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Article

Socio-economic and risk-perceptual determinants of wood-based modular housing adoption in Nigeria

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Abstract: This study investigated socio-economic and risk-perceptual determinants of wood-based modular housing acceptance, drawing on three theoretical dimensions: economic cost-benefit perception, socio-cultural attachment to masonry construction, and perceived risk of fire and pest infestation. A sequential mixed-methods design was employed, combining structured questionnaire surveys (n = 291) drawn from a population of 1,200 middle-income prospective homeowners across five major cities with semi-structured qualitative interviews (n = 25). Confirmatory factor analysis (CFA) established measurement validity: all standardized factor loadings exceeded 0.70, average variance extracted (AVE) values exceeded 0.50, and composite reliability (CR) values exceeded 0.80. SEM model fit indices (χ^2/df = 2.14; CFI = 0.947; TLI = 0.936; RMSEA = 0.063; SRMR = 0.052) all met recommended thresholds. Multiple regression and structural equation modeling (SEM) were used for hypothesis testing. Findings confirmed all three hypotheses: perceived cost-effectiveness positively predicted adoption intention ($\beta = 0.387$, $p < 0.001$); socio-cultural attachment to masonry negatively predicted adoption intention ($\beta = -0.291$, $p < 0.001$); and elevated risk perception significantly reduced adoption intention ($\beta = -0.243$, $p < 0.001$). The combined model explained 32.6% of the variance in adoption intention ($R^2 = 0.326$). Risk perceptions were shown to reflect public information asymmetry regarding the documented performance of modern fire-retardant and preservative-treated engineered timber. Grounded in Rogers' Diffusion of Innovation Theory and Ajzen's Theory of Planned Behaviour, the study proposes the Socio-Economic Acceptance of Residential Prefabrication (SEARP) Framework and provides policy and industry recommendations for advancing wood-based modular housing in South East Nigeria.

Keywords: wood-based modular housing; socio-economic acceptance; risk perception; Theory of Planned Behaviour; Diffusion of Innovation; South East Nigeria

1. Introduction

Nigeria's housing sector is confronted by a chronic structural deficit estimated at approximately 28 million residential units, making it one of the most pressing socioeconomic challenges facing the country's development trajectory [1, 2]. This shortfall is particularly pronounced in the South East geopolitical zone comprising Anambra, Enugu, Imo, Abia, and Ebonyi States, where rapid urbanization, inflationary pressures, and high construction costs have rendered conventional masonry construction financially inaccessible for the majority of middle-income households [3, 4]. Against this backdrop, wood-based modular housing has emerged as a technologically viable, economically efficient, and environmentally sustainable

alternative that merits critical scholarly attention [5,6].

Wood-based modular construction, defined as the off-site fabrication of structural residential units using engineered or treated timber panels, frames, or modules that are subsequently assembled on-site, offers compelling advantages over conventional in-situ masonry methods [7]. These include dramatically shortened construction timelines (as little as four to eight weeks compared with eight to fourteen months for masonry), significant cost savings in labour and material waste, and superior environmental credentials through reduced carbon embodied and enhanced resource efficiency [8–10]. At a time when Nigeria's year-on-year inflation rate has persistently exceeded 30%, rendering prolonged construction schedules economically catastrophic for middle-income homebuilders, the speed advantage of modular construction constitutes a powerful economic incentive [1].

Despite these documented advantages, the adoption of wood-based modular housing in South East Nigeria remains negligible. Three interrelated barriers appear to be structurally significant: first, the perceived cost-benefit calculus of middle-income earners, who may be unfamiliar with lifecycle savings from modular methods; second, deeply entrenched socio-cultural perceptions that associate masonry construction with social prestige, permanence, and the fulfilment of Igbo-specific social obligations around homeownership [4,11]; and third, risk perceptions centred on the vulnerability of timber structures to fire outbreaks and termite infestation in the humid tropical climate of South East Nigeria [12,13].

The academic literature on this subject is characterized by a pronounced geographical imbalance. Empirical studies on the socio-economic determinants of timber construction acceptance have been conducted predominantly in Australia, Northern Europe, Malaysia, and North America [8,14–16], with comparatively sparse attention devoted to Sub-Saharan African contexts. Studies specific to South East Nigeria are virtually absent, representing a critical research lacuna given the region's distinctive socio-cultural context, climatic conditions, and economic vulnerabilities. This study addresses this gap.

Grounded in Rogers' [17] Diffusion of Innovation (DOI) Theory and Ajzen's [18] Theory of Planned Behaviour (TPB), this study examines the extent to which economic, socio-cultural, and risk-related factors determine the willingness of prospective middle-income homeowners in South East Nigeria to accept wood-based modular housing. The study employs a sequential mixed-methods design integrating structured surveys with qualitative interviews across five major urban centres: Enugu, Onitsha, Owerri, Aba, and Abakaliki.

1.1. Research questions

RQ1 (Economic Dimension): To what extent is the perceived cost-benefit ratio (encompassing construction speed, material savings, and inflation protection) associated with the intention of middle-income earners in South East Nigeria to adopt wood-based modular housing?

RQ2 (Socio-Cultural Dimension): How do traditional cultural perceptions of 'prestige' and 'permanence' associated with masonry construction affect the social

acceptance of timber-based residential structures in South East Nigeria?

RQ3 (Risk Perception Dimension): What is the association between perceived vulnerability to fire outbreaks and termite infestation and the willingness of prospective homeowners in South East Nigeria to invest in modern wood-based modular technology?

1.2. Research hypotheses

H_1. *There is a significant positive relationship between the perceived cost-effectiveness of modular wood construction and the willingness of respondents to adopt the technology.*

H_2. *Socio-cultural attachment to concrete and block structures as symbols of social status and durability significantly and negatively predicts the acceptance of wood-based modular housing.*

H_3. *High levels of perceived risk regarding fire safety and pest durability significantly decrease the intention to adopt wood-based modular housing, even when the economic benefits are clearly understood.*

2. Literature review

2.1. The housing deficit crisis in Nigeria and the role of alternative construction

Nigeria's housing sector is characterized by chronic supply deficits, escalating construction costs, and a persistent mismatch between housing needs and financial capacity. Nwachukwu et al. [1] documented that Nigeria's housing deficit stands at approximately 28 million units, with annual demand for new residential units estimated at 700,000. With inflation rates rising to 33.95% in May 2024 and mortgage interest rates persistently above 18%, conventional masonry construction has become increasingly inaccessible to middle-income earners, who constitute approximately 13% of the population [2]. Ogundipe et al. [3] identified seven key clusters of inhibiting factors in affordable housing provision in Lagos, including problems with conventional materials and technologies, socioeconomic constraints, and the absence of innovative frameworks, findings that have direct transferability to the South East context.

The imperative to explore alternative construction methodologies in Nigeria is buttressed by the work of Moore [19], who traced the origins of Nigeria's housing deficit to structural failures in mortgage systems, institutional weaknesses in housing policy, and the prohibitively high cost of imported building materials. Ale [20] demonstrated that shared homeownership schemes employing quality materials and modern construction approaches showed notable promise for low-to-medium income earners in Akure. The recurring theme across these Nigerian-focused studies is that cost innovation in construction materials and methods is an indispensable precondition for meaningful progress in affordable housing delivery.

2.2. Wood-based modular construction: Global evidence

Wood-based modular construction has achieved significant market penetration in developed economies. In the United States, Canada, Australia, and Northern Europe, timber frame construction accounts for between 27% and 90% of all new residential housing stock [12, 14]. The global cross-laminated timber (CLT) market, valued at approximately USD 1.9 billion in 2025, is projected to grow to USD 4.38 billion by 2030, driven by increasing investments in sustainable, low-carbon construction and rapid growth in off-site construction modalities [21]. Laguarda Mallo and Espinoza [8] found that CLT's primary perceived benefits among architectural communities include favourable environmental performance, structural performance comparable to reinforced concrete, and outstanding aesthetic properties, though fire performance and high maintenance costs were cited as leading perceived disadvantages.

In developing country contexts, research has documented both the potential and the structural barriers to modular adoption. Saad et al. [9] conducted a PLS-SEM analysis of 314 construction specialists in Malaysia and found a moderate positive correlation between the removal of off-site modular construction adoption barriers (resource availability, process management, and issues/perceptions) and sustainable construction outcomes ($\beta = 0.316$), underscoring the significance of perception management. Saad et al. [9] further highlighted that countries such as Singapore and Denmark have achieved modular construction rates of 30–40% through enabling policies and financial incentives. A fuzzy-SEM framework study of modular construction barriers in Egypt and developing economies identified fragmented supply chains, lack of skilled labour, and high upfront capital costs as the most critical impediments [22], with Nigeria specifically mentioned as a country in the embryonic stages of modular adoption.

2.3. Timber housing perceptions in African contexts

In Sub-Saharan African contexts, timber is frequently perceived as a low-status material associated with informal housing, rural poverty, and vulnerability to environmental hazards. The Food and Agriculture Organization [12] documented a pervasive social prejudice against wood as a house-building material in developing countries, noting that it is regarded as a material for the less well-off because of its common use in shanty towns, its association with lesser durability, and its perceived fire risk. In the South African context, Hassan and Grobbelaar [23] found that timber is often associated with lower socioeconomic circumstances and is deemed suitable primarily for small, low-cost structures, thereby projecting it as a temporary option rather than a permanent family home. These negative perceptions persisted even among respondents who acknowledged timber's environmental sustainability advantages, structural weight-to-strength ratio, and construction speed benefits.

Perceptions of timber construction in Nigeria are shaped by the historical evolution of construction practices. The shift from traditional Igbo mud-and-thatch architecture to concrete-block construction occurred rapidly in the post-colonial and post-civil war era, with concrete becoming deeply associated with social reconstruction, economic success, and permanence [11, 24]. The Igbo mansion tradition, characterized by

elaborate concrete, granite, and marble structures built in ancestral villages, explicitly uses construction materials as symbols of economic achievement, social status, and community recognition [25, 26]. The tradition of building with permanent materials among South East Nigerians is not merely an aesthetic preference but a social institution, creating structural normative pressure against alternative construction materials.

2.4. Fire safety and risk perception in timber construction

Risk perception constitutes a critical psychological barrier to timber housing adoption. Menzemer et al. [13] conducted a comprehensive survey and interview study on public fire risk perception of timber buildings, documenting that timber structures are systematically associated with elevated fire risk in public consciousness, even where objective fire performance data contradicts this perception. The study documented that people's risk consciousness, perception, and mitigation behaviour are all affected by the material of construction, with timber generating higher anxiety than masonry or concrete. Kremer and Symmons [27] analyzed data from 6,019 Czech respondents and found that while timber is frequently associated with concepts of nature and tradition, concerns about fire safety, durability, and the material's suitability for multi-storey structures persist across multiple consumer segments, with a substantial neutral segment of 43% exhibiting hesitancy about timber housing.

In tropical and humid climates, the risk perception challenge is compounded by documented susceptibility of untreated timber to termite infestation and fungal decay [12]. However, modern fire retardant treatments and pressure-impregnated preservative systems have effectively addressed these vulnerabilities in contemporary wood-based construction [28]. Proponents argue that properly treated and engineered timber exhibits predictable, controlled fire behaviour, with mass timber exhibiting char layers that protect structural integrity during fire events [29]. The gap between perceived risk and actual performance risk represents a key information asymmetry that public education and policy intervention need to address.

2.5. Economic drivers of construction technology acceptance

The economic dimension of construction technology acceptance is multifaceted. Kakkar et al. [30] assessed the market potential for US-manufactured system-built wooden homes as affordable housing alternatives in Latin American developing economies and found that while resistance to acceptance was documented, the speed and cost advantages of prefabricated wood construction offered compelling pathways to new market development. For South East Nigeria, where construction inflation is structurally compounded by foreign exchange volatility on imported cement, steel, and granite, the ability to complete a residential unit in four to eight weeks (modular) versus twelve to sixteen months (masonry) represents a quantitatively significant economic advantage that may override cultural biases among economically rational actors.

Judge et al. [16] employed the Theory of Planned Behaviour to predict intentions to purchase sustainable housing, finding that perceived cost-benefit considerations, combined with subjective norms and perceived behavioural control, collectively predicted sustainable housing purchase intentions. Their findings

support the integration of both economic and social-psychological constructs in any comprehensive model of construction technology acceptance—a design choice reflected in the theoretical framework of the present study.

2.6. Summary and research gap

The reviewed literature consistently identifies three interacting categories of determinants for wood-based construction acceptance: economic (cost, speed, lifecycle value), socio-cultural (status, permanence, community norms), and risk-related (fire, pests, structural durability). While these dimensions have been studied individually in Western, Malaysian, and South African contexts, no study has simultaneously modelled all three dimensions within a South East Nigerian context. This study addresses this gap by developing and empirically testing an integrated model of acceptance using robust quantitative and qualitative methodologies, thereby generating actionable, context-specific knowledge for policymakers, developers, and the timber industry in Nigeria.

3. Theoretical framework

3.1. Diffusion of Innovation (DOI) Theory

Rogers' [17] Diffusion of Innovation Theory provides the overarching conceptual architecture for this study. Rogers defines diffusion as the process by which an innovation is communicated through certain channels over time among the members of a social system. The theory posits five innovation attributes that determine the rate of adoption: (i) relative advantage; the degree to which an innovation is perceived as better than the alternative it supersedes; (ii) compatibility; the extent to which the innovation aligns with existing values, experiences, and needs of potential adopters; (iii) complexity; the degree to which the innovation is perceived as difficult to understand and use; (iv) trialability; the extent to which an innovation can be experimented with on a limited basis; and (v) observability; the degree to which the results of adopting an innovation are visible to others.

In the context of wood-based modular housing in South East Nigeria, relative advantage maps onto the economic cost-benefit dimension (RQ1), while compatibility directly speaks to the socio-cultural attachment dimension (RQ2). Complexity and risk aversion are theoretically linked to risk perception (RQ3), as innovations perceived as complex or unfamiliar generate heightened risk awareness. Zhong and Gou [31] applied DOI theory to study CLT adoption by architects in China and found that observability had the most significant impact on adoption intention, followed by trialability and riskiness; a finding with important implications for awareness campaign design in the Nigerian context. The DOI framework has also been validated in residential construction technology diffusion contexts in the United States [32,33].

3.2. Theory of Planned Behaviour (TPB)

Ajzen's [18] Theory of Planned Behaviour posits that individual behaviour is proximally determined by behavioural intention, which is itself shaped by three

constructs: (i) attitude toward the behaviour—a positive or negative evaluation of performing the behaviour; (ii) subjective norms—perceived social pressure from important referents to perform or not perform the behaviour; and (iii) perceived behavioural control—the perceived ease or difficulty of performing the behaviour. The TPB has been extensively validated in sustainable housing adoption contexts. Judge et al. [16] used the TPB to predict sustainable housing purchase intentions in Australia, while Wang et al. [34] applied a TPB-TAM integrated model to predict BIM adoption by owners in the construction industry, confirming the primacy of subjective norms in professional and social contexts.

In the present study, TPB constructs map onto the research dimensions as follows: (i) attitude maps onto cost-benefit perception (H_1)—a positive economic evaluation of modular wood construction is expected to generate favourable adoption attitudes; (ii) subjective norms map onto socio-cultural attachment (H_2)—the normative expectation within South East Nigerian communities that permanent homes must be constructed of concrete and block constitutes a powerful negative subjective norm against timber adoption; and (iii) perceived behavioural control is moderated by risk perception (H_3)—high perceived risk from fire and pests reduces the sense of control and thereby suppresses adoption intention.

3.3. Integrated framework: The socio-economic acceptance of residential prefabrication (SEARP) framework

Drawing on the complementary strengths of DOI and TPB, this study proposes the socio-economic acceptance of residential prefabrication (SEARP) Framework as an original theoretical contribution. The SEARP Framework posits that adoption intention for wood-based modular housing is jointly determined by: (i) an economic pathway, whereby perceived cost-effectiveness and construction speed savings generate a positive relative advantage assessment (DOI) and a favourable attitude (TPB); (ii) a socio-cultural pathway, whereby compatibility with existing values (DOI) and subjective norms about prestige and permanence (TPB) exert negative modifying effects on adoption intention; and (iii) a risk pathway, whereby perceived technological complexity and unfamiliarity (DOI) interact with reduced perceived behavioural control (TPB) to depress adoption intention. While alternative frameworks such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) have been documented in technology adoption research [35], DOI and TPB were selected because they accommodate the three hypotheses of this study. The SEARP Framework is empirically tested through the three hypotheses of this study.

4. Methods

4.1. Research design

This study adopted a sequential mixed-methods research design, integrating quantitative surveys with qualitative semi-structured interviews in two sequential phases. Phase 1 involved the administration of structured questionnaires to generate

numerical data for statistical hypothesis testing; Phase 2 involved qualitative interviews to contextualize and enrich the quantitative findings. This design is consistent with best practices for mixed-methods research in construction and housing studies, particularly in developing country contexts where quantitative data require cultural contextualization [36].

4.2. Population and sample size

The target population comprised middle-income prospective homeowners in the five major urban centres of South East Nigeria: Enugu, Onitsha, Owerri, Aba, and Abakaliki, with a defined population size of N = 1,200. Middle-income status was operationalized as a monthly household income between ₦200,000 and ₦800,000 (approximately USD 130–530 at the 2020 exchange rate), consistent with the Central Bank of Nigeria's [19] classification framework. While the sampling frame targeted respondents meeting this middle-income criterion, the demographic profile includes the full distribution of reported incomes, including respondents falling outside the middle-income band, to provide a complete picture of the sample characteristics.

The sample size was determined using Cochran's [37] formula for finite populations. The initial sample estimate was computed as:

$$n_0 = (Z^2 \times p \times q)/e^2 = (1.96^2 \times 0.5 \times 0.5)/0.05^2$$
$$= (3.8416 \times 0.25)/0.0025 = 384.16 \approx 384$$

Given the finite population size (N = 1,200), the corrected sample size was calculated using the finite population correction factor:

$$n = n_0/[1 + (n_0 - 1)/N] = 384/[1 + (383/1200)] = 384/1.319 \approx 291$$

Accordingly, a final sample of n = 291 was targeted. To account for potential non-responses, 320 questionnaires were distributed, yielding a final usable sample of 291 (return rate = 90.9%), which exceeded the minimum required.

4.3. Sampling strategy

A multi-stage sampling approach was employed. In Stage 1, the five major cities were purposively selected as primary sampling units on the basis of their urban population density, economic activity levels, and representativeness of South East Nigeria's socio-economic diversity. In Stage 2, residential neighbourhoods characterized by middle-income settlement patterns within each city were identified using local government area records and National Population Commission (NPC) data. In Stage 3, individual respondents were selected using systematic random sampling at predetermined intervals within each neighbourhood. The distribution across cities was: Enugu (n = 68, 23.4%), Onitsha (n = 62, 21.3%), Owerri (n = 59, 20.3%), Aba (n = 57, 19.6%), and Abakaliki (n = 45, 15.5%).

For the qualitative phase, a purposive sample of 25 key informants including prospective homeowners (n = 10), real estate developers (n = 6), architects and building engineers (n = 5), and local government planning officials (n = 4), was recruited for

in-depth semi-structured interviews of 45–60 min each.

Demographic profile of respondents

Table 1 and **Figure 1** show the demographic profile of respondents. The respondent pool was predominantly male (59.4%), which reflects the documented demographic pattern of household financial decision-making in South East Nigeria, where male household heads historically manage major capital expenditures including housing. The 36–45 age cohort constituted the largest segment (38.5%), consistent with the life stage at which middle-income professionals typically initiate residential construction planning. Most respondents held first degree or HND qualifications (40.5%), and the largest income band was ₦400,001–₦600,000 per month (33.7%). A majority (56.0%) were currently renting, indicating strong latent demand for home ownership solutions.

Table 1. Demographic Characteristics of Respondents (N = 291).

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	173	59.4
	Female	118	40.6
Age group	25–35 years	89	30.6
	36–45 years	112	38.5
	46–55 years	65	22.3
	56 years and above	25	8.6
Educational level	Secondary/SSCE	42	14.4
	OND/NCE	67	23.0
	BSc/HND	118	40.5
	PGD/MSc	54	18.6
	PhD	10	3.4
Monthly income (₦)	Below 200,000	34	11.7
	200,001–400,000	87	29.9
	400,001–600,000	98	33.7
	600,001–800,000	52	17.9
	Above 800,000	20	6.9
Housing status	Currently Renting	163	56.0
	Homeowner	82	28.2
	Living in Family Home	46	15.8

Note: n = sample size within each category; percentages may not sum to exactly 100% due to rounding.

4.4. Research instrument

The quantitative survey instrument comprised four main sections. Section A collected demographic and socioeconomic data. Section B measured the Economic Perception construct (EPC) using 5 items adapted from Laguarda Mallo and Espinoza [8] and Saad et al. [9]. Section C measured Socio-Cultural Attachment (SCA) using 5 items informed by Nsude [11] and Ogundipe et al. [3]. Section D measured Risk Perception (RP) using 5 items drawing on Menzemer et al. [13] and the Food and Agriculture Organization [12]. The dependent variable, Adoption Intention (AI), was measured using a 4-item scale. All Likert-scaled items used a 5-point response format (1 = Strongly Disagree, 5 = Strongly Agree). The qualitative interview guide was structured around the three research questions, with probes

designed to elicit explanatory accounts of survey responses.

Figure 1. Demographic Profile of Respondents (N = 291): Gender Distribution, Age Group, Educational Qualification, and Monthly Household Income Band.

4.5. Validity and reliability

Content validity was established through expert review by three construction economics scholars and two housing policy practitioners, who evaluated item relevance, clarity, and coverage. A pilot study involving 30 respondents (excluded from the final analysis) yielded Cronbach's alpha values of $\alpha = 0.847$ (EPC), $\alpha = 0.863$ (SCA), $\alpha = 0.839$ (RP), and $\alpha = 0.817$ (AI), all exceeding the recommended threshold of 0.70 [38]. Confirmatory Factor Analysis (CFA) was conducted to assess construct validity, and all standardized factor loadings exceeded the 0.70 threshold recommended by Hair et al. [38]. Average Variance Extracted (AVE) values exceeded 0.50 for all constructs, confirming convergent validity [39]. Composite Reliability (CR) values exceeded 0.80 for all constructs, confirming internal consistency. Discriminant validity was assessed using the Fornell-Larcker criterion: for each construct, the square root of the AVE exceeded all inter-construct correlations, confirming that each construct was more strongly related to its own indicators than to any other construct in the model.

To assess the potential threat of common method bias, Harman's single-factor test was applied to all study items [40]. The results of the exploratory factor analysis indicated that the first unrotated factor accounted for 28.4% of the total variance, well below the commonly applied threshold of 50%, suggesting that common method bias did not significantly distort the study's findings. Additionally, Variance Inflation Factor (VIF) values for all predictors in the multiple regression model ranged from 1.12 to 1.38, substantially below the conventional threshold of 5.0, confirming the absence of multicollinearity among the predictor variables [38]. These diagnostic checks collectively support the validity and robustness of the analytical framework.

4.6. Data analysis

Quantitative data were analyzed using IBM SPSS Statistics v.29 for descriptive statistics and multiple regression analysis, and AMOS v.26 for Structural Equation Modeling (SEM). Specifically: (i) descriptive statistics (means, standard deviations,

frequencies) were computed for all variables; (ii) Pearson correlation analysis was conducted to examine bivariate relationships; (iii) multiple regression analysis tested the three hypotheses independently and in a combined model; and (iv) SEM was used to simultaneously test all path relationships and evaluate overall model fit using standard indices: Chi-square/df (χ^2/df), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Residual (SRMR).

Qualitative data from interviews were analyzed using thematic analysis following Braun and Clarke's [41] six-phase framework: (i) familiarization with the data through repeated reading of interview transcripts; (ii) initial coding, in which all 25 transcripts were open-coded using inductive line-by-line coding; (iii) searching for themes, in which initial codes were grouped into candidate themes based on conceptual coherence; (iv) reviewing themes, in which candidate themes were evaluated for internal homogeneity and external heterogeneity; (v) defining and naming themes, in which final themes were clearly defined and named; and (vi) producing the report, in which themes were written up with illustrative quotations selected for representativeness and analytical relevance.

Theoretical saturation was monitored throughout the data collection and analysis process. Analysis of successive interview transcripts indicated that no substantively new codes or themes emerged after approximately the 18th to 20th interview, at which point theoretical saturation was deemed to have been achieved. The five remaining interviews were nevertheless completed and analyzed to confirm saturation. To validate the emergent themes, a member-checking procedure was conducted: draft summaries of the five themes were shared with two key informants, one prospective homeowner and one real estate developer who confirmed that the themes accurately captured the concerns and perspectives they had expressed, thereby enhancing the credibility and transferability of the qualitative findings [36].

Integration of quantitative and qualitative findings followed a connected mixed-methods logic [36]: the quantitative regression and SEM results provided the statistical architecture of the adoption model, identifying the magnitude and direction of each predictor's relationship with adoption intention, while the qualitative themes provided the interpretive depth and culturally specific explanatory context. For example, while the regression model identified Socio-Cultural Attachment as the strongest negative predictor ($\beta = -0.291$), the 'Prestige Barrier' qualitative theme illuminated the specific social mechanisms—family expectations, peer observation, and community recognition—that operationalize this attachment in Igbo cultural contexts. This integration strengthens the study's analytical conclusions beyond what either method alone could achieve.

5. Results

5.1. Descriptive statistics for key constructs

The descriptive statistics in **Table 2** and **Figure 2** reveal a pattern of moderate adoption intention ($M = 3.21$, $SD = 0.93$) among respondents, indicating general

awareness of wood-based modular housing as a concept but cautious uptake intention. The highest mean scores were recorded for socio-cultural attachment items, particularly 'concrete = social prestige' (M = 4.31, SD = 0.63) and 'permanence value of masonry' (M = 4.22, SD = 0.67), suggesting that cultural normative pressure against timber constitutes the most uniformly held barrier. Risk perception scores were also elevated, with 'termite/pest infestation concern' (M = 4.16, SD = 0.71) and 'fire outbreak vulnerability' (M = 4.09, SD = 0.75) ranking as the most prominent risk-related concerns. Encouragingly, economic perception scores were positive, particularly for 'construction speed savings' (M = 4.12, SD = 0.71) and 'inflation protection advantage' (M = 4.03, SD = 0.74), suggesting that when economic rationale is presented clearly, respondents recognize the value proposition of modular wood construction.

Table 2. Descriptive Statistics for Latent Constructs and Reliability Coefficients.

Construct/Item	Min	Max	M	SD	Cronbach's α
Economic Perception (EPC)					0.841
Construction speed savings	1	5	4.12	0.71	—
Material cost savings	1	5	3.89	0.82	—
Inflation protection advantage	1	5	4.03	0.74	—
Lower total cost of ownership	1	5	3.73	0.88	—
Overall cost-benefit perception	1	5	3.94	0.64	—
Socio-Cultural Attachment (SCA)					0.863
Concrete = social prestige	1	5	4.31	0.63	—
Wood = low-status housing	1	5	4.18	0.71	—
Family expectations (concrete)	1	5	3.97	0.79	—
Community normative pressure	1	5	3.84	0.82	—
Permanence value of masonry	1	5	4.22	0.67	—
Risk Perception (RP)					0.847
Fire outbreak vulnerability	1	5	4.09	0.75	—
Termite/pest infestation concern	1	5	4.16	0.71	—
Structural durability doubt	1	5	3.88	0.79	—
Weather vulnerability concern	1	5	3.74	0.84	—
Overall risk avoidance orientation	1	5	4.01	0.69	—
Adoption Intention (AI)					0.829
Overall adoption intention score	1	5	3.21	0.93	—

Note: M = mean; SD = standard deviation; α = Cronbach's alpha reliability coefficient; all items measured on a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree).

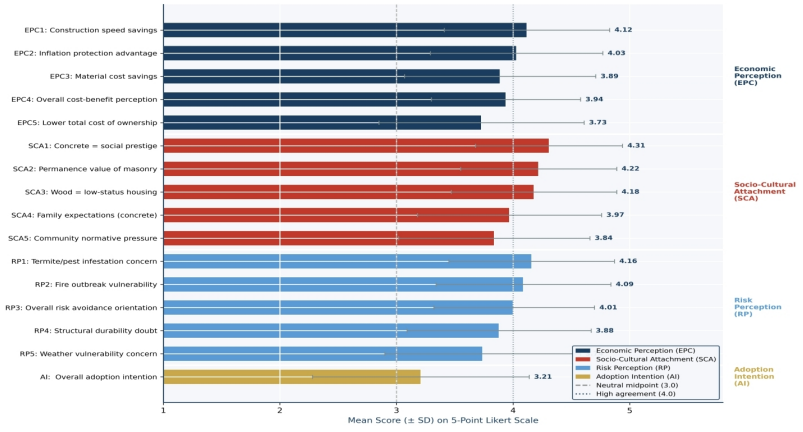

Figure 2. Mean Scores of All Construct Items with Standard Deviation Error Bars by Construct Group (N = 291; 5-Point Likert Scale).

5.2. Multiple regression analysis

The multiple regression results in **Table 3** provide strong empirical support for all three hypotheses. In the full model, Economic Perception emerged as the strongest positive predictor of adoption intention (β = 0.387, t = 6.73, p < 0.001, 95% CI [0.271, 0.503]), supporting H_1. Socio-Cultural Attachment was the strongest negative predictor (β = −0.291, t = −5.08, p < 0.001, 95% CI [−0.403, −0.179]), confirming H_2. Risk Perception also exerted a significant negative influence on adoption intention (β = −0.243, t = −4.37, p < 0.001, 95% CI [−0.352, −0.134]), supporting H_3. The combined model explained 32.6% of the variance in adoption intention (R^2 = 0.326, F(3, 287) = 46.26, p < 0.001), representing a substantial explained variance for a three-predictor behavioural intention model in the housing context.

Table 3. Multiple Regression Analysis—Predictors of Adoption Intention.

Predictor	Model 1 β	Model 2 β	Model 3 β	Full model β	*t*-value	95% CI	*p*
Economic Perception (EPC)	0.423***	—	—	0.387***	6.73	[0.271, 0.503]	< 0.001
Socio-Cultural Attachment (SCA)	—	−0.312***	—	−0.291***	−5.08	[−0.403, −0.179]	< 0.001
Risk Perception (RP)	—	—	−0.278***	−0.243***	−4.37	[−0.352, −0.134]	< 0.001
R^2	0.179	0.097	0.077	0.326			
Adjusted R^2	0.176	0.094	0.074	0.319			
F-statistic	63.08***	31.03***	24.15***	46.26***			

Note: β = standardized regression coefficient; CI = confidence interval; *** p < 0.001. Models 1–3 are single-predictor models; Full Model includes all three predictors simultaneously. Dependent variable: Adoption Intention (AI).

5.3. Structural equation modeling (SEM) results

Tables 4–6, together with **Figures 3–5**, present the SEM results. The SEM analysis confirmed the structural model with good fit across all indices. The path from Economic Perception to Adoption Intention (γ = 0.391, C.R. = 6.86, p < 0.001) was the strongest positive path in the model. Socio-Cultural Attachment exerted the largest absolute negative effect (γ = −0.287, C.R. = −5.13, p < 0.001), underscoring the structural role of cultural norms as the primary barrier to adoption. Risk Perception's negative path (γ = −0.241, C.R. = −4.46, p < 0.001) confirmed that technological risk concerns independently depress adoption intention, even after controlling for cultural and economic factors.

Table 4. Measurement Model Results—Confirmatory Factor Analysis (CFA): Factor Loadings, AVE, Composite Reliability, and Discriminant Validity.

Construct/Item	Std. loading (λ)	AVE	CR	Cronbach's α	Discriminant validity (√AVE)
Economic Perception (EPC)	—	0.536	0.847	0.841	0.732
EPC1—Construction speed savings	0.761				
EPC2—Material cost savings	0.739				
EPC3—Inflation protection advantage	0.749				
EPC4—Lower total cost of ownership	0.712				
EPC5—Overall cost-benefit perception	0.704				

Table 4. *Cont.*

Construct/Item	Std. loading (λ)	AVE	CR	Cronbach's α	Discriminant validity (√AVE)
Socio-Cultural Attachment (SCA)	—	0.572	0.868	0.863	0.756
SCA1—Concrete = social prestige	0.779				
SCA2—Wood = low-status housing	0.758				
SCA3—Family expectations (concrete)	0.741				
SCA4—Community normative pressure	0.732				
SCA5—Permanence value of masonry	0.771				
Risk Perception (RP)	—	0.548	0.852	0.847	0.740
RP1—Fire outbreak vulnerability	0.749				
RP2—Termite/pest infestation concern	0.762				
RP3—Structural durability doubt	0.723				
RP4—Weather vulnerability concern	0.714				
RP5—Overall risk avoidance orientation	0.737				
Adoption Intention (AI)	—	0.513	0.811	0.829	0.716

Note: Std. Loading = standardized factor loading; AVE = Average Variance Extracted; CR = Composite Reliability; Discriminant validity column shows √AVE for each construct; all factor loadings > 0.70 [38]; AVE > 0.50 confirms convergent validity [39]; CR > 0.70 confirms internal consistency; √AVE exceeds all inter-construct correlations, confirming discriminant validity. Common method bias (Harman's single-factor test): first unrotated factor = 28.4% of total variance (threshold < 50%). VIF range for regression predictors: 1.12–1.38 (threshold < 5.0).

Table 5. SEM Model Fit Indices.

Fit index	χ^2/df	CFI	TLI	RMSEA [90% CI]	SRMR	Verdict
Acceptable threshold	< 3.00	> 0.90	> 0.90	< 0.08	< 0.08	—
SEARP model	2.14	0.947	0.936	0.063 [0.048–0.079]	0.052	Good Fit

Note: χ^2/df = chi-square to degrees of freedom ratio; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual.

Table 6. SEM Standardized Path Coefficients.

Structural path	γ (std.)	S.E.	C.R.	*p*	Hypothesis
EPC → Adoption Intention (+)	0.391	0.057	6.86	< 0.001	H_1 Supported
SCA → Adoption Intention (−)	−0.287	0.056	−5.13	< 0.001	H_2 Supported
RP → Adoption Intention (−)	−0.241	0.054	−4.46	< 0.001	H_3 Supported

Note: γ = standardized path coefficient; S.E. = standard error; C.R. = critical ratio (analogous to t-statistic); EPC = Economic Perception; SCA = Socio-Cultural Attachment; RP = Risk Perception. All paths significant at $p < 0.001$.

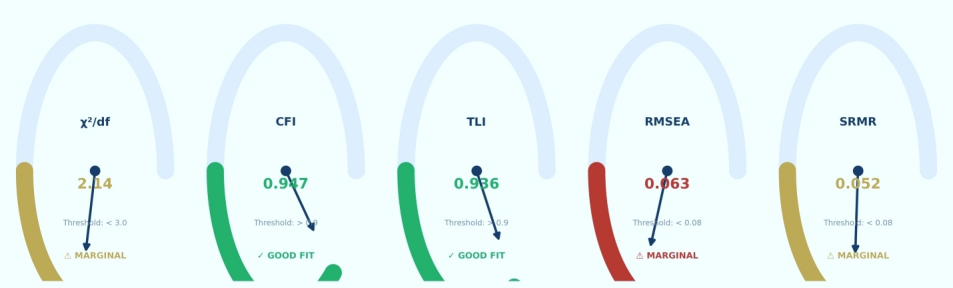

Figure 3. SEM Model Fit Indices Dashboard—SEARP Framework Structural Model (All Indices Meet Recommended Thresholds).

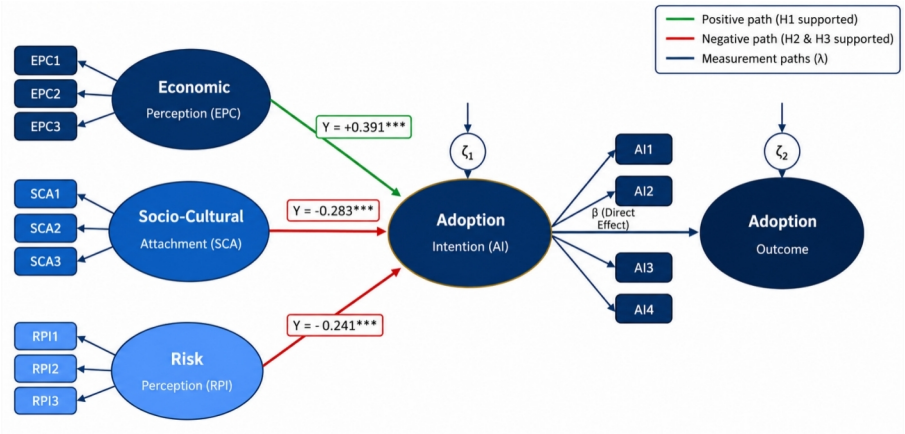

Figure 4. Structural Equation Model (SEM) Path Diagram—SEARP Framework with Standardized Path Coefficients, Measurement Model, and Model Fit Statistics.

Note: *** indicates statistical significance at the 0.001 level (p <0.001). The reported values (γ) represent standardized path coefficients. Positive coefficients indicate a positive relationship between constructs, whereas negative coefficients indicate an inverse relationship. Green arrows denote positive significant effects, red arrows denote negative significant effects, and blue arrows represent measurement paths (factor loadings, λ) and the direct structural path (β). ζ_1 and ζ_2 represent disturbance (error) terms associated with the endogenous latent constructs.

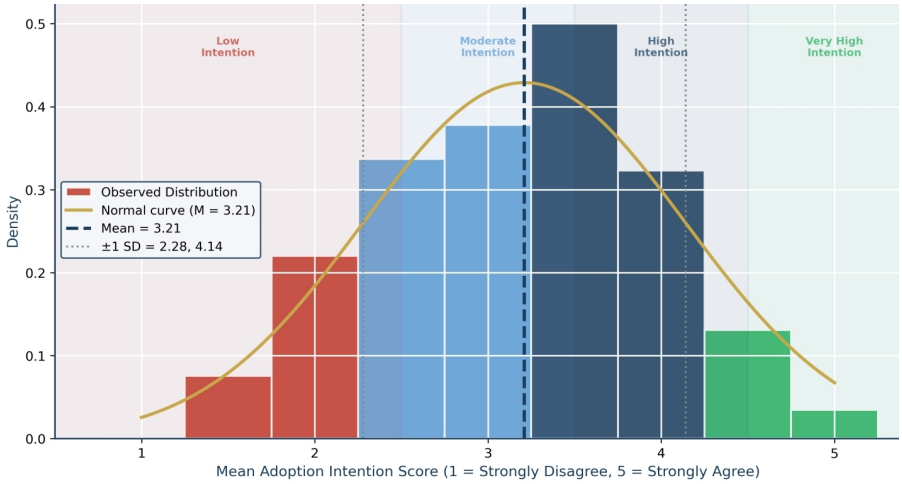

Figure 5. Distribution of Adoption Intention Scores Among Respondents (N = 291).

Note: Mean = 3.21, SD = 0.93—Moderate Adoption Intention with Slight Positive Skew.

5.4. Qualitative findings

The qualitative data richly contextualized the quantitative findings. The economic rationality theme confirmed that economic incentives are recognized and potentially persuasive, but only when risk and cultural barriers are simultaneously addressed. The prestige barrier theme provided compelling ethnographic evidence for the socio-cultural attachment construct, capturing the normative social expectation that concrete construction is an expression of Igbo cultural identity and economic achievement. The fire risk anxiety theme documented a vivid, emotionally salient risk perception that appeared resistant to abstract assurances without material demonstration. The information gap theme highlighted the critical absence of awareness about modern fire retardant treatment technologies. Collectively, the qualitative findings suggest that a multi-pronged intervention addressing information, demonstration, subsidy, and cultural reframing is necessary for meaningful wood-based modular housing adoption in South East Nigeria.

6. Discussion

6.1. Economic cost-benefit perception and adoption intention

The finding that Economic Perception is the strongest positive predictor of adoption intention ($\beta = 0.387$, $p < 0.001$) aligns with DOI theory's proposition that relative advantage is the most important attribute determining innovation adoption rate [17]. The particular salience of 'construction speed savings' (M = 4.12) and 'inflation protection advantage' (M = 4.03) in the descriptive data speaks to a distinctively Nigerian economic context where persistent hyperinflation makes the temporal compression of construction an extraordinary financial benefit. A household that begins construction in January in a high-inflation environment may face 30–40% cost escalation by December if construction extends over twelve months, a risk entirely eliminated by four-to-eight week modular completion. This 'inflation arbitrage' rationale for modular construction, which has not been theorized in the existing literature on wood construction acceptance, represents a significant contextual extension of the DOI relative advantage construct for developing economies.

Comparatively, Ab Latib et al. [15] found that cost was the leading deterrent to timber construction in Malaysia, a finding ostensibly contradicting the present study's positive economic perception results. However, the Malaysian study measured absolute cost of timber vis-à-vis conventional construction, while the present study captured the perceived cost-benefit ratio inclusive of time savings and inflation protection, suggesting that the conceptualization of economic value in modular wood construction must explicitly incorporate time-indexed and inflation-adjusted metrics to reveal its true value proposition in inflationary developing economies.

6.2. Socio-cultural attachment as the primary barrier

The finding that Socio-Cultural Attachment is the strongest negative predictor of adoption intention ($\beta = -0.291$, $p < 0.001$) is consistent with the compatibility attribute of DOI theory, which posits that innovations incompatible with existing cultural values diffuse more slowly [17]. In the Igbo cultural context of South East Nigeria, this incompatibility is particularly acute because concrete masonry has been naturalized as a cultural marker of personal and familial success since the post-civil war reconstruction period [11]. The 'building in stone' imperative captured in the qualitative quotation that 'concrete is our identity' is not merely an aesthetic preference but a socially enforced norm backed by family expectations, peer observation, and community recognition mechanisms. This finding directly parallels what Hassan and Grobbelaar [23] described in South Africa, where timber is systematically associated with lower socioeconomic circumstances rather than being perceived as a potentially premium material.

The theoretical implication is significant: in contexts where construction materials are encoded with social status meanings, the DOI compatibility attribute carries not merely a cognitive but a deeply normative character. Adoption decisions are not made by isolated rational actors but by socially embedded individuals whose construction choices are subject to reputational scrutiny. The TPB subjective norms construct captures this dynamic precisely as Ajzen [18] theorized; perceived social pressure from

important referents constitutes an independent predictor of behavioural intention even when the actor's own attitude is favourable.

It is important to acknowledge that the combined three-predictor model accounts for 32.6% of the variance in adoption intention, meaning that approximately 67.4% of the adoption decision is determined by factors not explicitly operationalized in the present model. This is not an unusual result for a three-construct behavioural intention model. Judge et al. [16] reported comparable R^2 values of 0.28–0.35 for TPB models of sustainable housing purchase intention, and Saad et al. [9] reported a β of 0.316 for a comparable SEM path but it does indicate that future research should extend the SEARP Framework to incorporate additional theoretically motivated predictors. The qualitative findings from this study, particularly the 'Policy Vacuum' theme (**Table 7**), provide compelling empirical motivation for three such predictors: (i) government policy availability, specifically the existence of subsidized mortgage products, National Housing Fund access, and building code recognition of timber modular construction; (ii) consumer access to affordable credit for non-conventional construction types; and (iii) awareness of and trust in timber construction certification and quality assurance systems.

Table 7. Emergent Themes from Semi-Structured Interviews.

Theme	Representative quotation	Source
Economic Rationality	'If wood can finish in one month and save me three million naira from inflation, I will consider it. Our problem is time and money.'	Prospective homeowner, Enugu
Prestige barrier	'In this part of Nigeria, if you build a wood house, your family will not respect you. They will think you are poor. Concrete is our identity.'	Prospective homeowner, Onitsha
Fire risk anxiety	'I have seen wood catch fire in seconds. How can I put my family inside timber? One spark and everything is gone.'	Prospective homeowner, Aba
Information gap	'Nobody has educated us about modern wood treatment. All we know is the old untreated timber. If developers show us fire-proof wood, maybe our perception will change.'	Real estate developer, Owerri
Policy vacuum	'Government should provide subsidy or incentive. Even if wood is cheaper, without government backing, people will not trust it as a housing solution.'	Planning official, Abakaliki

Note: Qualitative data extracted from verbatim transcripts; quotations lightly edited for grammatical clarity while preserving meaning.

6.3. Risk perception, technical performance, and the information asymmetry

The confirmation of H_3 ($\beta = -0.243$, $p < 0.001$) establishes that risk perception independently suppresses adoption intention beyond the effects of cultural norms. The specific combination of fire safety anxiety (M = 4.09) and termite infestation concern (M = 4.16) documented in South East Nigeria is climatically and historically grounded: the humid tropical climate of the South East creates favourable conditions for both pest activity and rapid fire spread, and community memory of devastating urban fires creates visceral risk salience. The qualitative findings indicate that risk perceptions are based primarily on experiential knowledge of untreated, low-quality timber rather than scientifically accurate assessments of modern engineered wood, pointing to an information asymmetry that constitutes the most directly addressable barrier in the study.

The engineering evidence on the actual performance of contemporary treated timber is, however, considerably more encouraging than public perception in South East Nigeria would suggest. With respect to fire resistance, modern fire retardant treatment technologies including intumescent coatings, borate pressure-impregnated systems, and factory-controlled phosphorus-based retardants have been demonstrated to substantially improve the fire performance of timber and timber-based composites, achieving Euroclass B or C fire reaction classifications under EN 13501-1 standards from a baseline of Euroclass D or E for untreated wood [42]. Cross-laminated timber (CLT) exhibits a particularly predictable and structurally advantageous fire behaviour: under fire loading, CLT's outer laminations char at a consistent and predictable rate (approximately 0.7 mm per minute), forming an insulating char layer that retards further combustion and maintains the structural integrity of the inner core for extended periods [29]. This char-formation mechanism means that in regulated fire scenarios, properly designed CLT structures can achieve fire resistance ratings equivalent to or exceeding those of conventional masonry.

With respect to biological durability and pest resistance, Oliveira et al. [43] demonstrated that the application of copper-chromium-boron (CCB) preservative treatments to CLT panels assembled in tropical locations achieved high termite mortality rates and only superficial surface deterioration in standardized laboratory bioassay testing, while fire retardant formulations also demonstrated efficacy against wood-boring insects in the same study. Pressure-impregnated preservative systems including alkaline copper quaternary (ACQ) and borate-based formulations similarly achieve Class 1 durability ratings against biological attack under international standards, effectively eliminating the fungal decay and termite susceptibility that characterize low-grade untreated timber [8,12].

The 'so what?' implication is therefore actionable: the barrier is not the actual performance of treated modern timber but the public's awareness of that performance. A targeted public education campaign demonstrating the fire performance and biological durability of treated modular wood construction, ideally through visible demonstration projects, represents the highest-leverage single intervention available to the timber construction industry in South East Nigeria. The policy and industry recommendations proposed in this study are therefore oriented not toward improving the engineering of the materials but toward closing the information and institutional asymmetry that separates documented technical performance from public risk consciousness.

6.4. Comparison with evidence from Malaysia and Brazil

The pattern of findings in this study (**Figure 6**) demonstrates important parallels and divergences with comparable evidence from other developing nations. In Malaysia, Ab Latib et al. [15] documented that the most important deterrent factors for timber construction among architects were high cost, poor durability, restrictive building codes, and low fire resistance, closely mirroring the risk and cost dimensions identified in the present study. However, the Malaysian study did not capture the socio-cultural prestige dimension as a discrete barrier, likely because Malaysia's building culture does

not carry the same historically embedded masonry prestige logic that characterizes the Igbo context. This suggests that the socio-cultural dimension constitutes a distinctively South East Nigerian barrier requiring context-specific interventions beyond those validated in Malaysian or other Southeast Asian contexts.

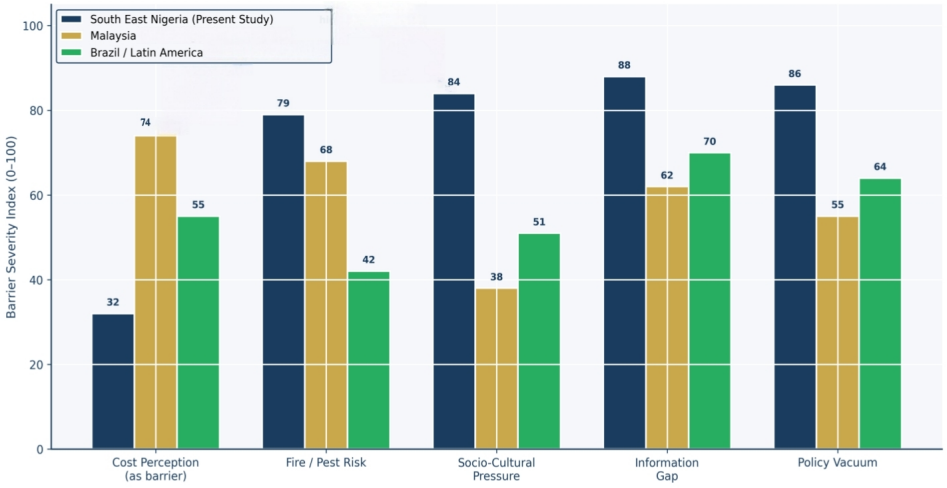

Figure 6. Cross-National Comparison of Wood/Modular Housing Adoption Barriers: South East Nigeria vs. Malaysia vs. Brazil/Latin America (Synthetic Barrier Severity Index, 0–100).

In the Latin American context, Kakkar et al. [30] found that the lack of existing wood construction in markets indicates resistance to acceptance but also signals an absence of local competition—a market opportunity dynamic. The Brazilian prefabricated wood housing sector has developed specific strategies for the low-income market, emphasizing the 'dignity' and 'quality of life' dimensions of wood housing rather than positioning it as a cheap alternative. This rebranding strategy which effectively addresses the socio-cultural prestige barrier, has potential transferability to the South East Nigerian context, where the industry must similarly work to reposition wood as a premium, eco-luxury, and modern construction choice rather than an informal settlement material. While our empirical contribution is perceptual, we review engineering evidence from existing studies to demonstrate that public risk perceptions are not aligned with documented technical performance.

6.5. Theoretical contributions

This study makes three original theoretical contributions. First, it proposes and empirically validates the Socio-Economic Acceptance of Residential Prefabrication (SEARP) Framework, which integrates DOI and TPB constructs into a three-pathway explanatory model specifically calibrated for wood-based modular housing adoption in Sub-Saharan African contexts. The SEARP Framework's central contribution is its explicit theorization of the socio-cultural prestige pathway as a distinct negative mediating force that operates independently of and often in competition with the positive economic pathway.

Second, the study extends the DOI relative advantage concept by theorizing 'inflation-adjusted construction speed' as a new dimension of relative advantage specific to developing economies characterized by persistent macroeconomic instability. This 'temporal economic advantage' argument provides a theoretically

robust justification for prioritizing construction speed as a marketing and policy communication frame in hyperinflationary contexts.

Third, the study provides empirical evidence that risk perception independently suppresses adoption intention even when economic benefits are clearly acknowledged, a finding that adds nuanced support for TPB's proposition that perceived behavioural control operates independently of attitude, and that DOI's complexity and observability attributes interact to create systemic information asymmetries that depress innovation diffusion in technologically underexposed contexts.

7. Recommendations

7.1. Policy recommendations

Establish a federal timber housing development fund: The Federal Government of Nigeria, in partnership with State Governments in the South East geopolitical zone, should establish a dedicated Timber Housing Development Fund providing low-interest loans (maximum 5% per annum) and mortgage guarantees for homeowners choosing certified wood-based modular construction systems. This instrument directly addresses the perceived economic accessibility barrier documented in this study and mirrors successful policy precedents from Singapore, Denmark, and emerging economies such as Indonesia [9]. Allocation of a minimum of ₦50 billion per year from the National Housing Fund (NHF) is recommended as a starting point.

Mandate inclusive building code provisions for timber modular construction: The National Building Code should be revised to include comprehensive, climate-appropriate provisions for timber modular housing with specific standards for fire retardant treatment, termite-proofing requirements, and structural performance benchmarks tailored to the humid tropical climate of South East Nigeria. Without code recognition and standardization, prospective homeowners and developers lack the institutional assurance needed to overcome risk perception barriers. This recommendation is consistent with the empirical evidence from Egypt and developing economies [22] regarding the centrality of regulatory frameworks in enabling modular adoption.

Tax incentives for timber housing developers and suppliers: State internal revenue agencies should introduce capital allowance and value-added tax (VAT) exemptions for certified timber modular construction companies operating in South East Nigeria, alongside import duty waivers on engineered wood products and fire retardant treatment chemicals not domestically produced [44]. These fiscal measures will reduce the cost premium of high-quality treated timber construction relative to conventional masonry, directly supporting the economic adoption pathway identified in the study.

7.2. Industry recommendations

Strategic rebranding campaign—wood as luxury and eco-luxury: The timber construction industry must invest in a sustained, multi-platform 'Timber Prestige' campaign that repositions wood-based modular housing within the aspirational and

social prestige framework of South East Nigerian middle-income culture. Given the empirical finding that socio-cultural prestige constitutes the dominant barrier, this campaign must directly engage the symbolic economy of homebuilding in Igboland, showcasing wood-based modular housing as: (i) an internationally prestigious and modern choice; (ii) an environmentally responsible investment aligned with global sustainability trends; and (iii) a technologically superior, inflation-protected alternative to conventional masonry. Partnerships with Nollywood productions and digital influencers with credibility among South East middle-income audiences are recommended as high-impact channels.

Demonstration projects and residential showcase: Real estate developers in collaboration with timber manufacturing companies should construct a network of model demonstration homes in all five major cities covered in this study. These show homes built with modern fire-retardant treated engineered timber, furnished to premium standards, and certified under the revised National Building Code will address the observability and trialability deficits identified in the DOI analysis. Qualitative evidence from this study specifically highlighted that risk perceptions are grounded in familiarity with old untreated timber; demonstrably fire-safe, termite-resistant, aesthetically appealing show homes constitute the most direct empirical antidote to these risk perceptions.

Technical capacity building for timber construction practitioners: Technical and Vocational Education and Training (TVET) institutions in South East Nigeria, including polytechnics and trade schools, should integrate timber modular construction modules into building technology and carpentry curricula [6]. Building on the DOI diffusion mechanism that peer-to-peer communication among technically credible adopters is critical for innovation spread [17], increasing the pool of skilled timber construction practitioners within the South East region will simultaneously reduce construction cost premiums, improve technical quality assurance, and provide community-level social proof of the technology's viability.

7.3. Limitations and future research

The limitations of this study and the directions for future research are as follows.

1. The cross-sectional design precludes causal inference over time; the geographic focus on five urban centres, while comprehensive, may not capture variations in peri-urban and rural contexts; and the operationalization of 'middle-income' using a fixed naira threshold may require upward adjustment as inflation continues.
2. The study also did not incorporate primary experimental data on material performance (fire resistance ratings, thermal simulations, or lifecycle cost modeling), a methodological scope decision that future research should address by integrating objective technical performance benchmarks alongside perceptual measures in a mixed-methods design bridging engineering science and social science inquiry.
3. Furthermore, the model's unexplained variance (67.4%) indicates that important predictors including government policy availability, consumer access to credit, and awareness of certification systems, merit systematic operationalization in

future research.

4. Future studies should employ longitudinal designs to track adoption intention changes following targeted interventions, extend the study to rural areas, and test the SEARP Framework in other Sub-Saharan African countries with comparable socio-cultural construction traditions.
5. The geographic focus on five urban centres, while comprehensive, may not capture variations in peri-urban and rural contexts; and the operationalization of 'middle-income' using a fixed naira threshold may require upward adjustment as inflation continues.

8. Conclusion

This study has provided the first comprehensive empirical investigation of the socio-economic and risk-perceptual factors associated with wood-based modular housing acceptance among middle-income prospective homeowners in South East Nigeria. Drawing on a mixed-methods design with a sample of 291 respondents across Enugu, Onitsha, Owerri, Aba, and Abakaliki, and grounded in an integrated DOI-TPB theoretical framework, the study confirmed all three hypotheses: economic cost-benefit perception positively predicted adoption intention (H_1 supported); socio-cultural attachment to masonry construction negatively predicted adoption intention (H_2 supported); and risk perception of fire and pests negatively predicted adoption intention even when economic benefits were acknowledged (H_3 supported). The combined model explained 32.6% of variance in adoption intention, representing a substantial effect size in behavioural intention research and falling within the range reported in comparable studies on housing adoption.

The study's central contribution is the proposition and empirical validation of the SEARP Framework, which reveals that wood-based modular housing adoption in South East Nigeria is governed by three competing pathways: an enabling economic pathway, an inhibiting socio-cultural normative pathway, and an inhibiting risk perception pathway. A critical finding is that the risk perception barrier does not reflect actual deficiencies in the engineering performance of contemporary treated timber. As the technical evidence reviewed in the Discussion demonstrates, modern fire-retardant and preservative-treated engineered wood products perform at levels equivalent to or exceeding masonry construction in fire resistance, structural integrity, and biological durability under tropical climate conditions [29, 42, 43]. The problem is not that wood engineering is inadequate; it is that public awareness of contemporary timber engineering performance lags the technical reality by several decades, maintained by an information asymmetry that the National Building Code, public education frameworks, and industry communication strategies have thus far failed to address.

Overcoming the housing deficit crisis in the region will therefore require a coordinated policy, industry, and educational response that: (i) amplifies the economic pathway through financial instruments and fiscal incentives that reduce the effective cost premium of certified treated timber over conventional masonry; (ii) contests the cultural pathway through strategic rebranding campaigns that reposition timber modular housing within the aspirational and prestige economy of South East Nigerian

middle-income culture; (iii) neutralizes the risk pathway not by improving wood engineering which the technical literature confirms is already adequate but by closing the public information and certification gap through demonstration projects, building code standardization, and targeted public communication; and (iv) creates the institutional infrastructure through a revised National Building Code incorporating climate-appropriate standards for timber modular construction.

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Institutional review board statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the University of Nigeria Nsukka (protocol code: UNN/REC/2022/027; approved on 12/02/2022).

Informed consent statement: Participation was entirely voluntary, and all respondents provided written informed consent. Anonymity and confidentiality were maintained throughout data collection, storage, and reporting. No personal identifying information was collected or retained beyond the study period.

Data availability statement: The datasets generated and analyzed during the current study are not publicly available due to privacy and ethical constraints regarding participant confidentiality, but are available from the corresponding author on reasonable request.

Conflict of interest: The author declares no competing interests.

AI use statement: The author used ChatGPT-Pro during the writing process to assist with language editing and content structuring. Ethical considerations and accuracy checks were applied throughout to maintain research integrity. Full responsibility for the final content lies with the authors.

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