THE ROLE OF NATIONAL INTELLECTUAL CAPITAL IN HOUSING IN NIGERIA: DEVELOPING SUSTAINABILITY ENHANCEMENT MODEL USING STRUCTURAL EQUATION MODEL(SEM) AND PARTIAL LEAST SQUARE REGRESSION(PLS)

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Abstract

Nigeria has seen a litany of failed attempts to address the myriad of housing problems, particularly during the period of military dictatorship that spanned the 1960s and 1990s. In a similar vein, the civilian government that took office in the late 1990s inherited a serious problem of housing inadequacy as a result of years of neglect, an underdeveloped housing finance system, limited long-term finance, high interest rates on mortgages, high cost of land acquisition, building materials, poor planning of housing policies, programs, administrative bottlenecks that make processing and securing building approvals, Certificates of Occupancy, and other documents difficult. Unlocking the housing conundrum in Nigeria requires new thinking from the realm of a knowledge economy. Thus, it is imperative to leverage on reducing the housing gaps and inequality from the intellectual capital perspective, especially national process capital / institutional dimensions and national social capital/ socio-cultural dimensions. The thrust of this paper is developing a structural model for sustainability enhancement in housing. It is against this backdrop that the study will adopt the use of a Structural Equation Model (SEM) and the Partial Least Square Regression (PLS) to develop a sustainability enhancement model for Housing in Nigeria. Key emphasis is on Public Private Partnership and Critical Project Management Success Factors as enablers.

Keywords: Housing, Sustainability, Intellectual Capital, Structural Equation Model, Partial Least Square Regression
JEL Classification: R31, H54, O17

1. INTRODUCTION

Due to the budding population and the demands of end-users in terms of housing quality, housing has become one of the most important public policies that shape sustainability (Doyon and Moore 2020).

The significant ripple effect of a growing population (in a consumption and not productive economy), rapid urbanization, failure of successive governments to diversify the Nigerian economy beyond revenue from oil, stagflation and overdependence on foreign goods and imported building materials without commensurate quality investment in human capital to research and develop cheaper and alternative building materials have put Nigeria into a serious housing conundrum.

There are profound qualitative and quantitative gaps based on the assessment of housing needs for low and medium- income earners. Therefore, the need towards construction of buildings to enhance sustainability and end user acceptance cannot be overemphasized. The basic condition for the development of sustainable housing is national process capital, for example, institutional capacity based on knowledge, processes, procedures, and education in this field. To improve the quality of lives at institutional level involves advocating the principle of involvement of end-user's requirements. The research problem relates to the fact that Nigeria does not have a sufficiently developed institutional capacity and involvement of end-users in the process of sustainable housing development, and that public-private partnership and the application of critical project management success factors for housing delivery is still evolving in Nigeria.

Sustainable development is usually categorized under the tripod stand of sustainability, economic and social environment (Mallien and Malys, 2009) appraise housing from an economic perspective, viewing housing construction as a major investment people make in their lives.

This perspective is validated when shelter is considered in Abraham Maslow's hierarchy of needs. Hence, there is great need for improvement in the delivery of housing stocks in a way that encourages greater environmental responsibility and places greater value on the welfare of future generations (Ding, 2008). Hill and Bowen (1997) proposed a framework for sustainable construction which suggests environmental factors in the specification and contract documents. Fisman et al. (2006) studied housing problems in Kerala, India and relate housing construction in the study area to socio-cultural impacts as well as the environment. Navarro et al (2019) studied the nexus between the quality of life and sustainability based on intellectual capital model, which includes environmental, economic, and social dimensions, emphasizing that well-being is multidimensional, and the economy would form a bedrock.

Analyzing social, economic and environment dimensions, Tibaijuka (2009) concluded that the social dimension of sustainability is often encompassed under the notion of

social capital and although housing provision need resources in form of financial capital for their development, it is glaring that economic resource alone does not lead to sustainable human settlement. The environment, social policy, and good governance are essential pillars of a good quality of life and can be analyzed in terms of types of intangible capital or intellectual capital (Alfaro, 2017). Dal Mas (2019) analysis showed that intellectual capital and sustainability influence each other.

Adamec et al. (2021) emphasized that for measuring sustainable development, indicators for institutional dimensions took account of the significance of institutions but focusing only on the impacts of organizations and thereby neglected important institutional aspects that predetermine activities and policies, as well as their effectiveness.

Ihuah et al (2014) investigated the Critical Project Management Success Factors (CPMSF) for sustainable social housing in Nigeria, stating that they should be supported by government policies based on the people's real needs.

Against this backdrop, this paper attempts to develop a sustainability enhancement model using the Structural Equation Model (SEM) and Partial Least Square Regression (PLS) with specific emphasis on improving housing in Nigeria through the intervention of Public Private Partnership schemes and the application of Critical Project Management Success factors in the delivery process.

2. LITERATURE REVIEW

Intellectual capital is defined as intellectual material-knowledge, information, intellectual property experience that can be put into use to create wealth (Stewart 1997), and function as the roots for future earning capabilities (Edvinsson and Malone,1997).

Over the past era, knowledge assets and intellectual capital have been attracting an increased amount of attention not only from academics and CEOs but from national policy makers. A new economic landscape is emerging based on intangibles or a deliberate and conscious evolution towards knowledge.

The old paradigm of Wealth of Nations might have been focused on tangible assets. Today and more practicably in the 21st century era, spending on micro economic level in nations for health, education, research, and development is prioritized and giving more attention. At the national level, this is somewhere between 7% and 20% of the GDP (Corrado et al, 2009). Every innovative step starts with a small spending on intangibles, sometimes this is referred to as soft dimensions such as culture and values (Japanese economy used the term soft economics in the 1980's).

Today, METI, (Ministry of Economy Trade and Industry) in Japan is calling this Intellectual Asset-based Management. The knowledge gap or ignorance of intangibles is still huge, so new perspectives and metrics for mapping are needed. The global financial meltdown with substantial amount of money circa 7300 billion Euros to cover losses and rescue institutions highlighting new systemic understanding. This understanding is based on the insights of investment handling and cultivation of intangibles. This is what is generally known as Intellectual Capital.

In recent years, intangible assets such as knowledge, patents and innovation have been acknowledged as essential sources of wealth and advancement and still evolving. These assets represent a major concern for business firms and their stakeholders (Garcia- Ayoso, 2003). Majority of intellectual capital studies have been analyzed particularly from the interests of business firms and from different perspectives, such as to explain the difference between accounting value and market value as a possible basic source of competitive advantage in companies (Bontis, 2001; Edvinsson, 2002) and the influence of intellectual capital on firm performance (Smriti and Das, 2018; Bayraktaroglu et al., 2019).

Drucker predicts the emergence of a society dominated by knowledge-based possessions, as well as a competitive landscape in the allocation of intellectual capital (Bontis,2004). In addition to studies conducted in firms, Sweden and Denmark have conducted several national assessments of intellectual capital.

In some models, social capital is included in the NIC structure (Navarro et al., 2011, Kapyla et al., 2012). Social capital is knowledge derived from social relationships and networks, and it reflects the characteristics of norms and institutions found in the national intellectual capital structure (Jaganjac et al., 2018).

Over the past few decades, intangible assets, or intellectual capital such as knowledge, patents, and innovation, have been identified as fundamental sources of wealth and progress. These assets represent a major concern for business firms, their stakeholders, as well as for policy makers (Garcia-Ayoso, 2003).

Human capital is defined as knowledge, wisdom, expertise, intuition, and individuals' ability to carry out national tasks and goals. It also includes the values encapsulated within the context of the nations' culture and philosophical underpinnings. A nation's total capabilities are reflected in educational investment and institutions, knowledge economy, wealth, diversity of experience, motivation, intuition, enterprise development, and expertise. Furthermore, a highly skilled labour force, the availability of Scientists and Engineers, a female labour force, and good health are all advantages (life expectancy). These elements are critical success factors in developing a nation's competitive edge in the present and future. Human Capital provides resources for the development and creation of other intellectual assets such as Research and Development.

Market capital is defined as the total assets embodied in a country's relationship with the global market. It is the sum of a country's competencies and successes in providing and attracting competitive solutions to the needs of global clients because of the country's investments and achievements in foreign relations, as well as its exports of premium products and amenities (Bontis, 2004). Customer or national loyalty, openness to globalization, flexibility and adaptability, economic resilience, and satisfaction expressed by strategic customers and national trading partners are among the assets under consideration.

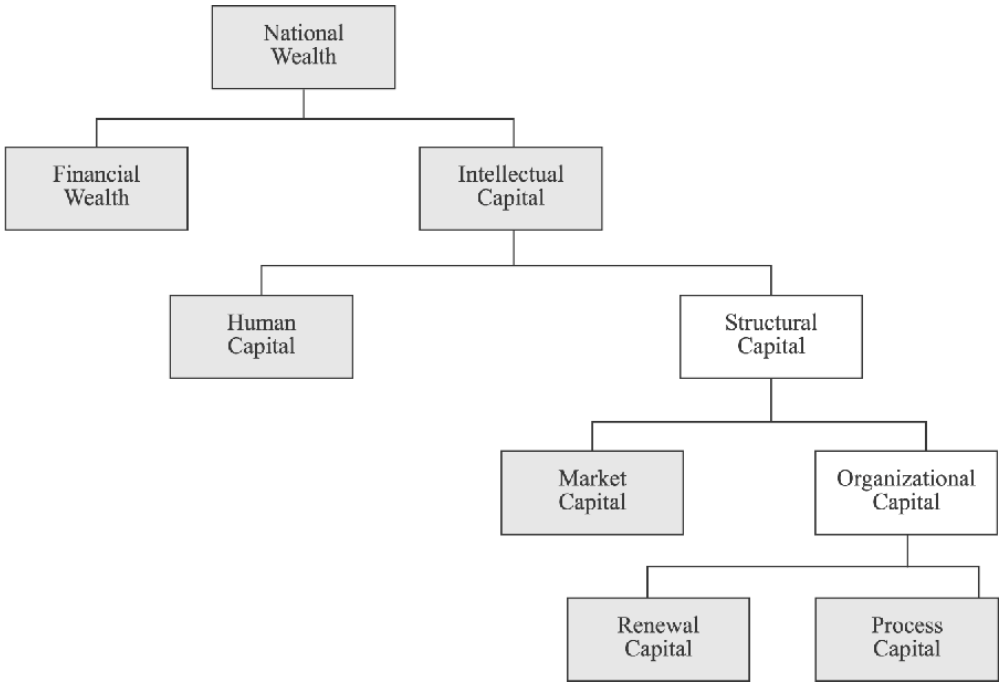
National process capital encapsulates knowledge at the country level that is entrenched in the country's substructure with the goal of supporting company competitiveness; driving public sector efficiency in governance; intellectual property rights protection; and capital availability (Edvinsson and Lin, 2011). Such structural intellectual assets sustain and increase human capital Renewal Capital refers to a country's capabilities and real investments to boost its competitiveness in future markets, which inspires future growth. Renewal and development assets include investments in R&D, patents, trademarks, start-up companies, the number of scientific publications, patents, R&D, and innovation capacity. Financial capital (financial wealth) is related to GDP, external debt, industrial production, and inflation by major traders, output.

Organizational capital is a subset of intellectual capital that focuses on the intangible value present characteristics of an organization because of its employees' efforts to transfer their knowledge to the company. Structural capital is one of the three main constituents of intellectual capital and consists of the organization's supportive infrastructure, processes, and databases that enable human capital to function efficiently.

The value of an enterprise is derived from the techniques, processes, and programs that implement and improve the delivery of goods and services.

There are numerous studies on national intellectual capital conducted by various authors worldwide. Figure 1 depicts a typical Nick Bontis Intellectual Capital schematic.

Figure 1. | Typical Intellectual Capital Schematic (Bontis, 2001)



The National Capital (NIC) analysis (Edvinsson and Yeh Yun Lin, 2018) found a strong correlation between intellectual capital and GDP per capita for forty countries from 1995 to 2018.

According to an analysis of capital structure in 115 countries (The World Capital, 2011), the share of intangible capital in total wealth ranges between 80% and 90%. Human capital is the most important intangible resource in developed countries. In the case of developing countries, the quality of institutions, legacies, and history all play a significant role in creating a high human capital potential (Jaganjac et al., 2018).

Connections between housing and social capital can be examined from several directions. First, the way in which housing is affected by social capital accumulation/depletion is an area for investigation. To what extent do changes in housing tenure, the development or decline of housing stock or the identification of policy issues around housing follow from the growth or decline of social capital? Second, the way in which social capital formation is affected by housing

policy and practice is equally of concern for research in this field. Does housing impact on social capital and how can this effect be understood? Third, what is the relationship between these two dynamics, and how can the interplay between housing and social capital be identified and examined?

Salvaris (2000) examines a variety of studies to advance new indicators of development in social and community life in Australia and around the world (a total of 52 projects are identified). Salvaris demonstrates that, despite differences in approaches, there are some key points of agreement in the criteria to be used in the development of indicators for social and community "progress" and "well-being." Local participatory processes; social inclusion; a comprehensive approach to 'community health'; trust and stronger communities; and open democratic processes that provide greater accountability and opportunities for citizen participation in governance are examples of these. These criteria are strikingly like some of the elements in Putnam's (1993) definition of a "civil society," and, like Putnam's ideas, provide a broad framework for analysis and debate. However, as Salvaris (2000) notes, indicators at the level of communities 'are certainly context specific ,'Salvaris' goes further on to demonstrate, many indicators therefore focus on particular aspects of community progress and well- being, for example 'sustainability' (such as the connections between economy and environment), 'local democracy' (such as the development of participatory processes of local governance) or 'quality of life' (such as an integrated audit of economic, environmental, democratic and personal welfare issues).

Other recent debates, for example, (Dalton, 1996; Marsh & Mullins, 1998) have also suggested that the links between housing and questions of citizenship and social participation have not been as fully developed as other areas of social policy and practice. Marsh and Mullins (1998, p. 749) note that in the UK, housing was identified in the late 1990s as one of the government's priorities in addressing long-standing problems of social disadvantage. As in other areas of policy research in the UK, the concept of 'social exclusion' has been used as the primary framework for analysis. This represents a major shift in housing research as, according to Room (quoted in Marsh & Mullins, 1998, p.752), the previous emphasis in housing research has been on disadvantage. Studies on shortcomings have tended to focus on the analysis of social distribution (for example, in looking at levels of income), while attention to social exclusion raises questions of social relation (such as social integration or relationships of social power). For this reason, using the concept of 'social exclusion' may refocus attention to the ways in which housing is seen within a more complex understanding of social structures and relations, such as those of socio-economic class, race and ethnicity, and gender. Attention to the dynamics of social relations from this perspective has led to a further debate about the connections between the processes of social exclusion and housing (as well as in other areas of social policy) (McGregor & McConnachie,1995; Goodlad, 1997; Marsh & Mullins, 1998; Somerville, 1998; Lee & Murie, 1999).

Some writers about social exclusion in housing (McGregor & McConnachie, 1995; Lee & Murie, 1999) see this to scrutinize the greater complexity of housing issues (especially tenure, mobility, and community development). McGregor and McConnachie (1995), for example, suggest that housing programmes and expenditure can be used as a basis for enhancing local employment, developing local leadership, and so increasing local economic capacity. The management of such programmes is crucial, so that, for example, builders do not simply import labour and export the economic benefit. Where inclusive practices, such as the hiring of local labour for building and renovation are achieved, the benefits for a community spread out beyond the immediate gain of new or improved housing stock because they enhance the inclusion of people in these areas with wider social relations. Instances of such gains to which McGregor and McConnachie (1995) refer to include the enhancement of local economic capacity, and the potential for the involvement of local community members in forming plans, leading to the empowerment of knowledge and skill at community level and providing opportunities for community leadership to develop. In addition, Lee and Murie (1999) advance the idea that processes of inclusion and exclusion are the key variables in considering the relationship between mobility and stability, and the ways in which this dichotomy (mobility/stability) is linked to economic marginalization. Such an analysis suggests that residential mobility, as an aspect of inclusionary/exclusionary social processes in housing, should be seen as a crucial element in social capital formation, and in turn as an indicator of community strength.

Given the reputation of housing, many stakeholders were interested in social capital data that may inform public housing policy. Data that quantify the level of social capital in communities where public housing is located would be most useful. Data of this type may be used for purposes such as siting and design of community and public housing, to encourage social interaction in the community. It may also be used in the development of business cases for community and urban renewal programs and gentrification.

To achieve social sustainability, social capital is expected to be one of the non-physical contributory factors. Social capital exists among members of the society and can promote cooperation and a feeling of solidarity. Unlike physical or human capital, social capital is engendered by relationship and interactions amongst people. In the context of housing and National Intellectual Capital, there are three types of social capital that are related: bonding, bridging, and linking.

Bonding social capital refers to connections between people of similar demographic backgrounds, whereas bridging social capital refers to connections between

people of different demographic backgrounds. Aside from these two types of social capital, a link to an influential figure is another type of social capital. As a result, a place for people to meet and interact is critical to the development of social capital, particularly bonding social capital.

The OECD and the British Office of National Statistics, for example, adopted Healy and Cote's (2001) definition of social capital as networks of shared norms, values, and understanding that facilitate cooperation within or among groups. According to the World Bank (2004), social capital refers to institutions, relationships, and norms that influence the quality and quantity of social interaction. Social capital is more than the sum of a society's institutions; it is the glue that holds them together.

An empirical relationship between social sustainability and social capital has also been discovered. People who live in a neighbourhood with a lot of social capital are less likely to leave because long-term residents are important for social sustainability. Theoretical studies in urban policy suggest that social capital can influence social sustainability and housing. There are several empirical studies regarding the bearing of neighbourhood-built environment on social sustainability.

Most people have focused on density as a key neighbourhood-built environment factor related to social sustainability. The density disorder, neighbourhood maintenance, perceived environment quality, and parks are all suggested to be related to housing sustainability.

Nonphysical factors, such as social capital, are linked to physical factors, as previously stated. Social capital is more than just the sum of people's abilities or capital. It is recognized through interactions and exists in social networks. Thus, space for communication is required in the advancement of social housing sustainability, and this highlights the environment in developing social capital in the neighbourhood. Many studies have discovered a link between social capital and the environment.

Similarly, studies at various scales have discovered a significant relationship between social capital and the environment. Leyden et al. (2014) discovered a link between walkable urban form and social capital. According to the findings of this study, macro-scale factors such as land use, density, neighbourhood type, and proximity have a relationship with social capital. Thus, National Intellectual Capital has a nexus in the housing sustainability value chain.

The housing sector has always been regarded as an important component of any economy and a key indicator of the economy's health. The construction industry typically accounts for 6-12% of an economy's GDP. In Australia in 2009, the residential sector accounted for approximately $70 billion (USD), and from 2000 to 2009, the average spend in the construction industry was 47% of total spend (ABS2010), which is not common in many countries.

According to research, not much has been done in national intellectual capital and housing in Nigeria, despite the nexus and importance of the application of intellectual capital to drive housing sustainability, engender nation building, and leverage such competitiveness and comparative advantage in the areas of policy formulation, capacity building, end user satisfaction, novel finance models, and partnerships.

3. APPLICATION OF STRUCTURAL EQUATION MODELLING (SEM)

Authors, notably Fernades (2012) and Hair et al. (2012), have described SEM as a second -generation multivariate analysis approach that brings together the attributes of the first- generation methods, such as PCA and Linear Regression Analysis.

Because of SEM's uniqueness, researchers can test entire theories, concepts, and complex models by estimating the composite relationship between the variables (Gil-Garcia, 2008).

The SEM technique for modelling can be covariance-based SEM(CB-SEM) or variance based partial least square SEM(PLS-SEM). According to Henseler et al. (2014), CBSEM is a confirmatory technique that focuses on the model parameters theoretically to estimate the relationships and aims at reducing the discrepancies between simple covariance matrices. The PLS -SEM is a predictive approach which aims at expanding the explained variance by focusing on the endogenous target construct in the model such as R2 value (Hair et al., 2012; Henseler et al., 2014).

It is important to note, however, that some studies on sustainability and housing have used different statistical techniques for model development, such as linear and multiple regressions. Thus, the PLS-SEM technique was used in this study, which is a multivariate technique that allows for the exploration of a set of relationships between one or more outcome variables, either continuous or separate. Furthermore, the PLS-SEM technique is used because it is thought to be a superior technique for refining and developing theoretical models, which is the focus of this study (Robsin, 2012, Hair et al., 2012, Henseler et al., 2014).

3.1. Modelling Filing and Analysis Using Partial Least Square Regression Analysis

To access the measurement capacities of the explanatory variables and the predictive strength of the model, the measurement model for this study was developed using Smart PLS 3 software. To obtain the measurement model results, all possible structural relationships between the constructs were drawn, and the reflective indicator of the constructs was changed from red to blue, indicating that all constructs have some degree of relationship with each other.

After determining that there is some relationship between the constructs, the PLS algorithm was used to compute the standardised regression rate, factor loadings, and the percentage variance (R2 value) explained by the explanatory variables. Variable items with low factor loading (0.4) were removed after the first iteration of the latent variable because their contribution to the model was deemed insignificant. However, because 0.4 was used in the PCA analysis reported in the previous section of this thesis, this study considers 0.4 as the factor loading threshold.

Individual item reliability on the latent constructs was also investigated. Table 1.0 displays the reliability results. The results show that the measures are robust in terms of internal consistency reliability, as demonstrated by the composite reliability. The composite reliabilities of the various measures range from about 0.85 to 0.93, which is higher than the recommended threshold value of 0.70. The greater the factor loading, the greater the variance shared by the latent variables and their indicators. Convergent validity was evaluated using the Average Variance Extracted (AVE) for each construct to evaluate the agreement between two or more construct variables.

When AVE is less than 0.50, the variance due to measurement error is greater than the variance captured by the construct, according to standard. If the AVE is greater than 0.5, convergence is achieved. Table 1 shows that, based on the AVE and Composite Reliability (CR) results, all constructs converged above the 0.5 and 0.7 thresholds for Average variance extracted and Cronbach's Alpha, respectively.

The elements in the matrix diagonals, which represent the square roots of the AVEs, are always greater than the off-diagonal elements in their corresponding row and column, indicating that the scales used have discriminant validity. The results, however, suggested higher factor loadings, and the constructs showed adequate shared variance with their indicators. As a result, the model has acceptable reliability and validity in explaining and predicting the model's construct links.

Table 1 | Latent variables inter construct correlation and reliability measure

	AVE (AVERAGE] VARIANCE EXTRACTED	COMPOSITE RELIABILITY	R SQUARE	CRONBACH'S ALPHA	CRT	DEV	INT	SUST	IMP
CRT	0.513	0.826	0.386	0.810	1				
DEV	0.669	0.754	0.591	0.752	0.507	1			
INT	0.637	0.906		0.904	0.530	0.769	1		
SUST	0.586	0.803	0.771	0.824	0.619	0.838	0.737	1	
IMP	0.613	0.915	0.529	0.909	0.597	0.669	0.697	0.712	1

3.2. Modelling and Filling

Variables for the model development were selected after critical analysis of data conducted in this study. These variables were the variables that contributed significantly to their individual construct. The details of the variables for the model development are displayed in Table 2. After reliability test of the item listed in the table above, some of the listed factors or variable were dropped for stronger and better model to be achieved. Thus, new set of latent variables construct for the model emerged and is presented in Table 3.

3.3. Measurement of Modelling Results

The convergent validity was tested by linking together the endogenous latent constructs in the model through Smart PLS-graph, to extract the factor and cross loadings of all indicator items to their respective latent constructs. The measurement model results, presented in Table 4 shows that all items loaded on their respective construct from a lower bound of 0.50 to an upper bound of 0.88, and more highly on their respective construct.

Convergent validity was tested by connecting the model's endogenous latent constructs via Smart PLS-graph to extract the factor and cross loadings of all indicator items to their respective latent constructs. Table 1.4 displays the measurement model results, which show that all items loaded on their respective construct from a lower bound of 0.50 to an upper bound of 0.88, and more highly on their respective construct.

Table 5 display the path coefficient which shows the contribution of each latent explanatory construct to the predictive ability of the endogenous construct. The coefficient shows that the endogenous constructs have positive contributions towards each other and the R2 value was calculated, and the results show that the R2 values of the endogenous constructs are above 10% which is acceptable, (Fornell & Lacker, 1981, Henseler, et al, 2014).).

Table 2 | Conceptual model latent variables

Latent variable Construct	Measurement variable
Sustainability	Detailed cost-benefit analysis assessment Favourable investment environment Stable macro-economic conditions Government acceptance of private-sector profit-seeking

	Effective utilisation of government-owned land
National Intellectual capital	Government and community structures Public awareness and understanding Lead agency arrangement Participation in global agendas Regulatory framework Policies and strategies Coordination mechanisms Programming Mainstreaming Participation and partnership Knowledge management
Critical management success factors	Client involvement Authority of the project manager/leader Top management support Realistic cost and time estimates Information/communication Planning Competent project team Project mission/common goal Monitor performance and feedback Adequate project control Problem solving abilities Project understanding Risk management Adequate resources
Strategic import of public-private partnership	Saves housing development costs and lowers taxes Encourages output-based contracts Timely delivery of project within budget Enhances public management Increases efficiency of the government's investment Risk sharing Ensures the transfer of skills Makes the country more competitive Boosts business and industry associated with infrastructure development Supplements limited public sector capacities development Extracts long term value for money
Factor influencing the development of PPP	Commitment of public/private sectors Nature of contractual agreement Sound economic policy Alignment with government's strategic objectives Identification and understanding of client/owner requirement Clear and precise briefing document Feedback from completed projects High cost of acquiring land Long period of processing planning approval Lack of access to long-term finance Absence of a mortgage-market infrastructure Lack of longer-term mortgage-based finance system

Table 3 | New Conceptual model latent variables

Latent variable Construct	Measurement variable
Sustainability	Detailed cost-benefit analysis assessment Favourable investment environment Stable macro-economic conditions Government acceptance of private-sector profit-seeking Effective utilisation of government-owned land
National Intellectual capital	Government and community structures Public awareness and understanding Policies and strategies Coordination mechanisms Programming Mainstreaming Participation and partnership
Critical management success factors	Realistic cost and time estimates Information/communication Planning Competent project team Project mission/common goal Adequate project control
Strategic import of public-private partnership	Encourages output-based contracts Enhances public management Increases efficiency of the government's investment Makes the country more competitive Boosts business and industry associated with infrastructure development Extracts long term value for money Imposes budgetary certainty
Factor influencing the development of PPP	Commitment of public/private sectors Clear and precise briefing document Feedback from completed projects

Table 4 | Path coefficient of the constructs

	Critical management success factors	Factors Development of PPP	National intellectual capacity	Sustainability	strategic import of PPP
CRT10	0.634	0.279	0.366	0.378	0.462
CRT4	0.561	0.313	0.3	0.178	0.317
CRT5	0.746	0.429	0.566	0.469	0.499
CRT6	0.768	0.403	0.367	0.55	0.398
CRT7	0.811	0.413	0.37	0.635	0.457
CRT8	0.734	0.287	0.228	0.307	0.378
FACT14	0.45	0.852	0.724	0.661	0.527
FACT15	0.334	0.822	0.726	0.651	0.516
FACT4	0.465	0.779	0.428	0.747	0.602
INT1	0.453	0.564	0.760	0.62	0.621
INT10	0.465	0.725	0.888	0.634	0.526
INT2	0.344	0.509	0.717	0.575	0.661
INT6	0.463	0.525	0.789	0.532	0.597
INT7	0.459	0.656	0.796	0.702	0.544
INT8	0.454	0.697	0.808	0.534	0.523
INT9	0.317	0.608	0.821	0.486	0.422
PP10	0.451	0.379	0.364	0.479	0.742
PP11	0.398	0.496	0.453	0.435	0.799
PP13	0.377	0.559	0.631	0.634	0.764
PP2	0.601	0.555	0.423	0.566	0.686

PP5	0.381	0.434	0.483	0.445	0.762
PP7	0.445	0.599	0.502	0.658	0.818
PP8	0.504	0.588	0.732	0.601	0.848
PP9	0.556	0.515	0.678	0.573	0.829
SUB1	0.585	0.532	0.524	0.719	0.666
SUB2	0.504	0.58	0.447	0.731	0.545
SUB3	0.464	0.512	0.428	0.758	0.341
SUB4	0.408	0.762	0.681	0.780	0.638
SUB5	0.467	0.766	0.682	0.835	0.488

Figure 2. | Structural model with Path coefficient and R-square values

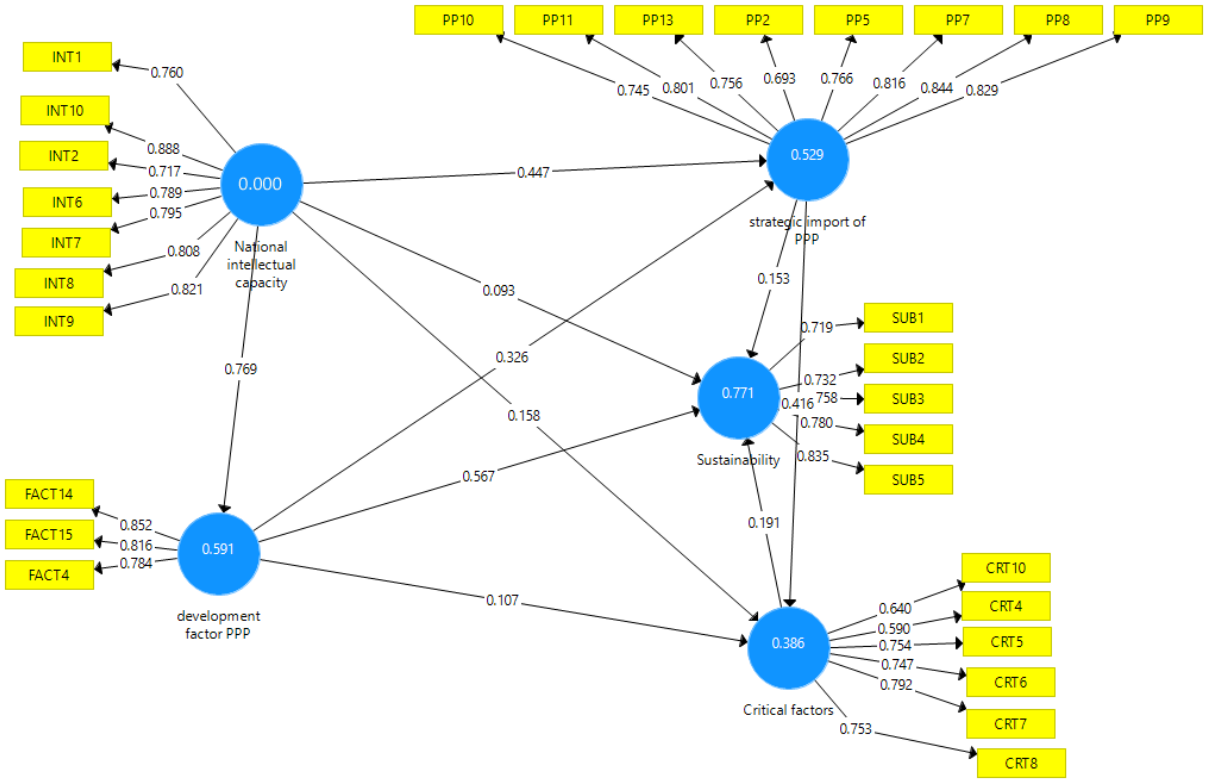
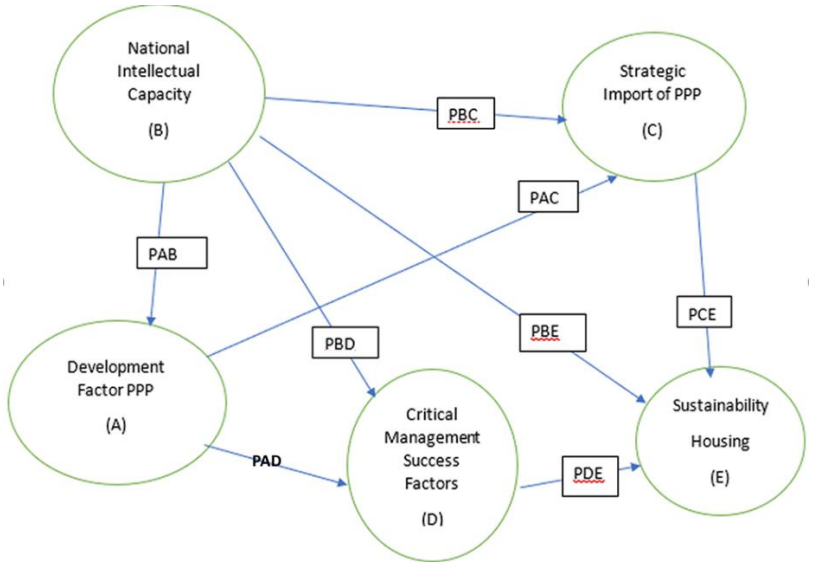


Figure 3. | Model for sustainable housing project objectives aligned with the constructs (see Appendix)



Smart PLS employs the "bootstrapping" technique to test the significance of PLS-SEM paths and resample the cases to determine the variable significance level. As a result, bootstrapping was used with 500 resamples to determine the significance level of the variables in this study.

Table 5. presents the results of T-statistics and Figure 2 shows the structural model with the path coefficients and T-statistics. The underlying assumption is that if the resultant empirical t-value is above 1.96, it shows that the path coefficient is significant at 5% significance level; when the t-value is above 2.57, it is significance at 1% and when the t-value is above 1.65, it is significant at 10%. In addition, each item's factor loading on its respective construct was highly significant (p-value < 0.001) as indicated by the t-statistics of the outer model loadings.

The structural model depicted in Figures 2 and 3 shows how the latent constructs interact with one another. Endogenous and exogenous variables are the two types of latent variables. Endogenous variables have both incoming and outgoing causal variables, whereas exogenous variables are variables produced by variables outside the model and whose function is to provide explanations for variables within the model.

National intellectual capacity is the exogenous variable in the structural model (Figures 2 and 3), as it has no preceding variables in the model. Because the PLS-SEM structural model is a combination of linear regressions, all the relationships are considered linear, additive, and causal.

However, the model in this study has four endogenous variables, and the PLS-SEM was used to estimate four sets of standardised coefficients. Some of the causal links hypothesized in this study are related to these PLS-SEM path equations. These represents the error terms, which indicate that the variations in the path model remain unexplained by the predicting variables. The equations are as follows:

- National intellectual capacity = INT + 0(Exogenous variable) + ε0…….1
- Development factors of PPP = INT (National intellectual capacity) + ε1 2
- Strategic import of PPP = FACT (Development factors PPP) + INT (National intellectual capacity) + ε2……. 3
- Critical project management success factors = INT (National intellectual capacity) + Development factors of PPP + Strategic import of PPP +ε3 ……4
- Achieve project objectives = PAE (National intellectual capacity) + PBE (Development factors of PPP) + PDE (Strategic import of PPP) + PCE (Critical management success factors) + ε5 ……5
- The abbreviations below represent the path coefficient shown in figure 1.2.
- Development factors of PPP -> National intellectual capacity…….. PAB National intellectual capacity -> Strategic import of PPP … PBC
- Development factors of PPP -> Strategic import of PPP ……. PAC
- National intellectual capacity -> Achieve sustainable housing ……. PBE Housing Finance System -> Achieve sustainable housing …… PAE
- Development factors of PPP -> Critical project management success factors……PAD
- Critical management success factors->Achieve sustainable housing …… PDE
- Strategic import of PPP -> Achieve sustainable housing …….. PCE

3.4. Model Evaluation

The R2 value was used to evaluate the PLS path model. This is because R2 gives or estimates the prediction's strength, and non-parametric assessment criteria, as well as resampling techniques, are used to evaluate the adequacy or fitness of PLS model structures (Chin, 2010). As a result, in this study, R2 value was used as a criterion to predict the model's significance or fitness. It is important to note that there is no overall goodness of fit of the model in Smart PLS Path Modeling. Tenenhaus et al. (2004), as cited in Henseler et al. (2014), proposed a global criterion of goodness of fit.

And the GoF index has been developed to consider the model performance in both the measurement and the structural model. Therefore, it provides a single measure for the overall prediction performance of the model. For this reason, the GoF index is obtained as the geometric mean of the average communality index and the average R^2 value, denoted mathematically as:

$$GoF = \sqrt{(\emptyset com \times \emptyset R^2)}$$

Where, Øcom is the average communality and $ØR^2$ is the average inner R-square value

As a result, the GoF value of 0.502 was obtained for the entire model using the GoF formula and the values which is close to 1. As a result, the study concludes that the PLS model developed in this study has a high level of explanatory power.

4. DISCUSSIONS AND FINDINGS

The thrust of this paper is to espouse the role of national intellectual capital in housing in Nigeria with the overarching remit of developing a sustainability enhancement model leveraging on advanced statistical techniques- SEM and PLS.

This has been narrowed down to two relevant research questions:

1. To what extent are critical Project Management Success Factors for sustainable housing applied in researched projects?
2. What are the levers of public-private partnerships that can be used as an intervention to achieve sustainability in housing?

In the light of the research questions highlighted, the following hypotheses were also developed:

H1: There is insufficient application of critical project management success factors in different projects.

H2: The development of public -private partnership for sustainable housing is influenced by national institutional capacity and policy.

According to the findings of this study's sustainability enhancement model, a national intellectual capital deployed for a housing project and taking factors influencing PPP development into account has a predictive power of 52.9% (R2 value: 0.529) to influence strategic import of PPP towards successful delivery of sustainable housing.

The relationships were significant and positive, implying that housing sustainability can be achieved with the help of national intellectual capital and factors influencing PPP development. The findings are consistent with those of Edvinsson and Lin (2011), who found a strong correlation between intellectual capital and GDP per capita in forty countries from 1995 to 2018. Similarly, Leyden et al. (2014) discovered a relationship between macro-scale factors such as land use, density, neighbourhood type, and proximity and social capital. National intellectual capital explained 44.7% of the contribution to strategic import of PPP used as a lever toward successful delivery of sustainable housing in the context of the study, and factors influencing PPP development explained 32.6% of the contribution to strategic import of PPP.

Considering indicators such as government and community structures, public awareness and understanding, policies and strategies, coordination mechanisms, programming, mainstreaming, and participation and partnership that contribute to national intellectual capital, as summarized by the model (path coefficient (r) = 0.447; t = 4.243), will aid in selecting or applying appropriate intellectual capital for sustainable housing projects. On factors that influence the development of PPP, as summarized by the model, commitment of public/private sectors, clear and precise briefing document, and feedback from completed projects are reflective indicators that contribute to the significance of PPP development to strategic import deployment (path (r) = 0.326; t = 2.691). As a result, the housing sector has always been regarded as an essential component of any economy.

Furthermore, the developed model revealed that national intellectual capital, factors influencing PPP development, and strategic PPP import have strong positive relationships with measures of critical project management success factors. However, the contribution of strategic import of PPP to critical project management success factor is the highest among them, exhibiting path coefficients of r2 = 0.416 and t-value = 3.995, while intellectual capacity (path (r) = 0.158; t = 1.400) and development factors influencing PPP development (path (r) = 0.107; t = 0.916).

Furthermore, the reflective indicators of increased efficiency of government investment, boosting business and industry associated with infrastructure development, and imposed budgetary certainty will aid in the successful delivery of sustainable housing because these factors can ensure a reduction in housing development costs.

As a result of combining national intellectual capital indicators with factors influencing PPP development and strategic import of PPP, predictive strength with an R2 value of 38.6% was obtained. Because this value is greater than the 10% acceptable R2 value suggested by Henseler et al. (2014), it implies that the combined effect of these indicators will result in the production of affordable houses at reasonable costs. The study backs up Kahn's (2006) contention that people who live in a neighbourhood with abundant social capital are less likely to leave. As a result, urban policy is likely to improve social capital, which can influence social sustainability and housing.

Also, the model examines the relationships that exist between national intellectual capital, factors influencing development of PPP, strategic import of PPP, measure of critical project management success factors and sustainability. The model indicates that national intellectual capital has predictive strength of 9.3% to influence achievement of sustainable housing projects by utilising and establishing: government and community structures, public awareness and understanding, policies and strategies that enhances sustainability, coordination mechanisms, programming and mainstreaming and participation and partnership, however the relationship is positive but insignificant (path (r) = 0.093; t = 1.748). The model also revealed that appropriate construction method selection has predictive strength of 37.9% to influence achievement of the aforementioned project goals. Factors influencing development of PPP has a very strong and positive significant relationship with sustainability as summarised by the model (path (r) = 0.567; t = 12.850). The results on the strategic import of

PPP indicator's predictive strength in achieving sustainable housing showed that it has 15.3% contribution, and the contribution is a positive and significant relationship (path (r) = 0.0153; t = 2.121). Lastly, the model showed that critical project management success factors indicators have a significant and positive relationship with sustainability. The predictive strength of critical project management success factors indicator is 19.1% and significant at 5% level of significance as summarised by the model (path (r) = 0.191; t = 4.890).

5. CONCLUSION

In conclusion, the sustainability enhancement model results show that the factors influencing the development of PPP indicators have very strong relationships and high predictive capabilities to influence the development of sustainable housing. Strategic PPP import and critical project management success factors, on the other hand, have weak predictive powers and significant relationships, but both have shown positive relationships. This result answers the second hypothesised statement, which seeks to determine whether critical project management success factors have been applied sufficiently in the delivery of sustainable housing. According to the outcome, it is possible that critical project management success factors have not been applied sufficiently in the delivery of sustainable housing.

Furthermore, national intellectual capital indicators showed a positive but insignificant relationship with sustainability. This implies that critical project management success factor was underutilized. This finding provides an answer to the study's first hypothesis. However, the overall predictive strength of all constructs to achieve sustainable housing achievement is strong, with an R2 value of 77.1%. This strong predictive power has supported the research proposition that a combination of the four constructs (national intellectual capital, strategic PPP import, factors influencing PPP development, and critical project management success factors indicator) could lead to the development of sustainable housing.

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APPENDIX: MODEL FOR SUSTAINABLE HOUSING PROJECT OBJECTIVES ALIGNED WITH THE CONSTRUCTS (CONT.)