could be dependable and representative.

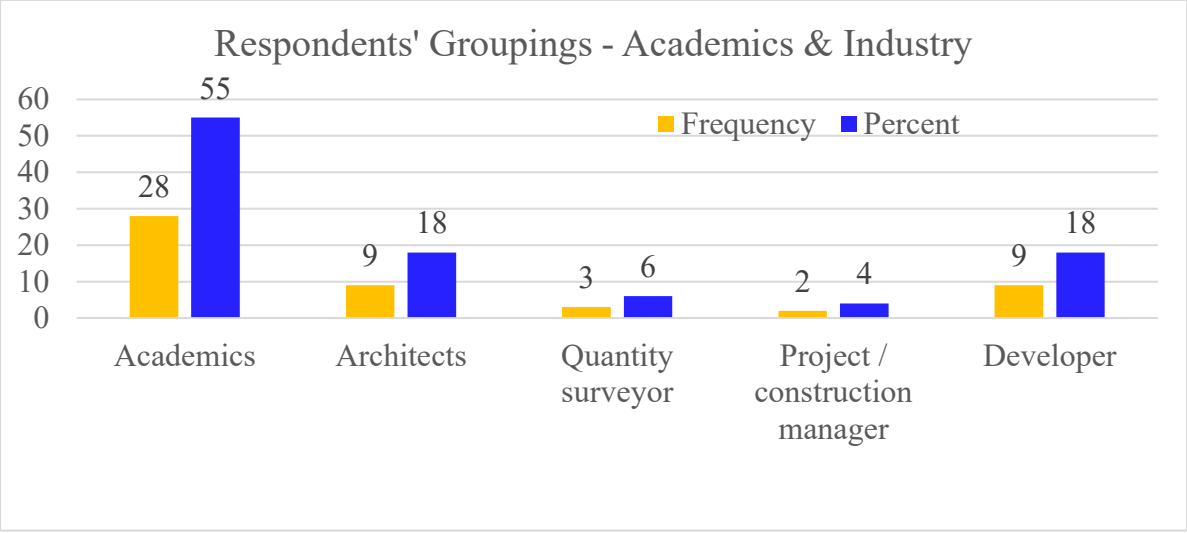

Fig. 2: Respondents' Grouping into Academic and Industrial Sectors

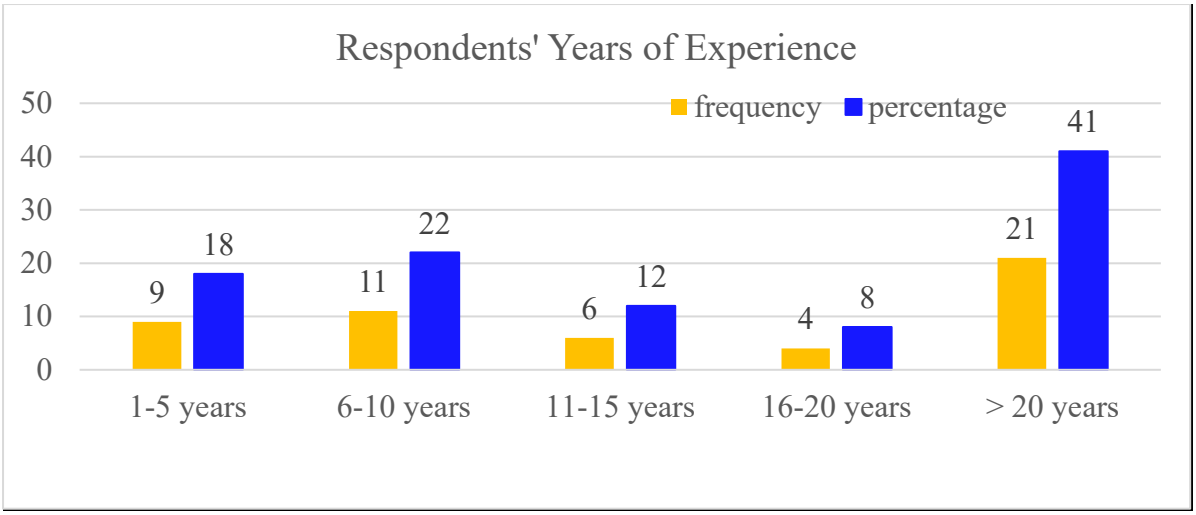

Fig. 3: Respondents' Years of Experience

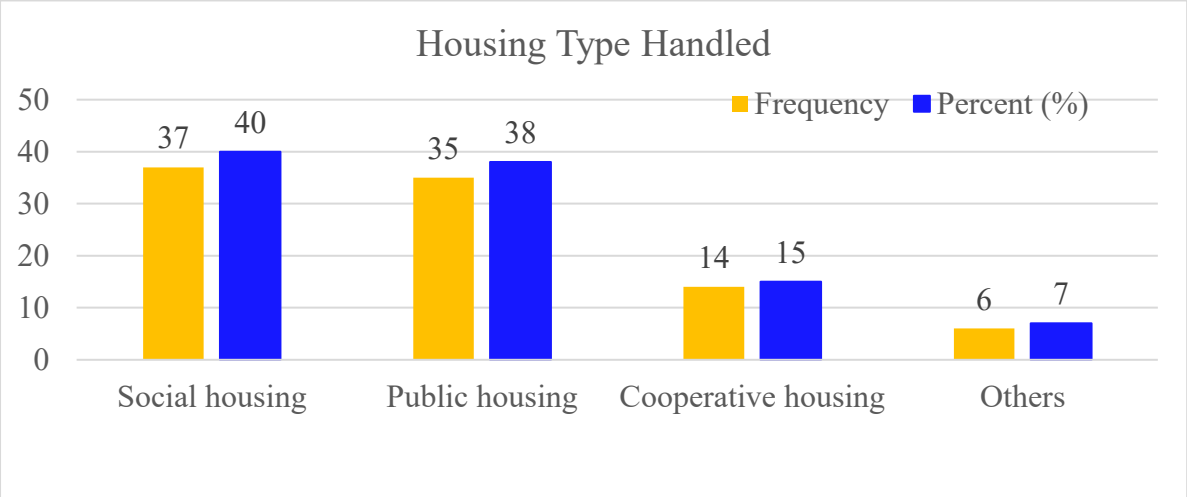

Fig. 4: Housing Type being Handled by Respondents

4 Data Analysis

The Statistical Package for Social Sciences (SPSS) software, version 20 was used to analyze data from the respondents. Statistical analyses such as descriptive means together with normalization, rank agreement analysis and factor analysis were employed for data analysis. Previous study has adopted the descriptive mean and normalization to determine the criticalities of a set of factors for public-private partnership projects (Osei-Kyei and Chan, 2017). Similarly, the mean scores of the various SFs were first computed and then used for the calculations of their respective normalized values. Based on the computed normalized values, the criticality of a factor was determined. Only factors with a normalized value ≥ 0.50 were considered critical (Osei-Kyei and Chan, 2017). Furthermore, the agreement analysis was used to determine the level of agreement between experts from the academic sector and those from the industrial sector on the ranking of the identified CSFs. Finally, factor analysis was conducted to group the CSFs into underlying components. The results of the analysis and the discussion are presented in subsequent sections.

4.1 Mean Score Ranking

The statistical mean, standard deviation and normalization values for each SF were computed (as shown in Table 3). Two of the factors: 'High density affordable housing development' (SF20) and 'Speculative measures on property sales through taxes' (SF28) with the same mean

value of 3.458 but different standard deviations of 1.051 and 1.129, respectively, were the lowest ranked factors. Based on the calculated normalization values, 13 CSFs were identified (normalization values ≥ 0.50) as shown in Table 3. The top six CSFs among the identified CSFs include "political will and commitment to affordable housing" (SF09), "formulation of sound housing policies" (SF11), "access to low interest housing loans to developers" (SF01), "adequate accessibility to social amenities" (SF14), "good location for housing projects" (SF13) and "monitoring condition / performance of completed houses" (SF19).

Table 3: Ranking of Potential CSFs for Sustainable Affordable Housing

Code	Respondents (All)			
	Mean	SD	Normalization	Rank
SF09	4.766	0.598	1.00[a]	1
SF11	4.575	0.542	0.85[a]	2
SF01	4.468	0.687	0.77[a]	3
SF14	4.362	0.819	0.69[a]	4
SF13	4.319	0.911	0.66[a]	5
SF19	4.277	0.743	0.63[a]	6
SF12	4.261	0.801	0.61[a]	7
SF24	4.222	0.441	0.58[a]	8
SF08	4.213	0.999	0.58[a]	9
SF22	4.208	0.922	0.57[a]	10
SF06	4.192	0.947	0.56[a]	11
SF15	4.192	1.014	0.56[a]	12
SF17	4.188	0.960	0.56[a]	13
SF04	4.085	0.747	0.48	14
SF25	4.083	0.739	0.48	15
SF10	4.044	0.788	0.45	16
SF26	4.042	0.746	0.45	17
SF23	4.042	0.849	0.45	18
SF30	4.000	0.918	0.41	19
SF27	3.957	0.779	0.38	20
SF02	3.938	1.040	0.37	21
SF16	3.872	0.992	0.32	22
SF24	3.792	0.898	0.26	23
SF29	3.729	0.983	0.21	24
SF05	3.717	1.129	0.20	25
SF21	3.604	1.026	0.11	26
SF03	3.575	1.175	0.09	27
SF07	3.511	1.140	0.04	28
SF20	3.458	1.051	0.00	29
SF28	3.458	1.129	0.00	30

Note: SD = Standard deviation

Normalized value = (mean – minimum mean) / (maximum mean – minimum mean)

[a] The normalized value indicates that the success factor is critical (normalized ≥ 0.50)

4.2 Agreement Analysis on CSFs Rankings

In earlier sections, the mean values and the normalization values have been calculated for all respondents from both sectors – the academic and the industry. It is worthwhile determining the level of agreement on the ranking of the 13 CSFs between the two groups of sectors. Agreement analysis is relevant to determine if there exists a consensus between the respondents in the different sectors and the implication of the outcome of the analysis on sustainable affordable housing. Due to the limited sample size, 51 valid respondents, parametric analysis could not be employed for determining any statistical significant difference in the ranking of the CSFs between respondents in both sectors. It is recommended that with large sample size, future study could conduct parametric analysis to either confirm or contradict the results of the

agreement analysis in this study. Studies by Okpala and Aniekwu (1988) and Zhang (2005) have employed a quantitative method for rank agreement analysis using the "rank agreement factor" (RAF). In Zhang (2005), agreement analysis was conducted to identify if there exists a consensus on a list of critical success factors for public-private partnership in infrastructure development. In conducting this analysis, Zhang (2005, p. 11) stated that the "RAF shows the average absolute difference in the ranking of factors between two groups". Given any two groups – in this case academic sector and industry sector, let the rank of the ith item in the academic sector or group one (1) be R_{i1} and in the industry sector or group two (2) be R_{i2} and N is the number of items (in this case 13CSFs), k is the number of judgements (in this case respondents from academic sector and those from the industrial sector) and $j = N - i + 1$. Prior to conducting the analysis, the null hypothesis was stated as "there is no good agreement in the ranking of the 13 CSFs between respondents from the academic sector and those from the industrial sector". Therefore, the alternate hypothesis is "there is a good agreement in the ranking of the 13CSFs between respondents from the academic sector and those from the industrial sector." To test the null hypothesis, the percentage agreement was calculated using equations 1 - 6.

Table 4: Agreement Analysis on Ranking of the CSFs for Sustainable Affordable Housing

Code	Academic			Industry			Agreement Analysis		
	Mean	SD	Rank	Mean	SD	Rank	R_i	$(R_{i1} - R_{i2})$	$\lvert (R_i - R_{j2}R) \rvert$
SF01	4.357	0.731	4	4.632	0.597	2	6	2	7.923
SF08	3.929	1.035	12	4.632	0.761	3	15	9	1.077
SF09	4.714	0.659	1	4.842	0.501	1	2	0	11.923
SF11	4.571	0.573	2	4.579	0.507	4	6	2	7.923
SF14	4.250	0.887	7	4.526	0.697	6	13	1	0.923
SF13	4.143	1.079	9	4.579	0.507	4	13	5	0.923
SF19	4.213	0.738	8	4.368	0.761	9	17	1	3.077
SF12	4.444	0.751	3	4.000	0.817	12	15	9	1.077
SF24	3.714	0.937	13	3.900	0.852	13	26	0	12.077
SF22	4.250	0.844	6	4.150	1.040	10	16	4	2.077
SF06	4.036	0.999	11	4.421	0.838	7	18	4	4.077
SF15	4.037	1.018	10	4.400	0.995	8	18	2	4.077
SF17	4.286	0.713	5	4.050	1.234	11	16	6	2.077
								$\sum_{i=1}^{n}(R_{i1} - R_{i2}) = 45$	$\sum_{i=1}^{n} \lvert (R_{i1} - R_{j2}) \rvert = 59.231$

$$R_i = \sum_{i=1}^{N} (R_{ij}) \quad \text{..... equation (1)}$$

Where R_{ij} is the sum of the ranks given to a particular CSF by the two different groups

The mean value of the total ranks ($R_{j2}R$) is given by

$$R_{j2}R = \frac{1}{N} \sum_{i=1}^{Nk} (R_{ij}) \quad \text{..... equation (2)}$$

The RAF is defined as

$$RAF = \frac{\sum_{i=1}^{N} |R_{i1} - R_{i2}|}{N} \quad \text{..... equation (3)}$$

The maximum rank agreement factor (RAF_{max}) is given by

$$RAF_{max} = \frac{\sum_{i=1}^{N} |R_{i1} - R_{j2}|}{N} \quad \text{..... equation (4)}$$

The percentage disagreement (PD) is given by

$$PD = \frac{\sum_{i=1}^{N} |R_{i1} - R_{i2}|}{\sum_{i=1}^{N} |R_{i1} - R_{j2}|} \text{ x } 100 \text{.....equation (5)}$$

$$PD = 0.759 = 76\%$$

The percentage agreement (PA) is given by

$$PA = 100 - PD \text{.....equation (6)}$$

$$PA = 24\%$$

Further explanation on these equations can be found in Zhang (2005). A higher RAF value is an indication of a lower level of agreement between two groups (Zhang, 2005). Therefore, a RAF of zero means perfect agreement. The RAFs, RAF_{max} and PAs for the 13 CSFs are calculated based on the formulae given in equations (1) – (6). The percentage of agreement for the 13CSFs is 24%. Thus, it was concluded that there was no good agreement between respondents from the industrial sector and those from the academic sector on the ranking of the 13CSFs. It is worth noting that the respondents from each of these different sectors differ in their ranking based on the target stakeholders in improving sustainable affordable housing. For example, policies that are solely focused on households were highly ranked by respondents from the academic sector while policies geared towards developers were highly ranked by respondents from the industrial sector. This could be the main reason for the low level of agreement in the ranking of the 13CSFs between respondents from the two different sectors. According to Apgar (1990), housing policy experts have often debated on how best to allocate scarce resources to assist low-income earners. Consequently, policy discussion has concentrated on whether it is more efficient to interfere on the supply-side via affordable housing construction or the demand-side via vouchers or tenants' payments to facilitate housing accessibility in the market. Generally, in terms of house price, there are two alternatives for making housing affordable. These alternatives are to reduce the overall market prices or to provide at a subsidized price for the low-income earners (Whitehead, 2007).

Per the agreement analysis, though some of the policies are nearly ranked similarly, there was an overall low level of agreement on the ranking of the policies required for sustainable affordable housing. For instance (as shown in Table 4), the CSF 'political will and commitment to affordable housing' (SF09) had the highest ranks between the respondents in both sectors. However, subsequent policies had different rankings. Among the respondents from the industrial sector, 'access to low interest loans to developers' (SF01), 'improved supply of low cost developed land'(SF08), 'mandatory inclusion of affordable housing unit in developer's project' (SF15) and 'incentives for developers to include affordable housing / sustainable designs'(SF06) were relatively ranked high. These relatively ranked factors can be categorized as supply-side policies. Therefore, the high ranking of these factors shows that, per the view of the respondents from the industrial sector, housing could be made sustainable and affordable through supply-enabling strategies. By providing low interest loans and improved supply of low cost developed land, the resource costs of producing sustainable affordable housing could be inexpensive (Kwofie et al., 2016; Huang et al., 2015). Besides, 'mandatory affordable

housing inclusion' and 'incentives for developers to include affordable housing / sustainable designs' are both regulatory mechanism that can be used to separate a housing market into two: affordable housing market and the normal housing market (Whitehead, 2007). This could ensure sustainable affordable housing supply.

Based on the ranking from the respondents in the academic sector, the CSFs 'government provision of subsidies to household'(SF12) and 'transparency in housing allocation'(SF17) were ranked relatively high. These factors are focused on the households. Therefore, responses from the academic sectors indicate that sustainable affordable housing could be achieved through demand-side strategies. Various subsidy policies such as vouchers or rental certificates and tenants' payment observation can be adopted. Concerning demand-side policies on subsidies, vouchers or rental certificates are preferred to the tenants' payments for the following reason: Tenants' payments are mostly computed based on tenant's income, while subsidy payments increase as gross rent increases. As such, households have little or no incentive to check the expenditure of their housing. Therefore, there is high possibility that property owners will increase rents without necessarily improving the quality of the housing provided (Apgar, 1990). However, with vouchers, tenants are better motivated to oppose increases in rents not related to improvement in housing quality or service provision. This is because in most cases the size of subsidy under voucher provision does not depend on rent paid and any extra charges on rent is paid by the tenant (Apgar, 1990). Moreover, gains to collusions are easily eliminated under vouchers. However, irrespective of the form of demand-side policies on subsidies, there are possibilities of inflationary impact on housing prices (Gurran et al., 2015).

Concerning both demand-based policies and supply-side policies, economic theory proposes that supply-side policies via subsidized affordable housing construction program are more efficient and may increase the overall supply of a factor of housing production in the construction industry (Apgar, 1990). Moreover, low interest loans to developers through government lending or financial intermediaries could increase the total flow of funds into housing construction and therefore increase total number of housing constructed. Furthermore, provision of low-cost developed land can increase total housing supplied as well as lower market rents (Huang et al., 2015). Therefore, supply-side policies promoters assert that such policies benefit the recipients and all members in a community through stabilization of the macro economy. Moreover, a supply-side policy can be used to foster neighborhood revitalization. Prior study achieved this benefit through the 'housing allowance supply experiment' as argued in Apgar (1990). This policy estimated a 'housing gap, minimum standard' housing payment plan, where a subsidy is set equivalent to the 'gap' between the cost of standard housing and some portion of the beneficiary's adjusted yearly income. Income-eligible households receive this subsidy if their housing unit meets specified health and safety minimum standards. However, residents in substandard units per the program standards must negotiate housing improvement plan with the owner of the property or move to a housing facility that fulfills the program standards. Debatably, the transaction cost in relocating a household to a facility that meets the program standard could impede the successful operation of the policy. Yet, it was found that substandard housing facilities were easily renovated to the standard conditions.

Similarly, by adopting regulatory-based policies (i.e. mandatory policies) and optimum retrofitting model as outlined in Tan et al. (2018) and Fan and Xia (2018), respectively, in addition to using the concept of 'housing gap, minimum standard', aged and substandard low-cost buildings could be green retrofitted effectively. Using this concept, low-income tenants in

substandard units per required sustainable affordable housing program standards must incorporate sustainable housing technologies into their housing facility upon agreed terms with the housing owners. Energy efficient technologies such as the installation of energy efficient lighting systems and installation of energy-efficient windows could be provided using government subsidy that is equivalent to the 'gap' between the cost of standard housing and some portion of the beneficiary's adjusted yearly income paid as rent. Besides, such policy could be used to fund water efficient appliances and fixtures such as rainwater harvesting technology, grey water reclaiming and reuse technology. Furthermore, through implementation, this policy could also reduce the inflationary impact of housing whose prices escalate without improvement on housing conditions. Moreover, the policy could incentivize other private developers to include sustainable technologies in existing properties without necessarily increasing housing rent or prices. Ultimately, the implementation of this policy could lead to sustainable affordable housing market.

To summarize, in the light of the discussion between supply-side policies and demand-side policies, supply-side policies are commendable and recommended over demand-side policies as efficient strategies for ensuring economic sustainability (i.e. price affordability) because of their efficiency in reducing inflationary prices of housing. Besides, supply-side policies are effective measures for green retrofitting of aged and substandard residential building for the attainment of sustainable affordable housing.

4.3 Factor Analysis

4.3.1 Internal Reliability

The Cronbach alpha method was used to assess the internal consistency of the 13 CSFs. Cronbach alpha coefficient (α) value ranges from 0 to 1. A high alpha value indicates high internal consistency / reliability of a set of factors in a scale. An alpha coefficient (α) of 0.724 was computed using the SPSS software. The alpha value shows that the 13CSFs are internally consistent or reliable (Santos, 1999).

Factor analysis is a data reduction technique. It is used to identify underlying variables which explain similar trend of correlation in a set of observed variables and then regroups the factors from large number to a smaller and more relevant set of factors or components. To proceed with this analysis, Kaiser-Meyer-Olkin test (KMO) and Bartlett's test of sphericity were conducted to determine the suitability of the data for factor analysis. While the KMO measures the sampling adequacy by comparing the size of the partial correlation coefficients, the Bartlett's test of sphericity checks the presence of correlation among a set of variables. If the Bartlett's test is significant ($p < 0.05$) and the KMO value is above 0.5, then the data are deemed appropriate for factor analysis (Kaiser, 1974). The obtained value for the KMO is 0.597 which is above the required minimum of 0.50. The Bartlett's test of sphericity result of 164.253 with a significance level of 0.00 indicated that the correlation matrix is not an identity matrix. Therefore, the data are suitable for factor analysis. Factor analysis was, therefore, conducted. First, factor extraction was carried out using the principal component analysis to identify the relevant variables. The eigenvalue, which measures the contributions of a variable to the principal components, was used as the criterion to determine the relevance of a variable. Judging from previous study (Chan et al., 2018), only variables with eigenvalues greater than one should be retained. Consequently, only 13 CSFs with eigenvalues above 1 were retained. Then, the Varimax rotation was conducted on the 13 CSFs which yielded four underlying components which explain 62.65% of the total variance (as shown Table 5). Only 11 CSFs were successfully loaded into the four underlying components. Two of the CSFs namely 'political will and commitment to affordable housing' (SF09) and 'transparency in allocation

of houses' (SF17) were excluded because their loading values were below 0.50. The factor loading measures the correlation coefficient between an original variable and an extracted component. Normally, factor loadings higher than 0.5 are regarded significant and contribute to the components interpretation. Otherwise, it is regarded insignificant (Li et al., 2011). Table 5 shows the variables with factor loadings above 0.50. The four factors were renamed and summarized as follows:

Table 5: Results of the Factor Analysis

Code	CSFs for Sustainable Affordable Housing	Components			
		1	2	3	4
Component 1	Developers' Enabling CSFs				
SF15	Mandatory inclusion of affordable unit policy in developer's projects	0.770	–	–	–
SF01	Access to low interest housing loan to developers	0.750	–	–	–
SF06	Incentives for developers to include affordable housing / sustainable designs	0.743	–	–	–
SF08	Improved supply of low cost developed land by government	0.661	–	–	–
Component 2	Household-demand Enabling CSFs				
SF19	Monitoring conditions / performance of completed houses	–	0.827	–	–
SF12	Governments' provision of housing subsidies to households	–	0.774	–	–
SF24	Adherence to project schedule	–	0.652	–	–
Component 3	Mixed Land Use CSFs				
SF14	Adequate accessibility to social amenities	–	–	0.794	–
SF13	Good location for housing projects	–	–	0.767	–
Component 4	Land Use Planning CSFs				
SF22	Adequate infrastructure supply by government	–	–	–	0.740
SF11	Formulation of sound housing policies	–	–	–	0.616
Eigenvalue		3.389	1.965	1.647	1.144
Variance (%)		17.850	17.802	13.685	13.313
Cumulative variance (%)		17.850	35.652	49.337	62.649

Extraction method: Principal Component Analysis
Rotation method: Varimax with Kaiser Normalization

4.4 Results and Discussion of Principal Component Analysis

4.4.1 Component 1: Developers' Enabling CSFs

Component 1 consists of four underlying factors: 'mandatory inclusion of affordable unit policy in developer's projects', 'access to low interest housing loan to developers', 'incentives for developers to include affordable housing / sustainability designs (strategies) in their projects' and 'improved supply of low cost developed land by governments'. All these factors are closely related to enhancing sustainable affordable housing supply among developers. Therefore, this component is named 'developer's enabling CSFs'. The total variance accounted by this component is 17.850% (as shown in Table 5). Inclusion of affordable housing in developer's project could be made mandatory for affordable housing supply. However, incentives such as the allocation of land and the provision of loan at low interest rates will also ensure lower housing prices (Whitehead, 2007). Thus, these policies lead to economic sustainability through price affordability. In the UK, for example, mandatory policies through section 106 (S106) are implemented. Conversely, in Australia and New Zealand, incentives such as low interest finances are provided for inclusionary affordable housing projects (Berry, 2004). In Singapore where there is strong public ownership of land, land allotment system has been an effective instrument in providing affordable housing. Among other incentives that could enhance developers' sustainable affordable housing supply are design flexibility, density bonus, fast-tracking processing, fee deferral, fee reduction, fee waiver and growth-control exemption (Garde, 2016). Design flexibility such as relaxations on maximum floor design, number of stories and number of units could have comparatively positive impact on sustainable affordable housing supply. Therefore, policy makers could use these design flexibilities as incentives to enable developers improve on sustainable affordable housing provision (Hui and Soo, 2002). Aside the attainment of economic sustainability, these policies could also ensure social sustainability.

Mandatory or incentives for inclusionary housing policies enable socially integrated forms of affordable housing. This leads to a form of mixed income housing thus preventing segregation of households, which could lead to the attainment of social sustainability (Adabre and Chan, 2018). For instance, in South Africa, inclusionary housing policy was initiated to remedy the divided apartheid community (Klug et al., 2013). Although developers can set aside 25% of land or the money equivalence for social housing, as witnessed in Bogota and Columbia, it is worth noting that in such approach, mix housing is traded off against housing supply (Mallach, 2010). To ensure maximum achievement of the inclusionary housing policies, the policies should be a combination of a voluntary pro-active deal-driven component and an obligatory but incentive-linked regulation based component (Klug et al., 2013).

Previous studies have evaluated the effectiveness of these policies in achieving price affordability with little regard to other economic and environmental sustainability goals. In many affordable housing projects, these sustainability factors can be achieved significantly through the implementation of energy efficient strategies. Strategies such as energy efficient lighting system, energy-efficient heating, ventilation and air condition (HAVC) systems, solar water heating technology, installation of water-efficient appliances (low-flow toilets), rainwater harvesting technology and grey water recycling techniques are active strategies that could be adopted for sustainable affordable housing (Nelms et al., 2005). Besides, improvement to the housing envelope elements – known as passive strategies – can be implemented for energy efficient housing. Different kinds of walls could be adopted in sustainable affordable housing construction. Typical examples are solar walls (i.e. trombe wall, insulated trombe wall, unventilated solar wall and composite solar wall); transwalls; white washing external walls and ventilated or double skin walls (Sadineni et al., 2011). These walls

are sensitive to weather factors and therefore perform better under certain climatic conditions and designs. For instance, insulated trombe walls or composite solar walls are suitable in zones with briefer heating seasons to prevent overheating during cooling seasons. However, unventilated solar walls or trombe walls are appropriate in zones with lengthier heating seasons (Sadineni et al., 2011). In zones where there is high differential in atmospheric air temperature between days and nights, thermal mass as a passive strategy is more efficient. Ventilated walls also improve passive cooling of a facility thus saving on energy consumption. Though the energy saving benefits of ventilated walls increase with increase in the size of the air gap, increases after 0.15m yield diminishing returns (Ciampi et al., 2003). On fenestration such as windows, 1.5m overhangs and wind walls and reflective coated glass window glazing to all windows are some recommendable passive strategies (Cheung et al., 2005). Roof architecture such as white-washed exterior roof, doomed and vaulted roofs, green roofs and double roofs are some examples of passive cooling strategies that can be adopted in tropical climates (Sadineni et al., 2011).

Integrating these strategies into affordable housing projects could lead to incremental costs of projects (Nelms et al., 2005). For instance, higher cost was identified as the major barrier to the adoption of some of these strategies in Ghana, USA, Canada and Australia (Chan et al., 2018). However, one of the most effective approaches to promote their integration into affordable housing construction is to incentivize the affordable housing market (Taylor, 2011). Incentives motivate developers to integrate sustainability techniques into projects (DuBose et al., 2007). These incentives could either be external or internal. On external incentives, beneficiaries must fulfil specified conditions or obligations so as to benefit from an incentive. However, the internal incentives allow beneficiaries to be incentivized out of their own desire due to the appeal of the benefits of sustainable construction (Olubunmi et al., 2016). External incentives can be classified into two categories: financial and non-financial (structural) incentives. Financial incentives (such as tax incentives, rebates, direct grant, low interest loans and development contribution remission) can be provided by government to alleviate the economic barriers of incorporating both passive and active strategies into housing projects. For instance, with tax incentives, developers that integrate these strategies in affordable housing could be offered tax deductions or completely exempted from tax payment (Azis et al., 2013). Most often, financial incentives can be paired with non-financial incentives for sustainable affordable housing supply.

With non-financial incentives, a government mostly grants developers the right or additional rights that are beyond the normally allowable when specific conditions are accomplished. At no or low cost, sustainable affordable housing construction can be made more appealing to developers (Taylor, 2011). Typical among the non-financial incentives include: Floor-to-Area density (FAR), expedited permitting, planning assistance and technical assistance. For example, the FAR allows developers who incorporate sustainable construction technologies into a proposed development to construct more building than are allowed by the usual zoning. In Singapore, for instance, the Green Mark Gross Floor Area Incentive scheme is offered to developers who accomplish the highest Green Mark Platinum or Green Mark Gold Plus rating for an extra floor area up to 2% of the total gross floor area of the project (Gou et al., 2013). Though the FAR is a non-financial incentive, additional rentable / saleable space resulting from the FAR bonuses could help developers to completely or partially recoup the expenditure on sustainability strategies incorporated into the housing facilities (Olubunmi et al., 2016). Furthermore, it has been estimated that review and permitting procedure for development could take up to 18 months (Taylor, 2011). In project delivery for marketing or for occupation, time is essential. A significant reduction in project duration promotes project cost and risks

reduction for the developer (Perkins and McDonagh, 2012). Through a shift in permitting priority, expedited permitting could be used to significantly save developers time in permit approval process in exchange for the developer committing to stated sustainable affordable housing strategies (Perkins and McDonagh, 2012; Choi, 2009).

Studies have been conducted in comparing the different incentives mechanisms – financial incentives, non-financial incentives (administrative incentives) and density-bonuses – to identify incentives which contribute most to sustainable housing development. Findings of a study by Sauer and Siddiqi (2009) indicated that density bonus (i.e. zoning ordinances), which allows projects to achieve a higher unit density, was the main cause for higher construction of LEED certified multi-unit residential buildings. Furthermore, administrative incentives (such as expedited permitting, fee remission, or fee waiver as well as free consultation) have a more substantial impact on the adoption of sustainable construction measures by developers than financial incentives (i.e. tax credits). Therefore, it was concluded that non-financial incentives are the most effective at encouraging sustainable construction (i.e. green building development) among developers. Similarly, a study by Choi (2009) confirms this assertion since monetary / financial incentive was found not to have effectively promoted sustainability practices in buildings. Rather, regulations and administrative incentives are strong tools for sustainable construction. Choi (2009) argued that it is possible that financial incentives have not been adequate to offset the cost of sustainable construction.

4.4.2 Component 2: Household-demand Enabling CSFs

Component 2 includes three factors: 'monitoring conditions / performance of completed houses', 'governments' provision of housing subsidies to households' and 'adherence to project schedule'. These factors emphasize strategies for meeting households' demand in an affordable housing market and are therefore termed 'household-demand enabling CSFs'. The total variance accounted by this component is 17.802%.

'Monitoring conditions / performance of completed houses' is essential for housing maintenance. It keeps a facility in a condition suitable for use. It also improves the quality of a building. One challenge in achieving maintenance of building projects is inadequate information about the building structure and performance. However, through automatic monitoring, routine inspections and feedback from users, data could be collected for the appropriate type of maintenance. Various forms of maintenance could be applied to housing facilities based on the conditions at hand. Corrective maintenance is recommended when the effect of failure is insignificant. With the possibility of a colossal cost due to failure, preventive maintenance is more appropriate (Sadineni et al., 2011; Lind and Muyingo, 2012). Preventive maintenance means circumstances where repair and / or replacement is carried out without the incidence of any particular fault. Preventive maintenance could be condition-based whereby various elements of a facility are inspected on a regular basis and the elements serviced or replaced based on certain noticed conditions. It could also be time-based whereby maintenance tasks are executed at a frequency based on the passage of time, irrespective of the condition of the elements of the housing facility (Lind and Muyingo, 2012). Due to high cost of over-maintenance, conditioned-based maintenance would be preferred to time-based maintenance for sustainable affordable housing facilities since it is more possible to make repairs only when needed. Another cost-effective maintenance strategy is opportunistic maintenance. It includes maintenance of various elements or components of a building if there arises an 'opportunity' to carry out certain activities in a cost-effective way (Lind and Muyingo, 2012).

There is the need for a considerable amount of opportunistic maintenance in existing affordable housing projects to meet sustainability requirements. A study conducted by Nikolaidis et al. (2009) recommended opportunistic maintenance for energy efficient residential buildings. It was found that the most effective energy saving methods are the improvement of lighting, the insulation of the roof of the building and installation of an automatic temperature control system (Nikolaidis et al., 2009). Among the alternative domestic light sources – incandescent lamps, compact fluorescent light (CFL), tungsten-halogen lighting and light emitting diode (LED) – Jacob (2009) stated that LED's are possibly the ideal replacement for the most widely use incandescent lamps, having a long lifespan and discrete appearance. Besides, Nikolaidis et al. (2009) recommend that replacing electric water heaters with thermal solar system could lead to 80% saving of the cost of heating water in addition to promoting environmental protection. Furthermore, replacing air-cooled with water-cooled air condition system could lead to substantial reduction in electricity consumption (Yik et a., 2001). Moreover, household appliances (i.e. refrigerators) could be replaced with low CFC and high energy efficient refrigerators to limit ozone depletion and to promote energy efficiency over time.

It is worth noting that long term energy efficiency would be achieved only through an integration of several energy efficient measures (Costolanski et al., 2013). For instance, in Ethiopia, CFL bulb distribution program contributed significantly to energy saving in the country. However, due to rebound effect on the CFL bulb distribution program, about 20% of the initial energy savings disappeared in 18 months after the implementation of the program. This finding was stated as not surprising because of high estimated income elasticity. As the economy grows, demands for other electrical appliances and electricity increase. Appropriately, it was recommended that for long term energy savings, the CFL bulb distribution program should be integrated with other energy efficient measures (Costolanski et al., 2013).

The least energy-efficient households are most likely to be lower-income residents. Yet, considering the net benefits of energy efficient measures, the take-up responses of these measures are very low and disappointing (Clinch and Healy, 2000). In a study by Zhao et al. (2012), it was found that although half of the respondents were interested in energy-efficient and renewable energy products, high investment cost was a major barrier that hindered purchases among income groups including low-income earners. However, subsidies programs such as tax credits, purchasing rebates and interest-free loans can be developed to promote the adoption of these measures. Taylor (2011) argued that revolving loans could be established to provide low-interest loans to low-income households who seek to renovate their residency to sustainability standards. However, between tax credits and interest-free loans, a study by Zhao et al. (2012) found that because of indebtedness concerns, households were not very attracted to loan subsidies (including interest-free loans). Rather, households are more disposed to take tax credits than interest-free loans, which may be attributable to the fact that tax credits cutback the actual purchase cost. Tax credits at higher rates are required for expensive products such as solar panels and for drawing interest from lower income households (Zhao et al. 2012) for opportunistic replacement of most of the energy inefficient elements in a housing facility.

4.4.3 Component 3: Mixed land use CSFs

Component 3 comprises two factors: 'adequate accessibility to social amenities' and 'good location for housing projects', which accounts for 13.685% variance. Both accessibility and location efficiency can be achieved through mixed land use (Aurand, 2010). Therefore, component 3 was named 'mixed land use CSFs'.

"Mixed land use is defined as a mixture of commercial, residential and industrial land uses within a specified geographical area as opposed to the segregation of residential land uses from non-residential uses" (Aurand, 2010 p. 1023). According to advocates of smart growth, one of the ways of better meeting the housing needs of low-income earners is by mixed land use than by neighborhood of single-family homes dominance (Kalinosky, 2001). 'Mixed land use' is one of the key planning principles among contemporary planning strategies. It is a planning strategy that ensures mix of shops, apartments, offices and homes for the attainment of sustainability goals. For instance, mixture of complimentary land use promotes transit-supportive development, encourages walkability and bicycle travel, builds a sense of community, expedites a more economic arrangement of landscape amenities and reserves open space. Consequently, this leads to reduce energy consumption, improve access to services and facilities and enables agglomeration economies (Koster and Rouwendal, 2012). Conversely, the isolation of employment, services and shopping from housing facilities has often led to substantial distance between residential neighborhoods and jobs or services. Arguably, this separation has led to excessive commuting time, air pollution, traffic congestion, job housing imbalance, inefficient utilization of energy which are some of the causes of increase pollution emission due to long traveling distance by vehicles and increase financial burden on household as a result of high commuting cost (Song and Knaap, 2004). Therefore, 'mixed land use CSFs' directly ensures environmental sustainability and economic sustainability while indirectly promoting social sustainability through household satisfaction (Adabre and Chan, 2018; Chan and Adabre, 2019).

4.4.4 Component 4: Land use Planning CSFs

Component 4 has two variables: 'adequate infrastructure supply by government' and 'formulation of sound affordable housing policies'. The provision of infrastructure leads to the appreciation of the value of land. If these infrastructure facilities are supplied by the government then policies could be formulated which link the appreciation of land value to development of sustainable affordable housing. This system is termed as land use planning. Therefore, component 4 was named 'land use planning CSFs.' The total variance accounted by this component is 13.313%.

'Land-use planning' is a governing mechanism that seeks to increase the efficiency of the use of land in addition to ensuring greater equity in that use (Evans, 2008). Some of the reasons for the increased value of housing include agglomeration economies and the provision of public infrastructure (Whitehead, 2007). The former could be enhanced by the latter (Whitehead, 2007). When both scenarios occur, they result in the reduction of the total quantity of housing to be provided since an amount of the input for housing – land – is channeled into the provision of infrastructure. The planning and provision of infrastructure provide communal benefits which can increase the value of land (Crook, 1996). This may lead to an increase in affordability difficulties. Therefore, on fairness grounds, planning and capital gains to the maximum of the increase associated with the infrastructure development are levied on developers / owners of land in the form of taxes and distributed to assuage the housing affordability difficulties. The main rationale for capturing uplift in land values rests on redistribution policies (Agyemang and Morrison, 2018). The realized taxes could be distributed as subsidies. As argued by Whitehead (2007), in a political environment of tight funding with priority for affordable housing, the link should be established between the potential for taxation resulting from the land-use planning system and the need for affordable housing funding / finance. Generally, studies have concluded that a successful case study of the 'land use planning' system is the UK (Whitehead, 2007; Crook et al., 2001). The land use planning CSFs have several benefits. Some of which include mixed development or mixed communities. If

efficiently implemented, the land use planning CSFs could promote economic and social sustainability (Chan and Adabre, 2019).

5. Conclusions

Due to income inequality, not every household will be able to compete in the same housing market to meet their housing needs. Households with fewer resources will naturally consume relatively little housing which will take greater fraction of their little income. Consequently, poorer households may be left with inadequate resources to buy other necessities. Though governments and other policy makers have recognized that society's welfare improves if the minimum standard of housing is attained by all households, there are controversies on the effectiveness of policies to realise sustainable affordable housing. To ensure sustainable affordable housing, this study aimed to investigate the CSFs to assist policymakers in their decision making. Through a thorough and critical review of the literature, 30 SFs were identified. Then, a questionnaire survey was conducted in which 51 responses were received from affordable housing experts around the world. The study results first revealed that among the 30 SFs, only 13 factors were found to be critical for sustainable affordable housing. The top six critical factors include: 'political will and commitment to affordable housing' (SF09), 'formulation of sound housing policies'(SF11), 'access to low interest housing loans to developers'(SF01), 'adequate accessibility to social amenities'(SF14), 'good location for housing projects' (SF13) and 'monitoring condition or performance of completed houses'(SF19). Besides, there was a low level of agreement in the ranking of the 13 CSFs between respondents from the academics sector and those from the industrial sector. While CSFs for improving demand for affordable housing were highly ranked by respondents from the academic sector, CSFs for improving affordable housing supply were highly ranked by respondents from the industrial sector. Furthermore, factor analysis indicated that the CSFs can be grouped into four underlying components: 'developers' enabling CSFs', 'household-demand enabling CSFs', 'mixed land use CSFs' and 'land use planning CSFs'.

Though the aim of the study was accomplished, there are some limitations worth stating. The sample size of respondents use for the study is relatively small. In this light, the interpretation and generalization could be enhanced in subsequent studies which employ higher sample size. Therefore, the available data are not robust enough to provide a thorough cross-country view and future study could increase the coverage of data and corroborate the quality of the findings of this study. Furthermore, future study could verify the identified CSFs in this study by using evidence-based case studies.

Albeit the limitations of the study, the research findings have several implications in both practice and theory. The findings of the study suggest the CSFs among the many success factors, that could be the pivotal interventions for sustainable affordable housing in both developing and developed countries. Besides, by classifying these factors, policy-makers are informed of the underlying groupings of CSFs which could be implemented concurrently. Moreover, successful implementation of these CSFs will ensure a holistic sustainable affordable housing market. For instance, economic sustainability could be attained if 'developer's enabling CSFs' are implemented while social sustainability could be accomplished through the execution of 'household-demand enabling CSFs' and 'land use planning CSFs'. The implementation of the underlying component 'mixed land use CSF' ultimately leads to environmental sustainability. For further study, quantitative analysis towards establishing a relationship between the identified CSFs and the success criteria of sustainable affordable housing project is a knowledge gap which is worth exploring.

Acknowledgement

This paper forms part of a research project entitled "Affordable Housing Supply: A Comparative Study between Developed and Developing Economies", from which other deliverables have been produced with different objectives but sharing common background and methodology. The authors wish to gratefully acknowledge the Research Grants Council (RGC) and the Department of Building and Real Estate, Hong Polytechnic University, for their financial support in conducting this study. The authors are also grateful to the editors and the anonymous reviewers for their insightful comments which helped to improve the quality of this paper.

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