Whole Life Cost of Plaster of Paris (POP) And Polyvinyl Chloride (PVC) Ceiling Finishes in Nigerian Housing: A Decision Framework, Robustness Tests and A Decade-On Re-Pricing from Nigeria

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ABSTRACT

Nigerian households often choose between Plaster of Paris (POP) and Polyvinyl Chloride (PVC) ceilings on first cost and appearance. This paper examines that choice's whole-life cost, whether it holds up a decade later, and how it can guide specification. Questionnaires were administered in 2014-2016 to 100 end-users and 50 installers/retailers in Osogbo, Osun State (80 and 40 usable responses). Perception data were analysed using Mean Item Score, Relative Importance Index and Spearman correlation. A 15-year whole life cost (WLC) model at 12% was stress-tested through sensitivity, break-even and 10,000-run Monte Carlo analyses, and re-priced at 2026 conditions. PVC buyers chose mainly on cost (MIS = 4.60), POP buyers on aesthetics (MIS = 4.70), with moderate agreement between groups (ρ = 0.46). Workmanship was the leading lifespan determinant for both (RII = 0.95), and lifespan rankings showed strong agreement (ρ = 0.77). PVC's 15-year present value (₦412,990.65) was 48.8% below POP's (₦806,851.55), remained lower in 99.8% of simulations, and stayed lower even with annual maintenance or one full replacement. POP reaches parity only when its installed rate falls to about 1.2-1.3 times PVC's; the observed ratio rose from 2.36 (2015/16) to about 2.7 (2026). Quantity surveyors can use the price-parity ratio as a quick screen and show clients the POP premium (about ₦5,000 per m² at 2026 prices), selecting contractors on competence, not lowest labour rate. The study re-tests an early-adoption baseline against a decade of economic shocks and proposes the five-stage Ceiling Finish Whole-Life Value (CF-WLV) decision framework.

KEYWORDS

whole life costing, life cycle cost, ceiling finishes, building materials, Nigeria, residential buildings

I. INTRODUCTION

The Construction industry has a central role in socio-economic development as it provides the physical environment on which education, health, commerce, and housing depend. In Nigeria, and indeed most developing economies, housing affordability and the long-term sustainability of its constituent materials urgent issues. Housing is still a socially important

issue in Nigeria, but the use of evidence-based materials choice is an essential economic focus given the high cost of construction and maintenance compared to the household income.

Although ceiling finishes are non-structural, they play a significant role in ensuring a building's structural integrity, acoustic comfort, thermal performance, aesthetic quality, and fire resistance. Plaster of Paris (POP) and Polyvinyl Chloride (PVC) are the most common ceiling systems in residential construction in Nigeria. These two materials have a significant market share, and buyers often choose based on cost and aesthetics rather than long-term financial performance. This is indicative of a larger trend in construction procurement in Nigeria, where short-term cost reduction often results in increased life cycle spending due to early failures, high turnover and unplanned maintenance.

Whole Life Costing (WLC) provides a systematic methodology of estimating all material-related costs such as acquisition, installation, maintenance and disposal over a specific period of analysis (Flanagan & Jewell, 2008). Although WLC has been widely used in the United Kingdom, Australia, and even in some parts of Asia, it is still underutilised in the Nigerian construction practice, especially on non-structural parts of the building like ceiling finishes. Most research on ceiling materials in Nigeria focuses on structural performance, user preferences, or defect frequency rather than the long-term financial impact of material choice.

This research paper bridges this gap by providing a systematic comparative WLC analysis of POP and PVC ceiling finishes in Osun State, Nigeria. It uses primary survey results from end-users and installers/retailers to characterise selection drivers, performance characteristics, and lifespan determinants, and integrates these with a 15-year present-value WLC model to produce cost comparisons that construction professionals, quantity surveyors, facility managers, and clients can use directly.

A fair question for a study like this is: POP and PVC are no longer new, so why revisit them? The answer lies in the data's timing. The fieldwork was carried out between 2014 and 2016, when PVC panels were still new to many households in the Osogbo market and POP was settling into the mainstream. Buyers of an unfamiliar product tend to decide on the cues they can see, the price on the invoice and the look of the finished ceiling (Rogers et al., 2014), and the habits formed at that stage persist long after the products stop being new. Since then the Nigerian economy has been through a recession in 2016, the unification and float of the naira in 2023, and inflation that passed 30 per cent, all of which moved material and labour prices several times over. A WLC comparison made at the point of adoption and re-tested a decade later can therefore answer a question that neither a one-off snapshot nor a current-price survey can answer alone: is the economic ranking of the two finishes a property of the materials, or simply a product of the prices of the day?

A. The study is guided by five objectives:

- To determine the factors that affect the selection of ceiling finishes by the residential end-users;
- To assess the nature and influences on the service life of PVC and POP finishes;

- To determine the comparison of the entire life cost of the two ceiling systems to give an evidence base on material selection decisions;
- To test how robust, the WLC ranking is to changes in cost, maintenance, discount-rate and time assumptions, including re-pricing at 2026 rates; and
- To develop a decision framework that links the survey and cost evidence to ceiling specification practice.

II. THEORETICAL FRAMEWORK

This study is grounded in Value-Based Procurement Theory, which holds that the best procurement decisions should be evaluated in terms of the overall value provided over the service life of an asset, rather than the original acquisition cost. Construction economics applies this principle through Whole Life Costing (WLC), a system that systematically combines all cost elements related to asset ownership, from procurement to disposal, to support rational economic decision-making.

In construction, WLC has its roots in the cost-in-use models formulated in the United Kingdom during the 1960s, then the life cycle costing models formalised during the 1990s (Clift & Butler, 1995) and the modern WLC standards such as BS ISO 15686-5:2017, which defines whole life costing as a method for the economic evaluation of all significant costs of an asset over its life or a chosen period of analysis (BSI, 2017). This paper uses WLC in this tradition, using a present-value methodology to discount future maintenance costs to their present value to compare the two on an equivalent financial basis.

WLC, as the main analytical tool, is also explained by its proven usefulness in material selection in residential buildings. In situations where capital budgets are constrained (like the residential market in Nigeria) the difference between initial cost and whole life cost is often greatest, and the potential benefit of WLC analysis consequently the most abundant. In this context, the empirical comparison of POP and PVC transcends user-preference surveys to generate economically rigorous evidence that can be directly applied to procurement decisions.

Two behavioural ideas help explain why WLC evidence is so often set aside in this setting, and both shape the framework developed later in the paper. The first is bounded rationality. People rarely have the time, information or means to optimise, so they settle for options that look good enough on the few criteria they can judge readily (Simon, 1955). For a household buying a ceiling, first cost and appearance are visible on the day; maintenance and replacement costs are spread over years and are hard to picture. Second, households tend to apply implicit discount rates to future savings that are far above market interest rates, which makes distant maintenance bills look almost free at the point of purchase. Diffusion of innovations theory adds a third element. When a product is new to a market, buyers lean on observable attributes and on intermediaries, in this case installers and retailers, because they have little experience of their own to draw on.

Taken together, these ideas suggest that WLC information is necessary but not sufficient. It must be packaged into a simple decision rule and delivered to the client through the

professionals the client already trusts. That is the logic behind the CF-WLV framework set out in this study.

III. LITERATURE REVIEW

A. Ceiling Finishes in Residential Construction

Interior surface finishes are fundamental to the aesthetic, functional, and environmental quality of the built environment. The ceiling being the main overhead surface in any occupied area, affects the visual experience, sound transmission, thermal resistance, lighting efficiency, and fire safety. Ceilings, despite being non-structural, have important functional roles to play in the building of structures; they hide the services of the building, enhance acoustic performance, and contribute to thermal insulation, as well as offer fire protection. Ceiling finishes POP, PVC, gypsum board, acoustic tiles, and, more recently, fiber cement panel are the most frequently used in the Nigerian construction industry, but the residential market is dominated by POP and PVC finishes.

Plaster of Paris is made from calcified gypsum, and it is appreciated for its design ability, high aesthetic quality, and ability to be molded into customized forms. The main weaknesses include the fact that it’s susceptible to moisture damage, cracking when subjected to structural movement, and its material and labor costs are relatively high. PVC ceiling systems are produced from sheets of polymer made from salt and hydrocarbons, are lightweight to construct, easy and fast to install, moisture-resistant, and require low maintenance. They are sensitive to very high temperatures, offer fewer design options than POP, and pose environmental issues related to the presence of chlorine. Installation quality, maintenance frequency, moisture exposure, roof integrity, and the installer's expertise are important factors that affect the performance of both ceiling types. Such issues are not only technical; they directly determine the number of maintenance interventions and, thus, the overall cost of owning the ceiling throughout the life of a building.

B. Influencing Factors in the Material Selection.

The choice of construction material is a multi-criteria decision-making process that is influenced by cost, availability, performance properties, aesthetic features, and long-term financial effects. In the developing world, cost is often a higher priority than technicality: the cost of building materials is subject to dependency on imports, exchange rates, and disruptions of supply chains, and these forces compel procurement decisions to be the lowest cost and not the most appropriate in the long term.

In the Nigerian context, found that aesthetic factors and up-to-date market trends, rather than evidence-based assessments of life-cycle performance, maintenance needs, or environmental appropriateness, are the primary factors driving the choice of ceiling materials. Eze et al. (2021) affirmed that the sustainability building material characteristics such as durability, low maintenance and life-cycle cost, are not often the main factors influencing the specification decision in the Nigerian construction projects. The trend aligns with Akadiri and Olomolaiye (2012), who reported the unremitting preponderance of initial cost over life-cycle value in the process of acquiring materials in Nigeria, and the lack of available WLC data as a major structural impediment to evidence-based specification.

Aesthetics is a second key determinant of ceiling material choice, consistent across a wide variety of geographic and building-type settings. Lau and Choi (2021) indicated that perceived aesthetic quality has a significant impact on occupant satisfaction and is strongly linked with the readiness to pay a high price. The differentiated, context-dependent role of product appearance in consumer choice established by Ceruse and Schoolman's (2005) also applies to the dominance of aesthetic criteria in POP selection. The implication in the context of WLC-based procurement structures is that aesthetic value should be treated as an objective parameter of preference rather than an irrational bias, its priority in the selection decision is valid but must be offset by financially proven whole-life performance.

C. Whole Life Costing in Construction.

Whole Life Costing has been developed over the years since the 1960s, from cost-in-use models to the modern value-based decision-making models embodied in the international standards. WLC enables informed decision-making by considering all the relevant costs and revenues associated with the acquisition and ownership of an asset in a systematic way, as defined by the Construction Research and Innovation Strategy Panel as: the systematic consideration of all the relevant costs and revenues associated with the ownership and acquisition of an asset.

The present-value technique used in this research converts future cash flows to their present value using a discount rate that reflects the time value of money and the cost of capital in the current economic environment. According to Flanagan and Jewell (2008), WLC is not a spending-more tool in the first place; it is a spending-right decision tool at the first place since it determines the entire financial impact of every procurement option. This difference is especially critical in residential construction in developing countries, where there is a myth that WLC must imply increase initial spending, which has hindered its adoption by clients and practitioners. The use of WLC in selecting building materials is not new in the international literature. As demonstrated by Altaf et al. (2023), it is valuable for the sustainability assessment of a variety of construction projects. Mostavi et al. (2017) created a WLC-conceptualized approach that maximizes the cost of a building life cycle, environmental footprint and occupant comfort. Koenig and Wüstenhagen (2010) demonstrated that offering consumer's information on the life cycle cost has a significant effect of changing investment choices towards more efficient but initially costly choices. Nonetheless, there are few applications directly focused on non-structural internal finishes used in residential construction in Sub-Saharan Africa, which is a gap this study fills.

A recurring criticism of WLC practice is that it presents single-point estimates as though the inputs were known with certainty. Service lives, maintenance intervals, future prices and the discount rate are all uncertain, and a ranking that flips under modest changes to these inputs gives a client little to act on. The literature therefore treats sensitivity analysis as a minimum and recommends probabilistic methods such as Monte Carlo simulation where data allow. The problem is sharper in developing economies, where historical cost data are thin and inflation and exchange-rate movements can reshuffle relative prices quickly. Few Nigerian studies of building materials report how sensitive their WLC results are, and we are not aware of any that has returned to an earlier WLC comparison to check whether its conclusion survived a major change in the price environment.

D. Summary and Research Gap

Three gaps follow from the review. Evidence on ceiling finishes in Nigeria is largely descriptive and preference-based, with little on long-term cost. Where WLC has been applied to building materials, the results are usually deterministic and untested for robustness. While the literature sets out the principles of WLC-informed choice, it offers few decision tools a practitioner could apply to a small residential job. This study addresses all three.

IV. RESEARCH METHODOLOGY

A. Research Design and Approach

A quantitative research design was adopted to address the study's five objectives. Quantitative methods are appropriate when the research aims to produce measurable, generalizable evidence on material attributes and cost relationships, and when the findings are intended to support reproducible decision-support tools (Creswell & Creswell, 2017). The research integrates two different, yet complementary, data collection tools: a structured questionnaire completed by two groups of respondents (end-users and installers/retailers) and a whole-life cost model populated with survey-collected cost data and market rates prevailing in Osogbo, Osun State.

B. Study Area and Population

The research was carried out in Osogbo, the capital of Osun State in south-western Nigeria. The town of Osogbo was chosen because it represents a medium-density Nigerian city centre with a residential construction market dominated by both POP and PVC ceiling systems, and because its construction cost profile is representative of south-western Nigeria in general. The sample population consisted of two categories: (i) residential end-users, people who now occupy buildings which have either POP or PVC ceilings installed, or (ii) ceiling installers and retailers working in Osogbo city.

C. Sampling and Data Collection

Simple random sampling was used for end-users to ensure equal probability of selection across the study population (Singh & Masuku, 2014). The sampling frame comprised ten residential communities within the Osogbo construction-market catchment: Ila Orogun, Otan-Ayegbaju, Iree, Ikirun, Iresi, Osogbo, Ede, Iwo Road, Ogo-Oluwa, and Old Garage. 100 end-users were randomly selected. Fieldwork was carried out between 2014 and 2016, when PVC ceiling panels were still relatively new in this market. The installer/retailer group was purposively selected to give direct working knowledge of the two ceiling materials, and 50 installers, suppliers, and retailers were contacted.

Of the 100 end-user questionnaires sent, 90 were returned, of which 80 were usable for analysis (80% usable response rate). Of the 50 installer/retailer questionnaires sent, 47 were returned, with 40 valid (80% usable response rate). The usable end-user responses were split evenly between occupants of PVC-ceiled and POP-ceiled buildings (40 each), and the usable installer/retailer responses between PVC and POP specialists (20 each). The response rate is relatively good compared to the 70% mark considered good in construction management rese.

The questionnaire tool was designed in two forms. The end-user instrument captured information on: (Section A) the respondent's background; (Section B) the factors influencing the selection of ceiling materials; and (Section C) maintenance experiences and satisfaction. The installer/retailer instrument captured information on: (Section A) the professional background; (Section B) the performance characteristics of each finish; (Section C) lifespan factors; and (Section D) the unit cost of materials and installation. The instrument's pilot test involved five respondents from each group to assess clarity and completeness; slight amendments were made after the pilot test.

D. Data Analysis

Descriptive statistics, Mean Item Score (MIS), and Relative Importance Index (RII) were used to analyse perception-based data. MIS was computed as:

$$MIS = \Sigma (f \times s) / N$$

Where f is the frequency of each Likert scale response, s is the scale value (1–5), and N is the total number of respondents. RII was computed as:

$$RII = \Sigma (W) / (A \times N)$$

Where W is the weighting assigned by respondents, A is the highest weight on the scale (5), and N is the total number of respondents. RII values range from 0 to 1 and MIS values from 1 to 5; for both, higher values indicate greater perceived importance. Both measures are widely used in construction management research to rank and prioritise factors identified through questionnaire surveys (Ogunsemi, 2002).

Whole Life Cost: The present-value method of calculating Whole Life Cost was applied at a discount rate of 12 per cent, which was close to the Central Bank of Nigeria’s Monetary Policy Rate during the fieldwork period (12 per cent until November 2014 and 13 per cent for most of 2015) (Flanagan & Jewell, 2008). A 3 per cent sinking fund rate was used when converting present values into annual equivalents, following the dual-rate convention common in quantity surveying valuation practice; a single-rate check is reported in Section 5.7.2. The analysis covered a 15-year period, based on respondents' reported average life expectancies for the two materials. The WLC formula used was:

WLC = Initial Cost (material + installation) + Present Value of Maintenance Costs

The model also excluded disposal costs because no market data could be relied upon to accurately determine the cost of ceiling removal and disposal in Osogbo. This is a limitation, although it follows previous practice where data are limited (Altaf et al., 2023). All base-care costs are in Nigerian Naira (₦) at 2015/16 market prices, the period of the fieldwork; Section 5.7.5 re-prices the model at 2026 rates.

E. Robustness, Threshold and Re-Pricing Analyses

The base-case model rests on point estimates, so five further analyses were carried out to see how far the conclusions depend on them. All were run in Python using the same cost equations as the base case.

- Rank concordance. Spearman’s rank correlation (ρ) was used to compare how PVC and POP users ranked the 19 common selection factors, and how installers ranked the seven lifespan factors for each finish (Siegel, 1957). The 19 selection factors

were also grouped into six value dimensions to give a simpler profile of what each group was buying.

- One-way sensitivity analysis. Each input was varied across a plausible range while the others were held at base values: initial costs by ±20 per cent; POP maintenance cost from ×0.5 to ×1.5; PVC maintenance cost from ×0.5 to ×2 (a wider band, because the PVC figure was derived from a rule of thumb); maintenance intervals by ±1 year; the analysis period from 10 to 20 years; and the discount rate from 3 to 20 per cent.
- Switching values. For the most influential inputs, the value at which the two finishes reach whole-life parity was solved directly. This includes a price-parity ratio, R*, defined as the ratio of POP to PVC installed unit rates at which the two whole-life costs are equal, with maintenance held at the same proportion of initial cost as in the base case.
- Monte Carlo simulation. Ten thousand runs were drawn using triangular distributions for costs (initial costs ±20 per cent; POP maintenance ×0.5-×1.5; PVC maintenance ×0.5-×2.0), discrete distributions for maintenance intervals (POP 4, 5 or 6 years; PVC 2, 3 or 4 years, weighted 25:50:25) and for the analysis period (10, 15 or 20 years), and a uniform distribution for the discount rate (3-20 per cent). The random seed was fixed so that the results can be reproduced.
- Re-pricing at 2026 conditions. Current installed rates for each finish were obtained through written quotations from five ceiling installers operating in Osogbo in July, 2026. These were checked against published Nigerian market price guides (Engineeringall, 2025; Lodpost, 2024; Prioni, 2026; Stocker, 2025), which fell within the same range. For the fieldwork period, a contemporary source (Nairaland, 2017) gave about ₦1,200/m² for PVC panels and ₦400/m² for installation, consistent with the base-case figures. Quotations naturally vary between installers, so the 2026 rates are reported as a central value with a low-high band rather than a single figure. Maintenance costs were scaled to installed cost in the same proportion as in the base case. Two discount rates were applied. The first is a real rate of 6.6 per cent, derived from the Monetary Policy Rate of 23 per cent set in September 2026 and headline inflation of 15.39 per cent for August 2026 (CBN, 2026; NBS, 2026). The second is the nominal 23 per cent, used for comparison. For consistency, the base case was also re-run at an approximate 2015 real rate of 3.7 per cent (a 13 per cent policy rate against inflation of about 9 per cent).

V. RESULTS

A. Respondent Background of End Users

Table 1: Background Characteristics of End-User Respondents (n = 80; 40 per ceiling type)

PVC		**POP**			
Type of building	**Frequency**	**Percent (%)**	**Type of building**	**Frequency**	**Percent (%)**
Residential	40	100.0	Residential	40	100.0
Did you choose the finishes?			Did you choose the finishes?		

Yes	29	72.5	Yes	35	87.5
No	11	27.5	No	5	12.5
Maintenance frequency			Maintenance frequency		
6 months-1 year	5	12.5	6 months–1 year	5	12.5
1–3 years	12	30.0	1–3 years	13	32.5
3–5 years	7	17.5	3–5 years	17	42.5
Never	11	27.5	Never	5	12.5

Table 1 shows that PVC and POP ceiling finishes are most likely applied in residential buildings, which justifies the residential nature of this study. There is also a significant difference in the autonomy to choose between the two groups: 87.5% of POP users personally chose the ceiling finish, compared with 72.5% for PVC. This trend suggests that POP installation is more of a client-driven choice, which aligns with its stronger aesthetic appeal (Lau & Choi, 2021). Whereas PVC is often left to installers based on cost and time. Maintenance frequency data further distinguish between the two materials: 42.5% of POP users said they maintained their ceiling in 3 to 5 years, 27.5% of PVC users said they had never maintained their ceiling, and 17.5% of PVC users said they maintained it every 3 to 5 years. These differences in maintenance frequency precede the WLC results in Section 5.6.

B. Factors Influencing the Selection of Ceiling Finishes

Table 2: Factors Influencing Ceiling Finish Selection and Mean Item Score Rankings (n = 80; 40 per ceiling type)

PVC Factors	**MIS**	**Rank**	**POP Factors**	**MIS**	**Rank**
Cost	4.60	1	Aesthetics	4.70	1
Readily available	4.40	2	Cost	4.58	2
Water resistance	4.37	3	Heat resistance	4.27	3
Aesthetics	4.15	4	Sound absorption	4.25	4
Easy to install	4.10	5	Durability and sturdiness	4.20	5
Durability and sturdiness	4.10	5	Strength and stability	4.12	6
Ease of maintenance	4.05	7	Antimicrobial resistance	4.10	7
Antimicrobial resistance	4.05	7	Readily available	3.98	8
Light reflectance	4.00	9	Ease of maintenance	3.93	9
Strength and stability	3.92	10	Sound isolation	3.88	10
Sustainability	3.90	11	Sustainability	3.88	10
Heat resistance	3.88	12	Light reflectance	3.80	12
Sound isolation	3.85	13	Easy to install	3.73	13
Easily manipulated	3.68	14	Resist air leakage	3.72	14

Resist air leakage	3.68	14	Fire resistance	3.68	15
Sound absorption	3.68	14	Easily manipulated	3.65	16
Humidity resistance	3.58	17	Humidity resistance	3.53	17
Wind load resistance	3.50	18	Wind load resistance	3.47	18
Fire resistance	3.08	19	Water resistance	3.30	19

Table 2 presents the MIS rankings for 19 ceiling finish selection factors rated by end-users for PVC and POP, respectively. For PVC, cost (MIS = 4.60), availability (MIS = 4.40) and water resistance (MIS = 4.37) are the major selection criteria. These rankings reflect the cost-sensitive decision-making environment documented in the Nigerian residential construction literature (Eze et al., 2021; Makinde et al., 2024) and indicate that the choice of PVC is primarily driven by economic and functional utility.

For POP, aesthetics is the most important (MIS = 4.70), followed by cost (MIS = 4.58). The attributes of heat resistance (4.27) and sound absorption (4.25) are ranked as the third and fourth ones, which means that the POP users take into account sensory and functional performance qualities and consider it with respect to cost. This highest ranking of aesthetics by POP aligns with Creusen and Schoormans (2005) findings that product appearance is a powerful consumer choice determinant when there are numerous functional substitutes. It is worth noting that PVC has the lowest fire resistance (MIS = 3.08) and POP ranks 15th (MIS = 3.68), suggesting that fire protection is not a major factor in either decision, which may have implications for building codes.

C. Background Characteristics for Installers and Retailers

Table 3: Background Characteristics of Installer/Retailer Respondents (n = 40 per ceiling type)

PVC		**POP**			
Role of respondent	**Frequency**	**Percent (%)**	**Role of respondent**	**Frequency**	**Percent (%)**
Installer	14	70.0	Installer	16	80.0
Retailer	6	30.0	Retailer	4	20.0
Years of experience			Years of experience		
1-5	8	40.0	1-5	8	50.0
6-10	6	30.0	6-10	6	37.5
11-15	6	30.0	11-15	2	12.5
Projects handled/supervised			Projects handled/supervised		
1-10	9	45.0	1-10	8	40.0
11-20	5	25.0	11–20	7	35.0
21-30	2	10.0	21-30	5	25.0
31-40	4	20.0	31-40	0	0.0

Table 3 shows that each respondent subgroup is led by installers (PVC: 70%; POP: 80%) rather than retailers, ensuring the performance and cost data are based on first-hand installation experience. At the lower levels, professional experience can be considered relatively similar between the two groups, but PVC professionals exhibit a higher percentage in the experience bracket of 11-15 years (30%) than POP professionals (12.5%), which can be attributed to the fact that PVC has enjoyed a longer presence in the urban residential sector in Nigeria. The project experience distribution is also similar, except that POP specialists are slightly higher in the 21-30 projects category (25 per cent versus 10 per cent for PVC).

D. Performance Characteristics of Ceiling Finishes

Table 4: Performance Characteristics of PVC and POP Ceiling Finishes with their RII Rankings (n = 40)

PVC Characteristic	RII	Rank	POP Characteristic	RII	Rank
Easy to install	0.87	1	Easily manipulated	0.96	1
Ease of maintenance	0.85	2	Aesthetics	0.95	2
Aesthetics	0.83	3	Light reflectance	0.92	3
Light reflectance	0.77	4	Sound absorption	0.91	4
Antimicrobial resistance	0.76	5	Strength and stability	0.90	5
Water resistance	0.76	5	Resist air leakage	0.88	6
Durability and sturdiness	0.73	7	Fire resistance	0.87	7

Table 4 presents the ranking of RII ratings for the performance attributes of each ceiling type, as rated by the installer/retailer group. PVC has the highest ratings for ease of installation (RII = 0.87) and ease of maintenance (RII = 0.85), confirming its market positioning as an easy-to-install and easy-to-maintain system. POP scores the highest in ease of manipulation (RII = 0.96) and aesthetics (RII = 0.95), indicating its adaptability in the design and the value of visual performance in the residential market. This significantly higher aesthetic score for POP (0.95 vs. 0.83 for PVC) supports the MIS scores in Table 2 and affirms that aesthetic superiority is POP's key competitive edge.

E. Factors Affecting the Lifespan of Ceiling Finishes

Table 5: Factors Affecting the Lifespan of Ceiling Finishes (RII Rankings, n = 40)

PVC Lifespan Factor	RII	Rank	POP Lifespan Factor	RII	Rank
Workmanship	0.95	1	Workmanship	0.95	1
Material quality	0.91	2	Material quality	0.94	2
Proper maintenance	0.88	3	Roof covering type	0.89	3
Roof covering type	0.83	4	Structural flexibility	0.83	4
Weather conditions	0.82	5	Proper maintenance	0.81	5

Structural flexibility	0.80	6	Weather conditions	0.80	6
Moisture exposure	0.80	6	Moisture exposure	0.75	7

Table 5 presents RII rankings for the seven factors identified as determinants of ceiling finish lifespan. Workmanship quality is the most significant lifespan factor for both PVC (RII = 0.95) and POP (RII = 0.95), and the next most crucial factor is material quality (PVC: 0.91; POP: 0.94). The practical implication of this finding is direct and practical: the quality of installation is more decisive for the long-term performance of ceiling finishes, irrespective of the type of material used, than any other single factor. Professional standards and regulatory frameworks that govern installation quality have greater potential to extend the lifespan of ceiling services than the substitution of materials alone.

An interesting deviation is observed in the relative significance of structural flexibility: it ranks fourth for POP (RII = 0.83) and sixth for PVC (RII = 0.80). This indicates a greater tendency for POP to crack due to structural movement, a mechanical weakness of gypsum-based systems. POP (0.75) and PVC (0.80) are the seventh and sixth-most affected by moisture exposure, respectively, which suggests that for PVC the risk lies less in the panel itself, which resists water well, than in water from roof defects collecting on the panels and their joints.

F. Whole Life Cost Analysis

Table 6: Unit Cost Summary per m² of Ceiling Area

S/N	Item	POP (₦)	PVC (₦)
1	Initial material cost per m²	3,430.00	1,258.64
2	Installation cost and profit per m²	600.00	450.00
	Total cost per m²	4,030.00	1,708.64

Table 7: Total Initial Outlay for a 176.8 m² Ceiling Area

S/N	Item	POP (₦)	PVC (₦)
1	Initial material cost × 176.8 m²	606,424.00	222,527.55
2	Installation cost × 176.8 m²	106,080.00	79,560.00
	Total initial outlay	712,504.00	302,087.55

Tables 6 and 7 establish the initial cost difference of the two ceiling systems. The unit material cost of POP (₦3,430.00/m2) is 2.73 times higher than that of PVC (₦1,258.64/m2), as POP gypsum compounds are costlier to import and require more skilled labour to install. For the 176.8 m² reference area, the total initial outlay for POP (₦712,504.00) is 2.36 times that of PVC (₦302,087.55).

Table 8: Parameters Used in the Whole Life Cost Calculation

S/N	Material	Initial cost ×176.8 m² (₦)	Installation cost ×176.8 m² (₦)	Maintenance cost per m² (₦)	Maintenance interval	Life expectancy
1	POP	606,424.00	106,080.00	600.00	Every 5 years	15 years
2	PVC	222,527.55	79,560.00	341.73	Every 3 years	15 years

Table 8 presents the input parameters for the WLC model. POP (₦ 600.00/m²/5 years) maintenance expenses were directly sourced from installer/retailer respondents. PVC maintenance cost (₦341.73/m², every 3 years) was estimated as a 20 per cent allowance on the total installed unit cost (₦1,708.64/m²). Both figures reflect the prevailing market rates in Osogbo and align with the maintenance data frequency reported by end-users in Table 1.

1. WLC Calculation for POP

- Initial cost: ₦712,504.00. Maintenance costs discounted to present value at 12% per annum:
- At year 5: PV factor = 1/ $(1.12)^5$ = 0.5674; at year 10: PV factor = 1/ $(1.12)^{10}$ = 0.3220. Combined PV factor = 0.8894.
- Maintenance present value = 600 × 0.8894 × 176.8 = ₦94,347.55
- Total WLC (POP) = ₦712,504.00 + ₦94,347.55 = ₦806,851.55
- Annual Equivalent Cost (AEC) = WLC × (i + s) = ₦806,851.55 × (0.12 + 0.054) = ₦140,392.17, where i is the discount rate and s is the sinking fund factor at 3 percent over 15 years (0.0054)

2. WLC Calculation for PVC

- Initial cost: ₦302,087.55. Maintenance costs discounted at 12% at years 3, 6, 9, and 12:
- PV factors: 0.7117 + 0.5066 + 0.3606 + 0.2567 = 1.8356
- Maintenance present value = 341.73 × 1.8356 × 176.8 = ₦110,903.10
- Total WLC (PVC) = ₦302,087.55 + ₦110,903.10 = ₦412,990.65
- Annual Equivalent Cost (AEC) = ₦412,990.65 × 0.174 = ₦71,860.37

Table 9: Summary of Whole Life Cost (POP versus PVC)

S/N	Material	Present Value / WLC (₦)	Annual Equivalent Cost (₦)	Life expectancy
1	POP	806,851.55	140,392.17	15 years
2	PVC	412,990.65	71,860.37	15 years

Table 9 confirms that, in terms of whole-life cost, PVC is much more economical than POP over a 15-year analysis period. The present value of PVC (₦412,990.65) is 48.8% lower than that of POP (₦806,851.55), and the annual equivalent cost of PVC (₦71,860.37) is

48.8% lower than that of POP (₦140,392.17). The economic argument for PVC remains strong, even when accounting for POP's higher aesthetic performance ratings (Table 4) in situations with budget constraints and where regular maintenance cannot be guaranteed.

Figure 1 shows how the two cost profiles build up over the analysis period. The gap is set on the day of installation and never closes. PVC's more frequent maintenance adds about ₦16,560 more in present value than POP's (₦110,903 against ₦94,348), which is small beside the ₦410,416 difference in initial outlay. Initial cost accounts for 88 per cent of the POP whole-life cost and 73 per cent of the PVC figure, so for both finishes the specification decision is, financially, a front-loaded one.

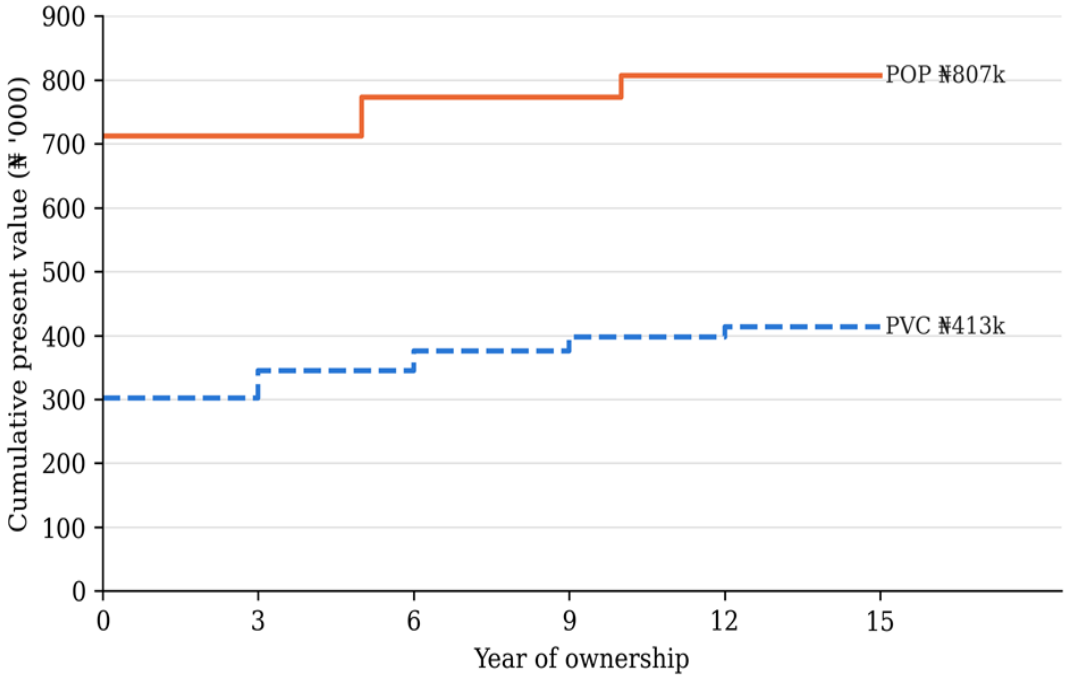

Figure 1: Cumulative present value of ownership for a 176.8 m² ceiling (2015/16 prices, 12% discount rate)

G. Robustness, Threshold and Re-Pricing Results

1. Do POP and PVC buyers value the same things?

Mean scores across all 19 selection factors were almost identical for the two groups (3.92 for PVC users and 3.94 for POP users; Wilcoxon signed-rank $p = 0.78$), so neither group was simply more demanding than the other. What differed was the order of their priorities. The rank correlation between the two sets of scores was only moderate ($\rho = 0.46$, $p = 0.047$). The largest gaps were on water resistance, which PVC users scored 1.07 points higher, and on fire resistance, sound absorption and aesthetics, which POP users scored 0.55–0.60 points higher.

Grouping the factors into value dimensions (Table 10) makes the pattern plain. PVC users put economic and procurement attributes first, while POP users spread their weight across

aesthetic, acoustic and structural attributes. Installers, by contrast, ranked the seven lifespan factors in much the same order for both finishes (ρ = 0.77, p = 0.041). Put simply, the two finishes are bought for different reasons but fail for the same ones.

Table 10: Selection-Value Dimension Profile of PVC and POP Users (mean MIS)

Value dimension	Factors grouped	PVC users	POP users	Higher
Economic and procurement	Cost, availability, ease of installation, ease of maintenance	4.29	4.06	PVC
Aesthetic and design	Aesthetics, light reflectance, ease of manipulation	3.94	4.05	POP
Acoustic comfort	Sound absorption, sound isolation	3.76	4.06	POP
Environmental resistance	Water, humidity, heat, antimicrobial, air leakage, wind load	3.84	3.73	PVC
Structural durability	Durability and sturdiness, strength and stability	4.01	4.16	POP
Safety and sustainability	Fire resistance, sustainability	3.49	3.78	POP
Spearman's ρ, 19 selection factors (PVC vs POP users) = 0.46, p = 0.047; Spearman's ρ, 7 lifespan factors (PVC vs POP installers) = 0.77, p = 0.041.				

2. One-way sensitivity analysis

Figure 2 shows the effect of each input on PVC's whole-life advantage. The POP initial cost has the largest effect, followed by the PVC maintenance cost and the PVC initial cost. The discount rate, which often dominates WLC studies, barely matters here: moving it from 3 to 20 per cent shifts the advantage by only about ₦10,000, because most of the cost of both finishes falls at installation. Across every range tested the advantage stays between roughly ₦251,000 and ₦536,000, and no bar comes near zero. A single-rate annual equivalent (capital recovery factor 0.1468 at 12 per cent over 15 years) gives ₦118,465 for POP and ₦60,637 for PVC. These are lower than the dual-rate figures in Table 9, but the ratio between the two finishes is unchanged.

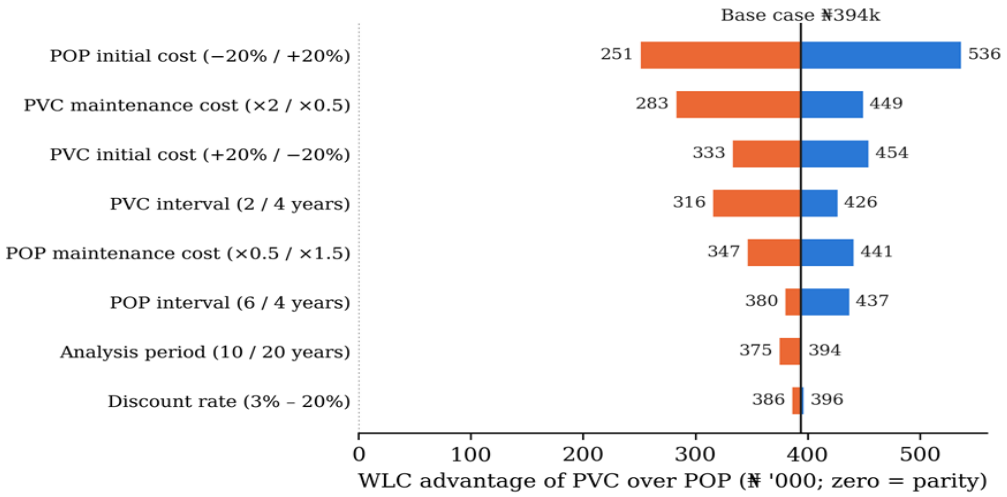

Figure 2: One-way sensitivity of the WLC advantage of PVC over POP. Orange bars show the input value that narrows the gap; blue bars show the value that widens it

3. Switching values and the price-parity threshold

Table 11 reports how far each input would have to move before POP and PVC cost the same over their lives. The thresholds are far from the base case. PVC maintenance would have to cost 4.6 times the assumed rate at every visit. Annual maintenance would not be enough to close the gap, and neither would tearing out the PVC ceiling and installing a new one partway through the period. POP could match PVC only if its installed price fell by more than half, or if a PVC ceiling failed within three to four years. The price-parity ratio is probably the most useful result for practice. With maintenance held at base-case proportions, POP becomes whole-life competitive only when its installed rate is within about 21-31 per cent of the PVC rate, depending on the discount rate. The observed ratio in 2015/16 was 2.36.

Table 11: Switching Values at Which POP and PVC Reach Whole-Life Parity (12% discount rate unless stated)

Input	Base case	Parity value	Distance from base case
PVC maintenance cost per event	₦341.73/m²	₦1,555/m²	×4.6 (91% of the PVC installed rate at every visit)
PVC maintenance interval	Every 3 years	Not reached	Annual maintenance still gives WLC of ₦702,547
Full PVC replacement within 15 years	None	Not reached	Replacement even in year 1 gives WLC of ₦682,717
POP installed cost	₦712,504 (₦4,030/m²)	₦318,649 (₦1,802/m²)	-55%
PVC service life (equal annual cost basis)	15 years	Between 3 and 4 years	PVC must last at least 4 years
Price-parity ratio R^* (POP rate ÷ PVC rate)	2.36 (observed)	1.21 at 12%; 1.27 at 6.6%; 1.31 at 3.7%	Observed ratio is about double the threshold

4. Probabilistic (Monte Carlo) analysis

Across 10,000 simulated runs, PVC had the lower whole life cost in 9,980 cases (99.8 per cent). The median advantage was ₦371,158, and the 90 per cent interval ran from ₦198,646 to ₦515,717 (Table 12; Figure 3). All 20 runs in which POP came out ahead combined a two-year PVC maintenance cycle with a PVC maintenance cost well above the base value (on average 1.7 times) and a POP installed cost below it. That combination is possible but unlikely. Rank correlations between the sampled inputs and the simulated advantage confirm the one-way results: the POP initial cost ($\rho = 0.60$), the PVC maintenance interval ($\rho = 0.45$) and the PVC maintenance cost ($\rho = -0.38$) did most of the work, while the discount rate ($\rho = 0.08$) and the analysis period ($\rho \approx 0$) did very little.

Statistic	POP WLC (₦)	PVC WLC (₦)	PVC advantage (₦)
5th percentile	696,916	347,939	198,646
Median	815,530	436,314	371,158

95th percentile	958,911	624,722	515,717
Share of runs in which PVC is cheaper			99.8%
Percentiles are computed separately for each column, so the advantage column is not the difference between the other two.			

Table 12: Monte Carlo Results for a 176.8 m² Ceiling (10,000 runs)

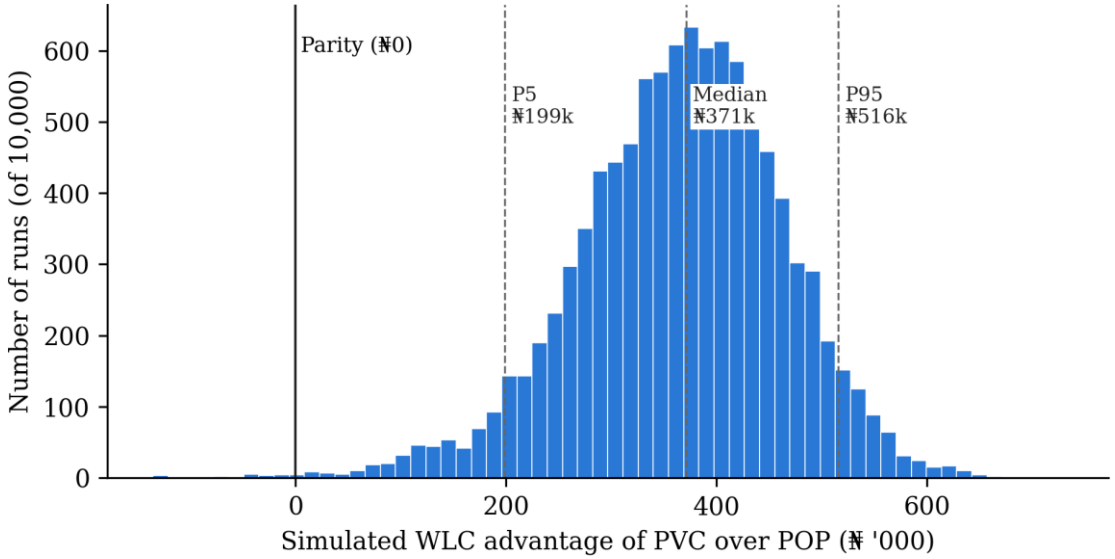

Figure 3: Distribution of the simulated WLC advantage of PVC over POP (10,000 runs)

5. A decade on: re-pricing at 2026 conditions

Table 13 re-runs the model at 2026 rates. On the central estimates, installed rates for POP roughly doubled in naira terms between the fieldwork period and 2026, and those for PVC rose by about three-quarters. Both increases are smaller than general inflation over the decade, which may reflect the limits of secondary price data, a shift towards lighter specifications, or competition among installers; the level of prices matters less here than their ratio. POP rose faster than PVC, and the likely reason is labor. Labor for POP is now quoted at ₦3,000–6,000/m², against ₦600/m² in the base case, while PVC panels are increasingly made in Nigeria.

On the central estimates the rate ratio has moved from 2.36 to about 2.7, and PVC's whole-life saving has grown from 48.8 per cent to 52 per cent at a real discount rate. Even in the scenario least favorable to PVC, with POP at the bottom of its price band and PVC at the top, PVC remains about 15 per cent cheaper over 15 years, because the rate ratio in that scenario (1.50) is still above the parity threshold (1.27). The ranking found a decade ago has held, and the premium a client pays for POP is now larger in both absolute and relative terms.

Table 13: Whole Life Cost of a 176.8 m² Ceiling Re-priced at 2026 Conditions (15 years)

Scenario	POP rate (₦/m²)	PVC rate (₦/m²)	Ratio	Discount rate	POP WLC (₦)	PVC WLC (₦)	PVC saving
2015/16 base case	4,030	1,709	2.36	12% nominal	806,852	412,996	48.8%
2015/16 base case	4,030	1,709	2.36	3.7% real	874,727	487,484	44.3%
2026 central	8,000	3,000	2.67	6.6% real	1,678,513	799,208	52.4%
2026 central	8,000	3,000	2.67	23% nominal	1,515,767	643,348	57.6%
2026, least favourable to PVC	6,000	4,000	1.50	6.6% real	1,258,885	1,065,611	15.4%
2026, most favourable to PVC	10,000	2,500	4.00	6.6% real	2,098,141	666,007	68.3%

VI. DISCUSSION OF FINDINGS

A. Selection Drivers and Their Implications for Procurement Practice

The finding that cost is the primary driver of PVC selection (MIS = 4.60) and the second-ranked driver of POP selection (MIS = 4.58) is consistent with established patterns in the Nigerian construction material literature. Makinde et al. (2024) documented the dominance of financial constraints in material specification decisions, and Eze et al. (2021) established that initial cost is the primary filter used by Nigerian residential clients at the building material purchase stage. The contribution that the current study makes to this picture is that this cost-first mindset is linked with a significant long-term financial cost: clients choosing POP because of its aesthetic qualities and willing to pay a price that is higher than that of PVC (₦712,504.00) will have a whole-life cost that is about two times higher than that of PVC during 15 years.

The fact that aesthetics comes first in POP selection (MIS = 4.70) aligns with the role of product appearance in consumer choice reported (Creusen & Schoormans, 2005; Lau & Choi, 2021). This observation is no trifle: it confirms that the POP premium, the extra ₦393,860.90 in whole life cost, compared to that of PVC, is the price of aesthetic excellence. This is a reasonable and warranted premium to some clients. It is not the case with most people who are under housing budget constraints in Osun State. The practical value of this study is that it quantifies that premium so clients and their advisers can make an informed decision, not an assumption.

The low fire-resistance ranking in both material selection tables (PVC: MIS = 3.08, rank 19; POP: MIS = 3.68, rank 15) raises concerns for building safety. The lowest-ranked factor in the selection of PVC used in this study was fire resistance. The observation fits into the overall trend of Nigerian construction procurement of safety-related performance attributes being systematically underweighted compared to cost and aesthetics (Akadiri & Olomolaiye, 2012). It indicates that the National Building Code should strengthen minimum fire

performance requirements for ceiling systems and that professional advice is needed to address the safety implications of ceiling-material choices alongside cost considerations.

B. Workmanship at the main Determinant of Ceiling Performance.

The installer/retailer survey show that workmanship quality is the top-ranking determinant of lifespan for both PVC (RII = 0.95) and POP (RII = 0.95). The outcome of this finding confirms that the difference in investment of the two materials is, to a high extent, compromised when there is a lack of control in the quality of installation. An expert and qualified POP ceiling fitted by a qualified and experienced contractor would perform significantly better than one fitted by a layman, and the same applies to PVC. The implication of this discovery on the procurement strategy is direct: the choice of ceiling contractor based on lowest labor cost alone - a common practice in residential construction in Osun State - is a form of false economy that hastens the degradation of materials and heightens the number of maintenance cycles that drives whole life cost.

The greater weight given to structural flexibility to POP (RII = 0.83, rank 4) than to PVC (RII = 0.80, rank 6) indicates the sensitivity of POP to differential settlement and structural movement. According to Brambilla and Sangiorgio (2021), construction movement is one of the major contributors to the cracking of gypsum ceilings, which decreases the service life and causes the frequency of maintenance. This difference in vulnerability, as applied to the Nigerian context, where foundation performance is inconsistent and structural quality control is inconsistent, has practical implications of material specification: in structures where structural performance cannot be assured, the increased flexibility of PVC can be a technical benefit that boosts its whole-life cost benefit.

C. Whole Life Cost: Implications and Limitations

The WLC results show that PVC's low initial cost (₦302,087.55 against ₦712,504.00) is not offset by higher running costs. This runs against a belief often voiced in the local market, that a cheaper finish will cost more in the long run. PVC does need attention more often, every three years rather than every five, and in present-value terms its maintenance costs slightly more than POP's (₦110,903.10 against ₦94,347.55). But each intervention is cheaper (₦341.73/m² against ₦600.00/m², or 43 per cent less), and the extra maintenance is small beside the ₦410,416 saved at installation. The maintenance penalty would have to be roughly twenty-five times larger before it offset that saving.

These results are consistent with the argument by Flanagan and Jewell (2008) that whole life cost analysis will often show the option that is more expensive initially to be the less expensive one in the long term - the opposite of this situation is observed here, PVC is the cheaper option both at procurement and throughout its service life. This aligns with the results of a comparative analysis of PVC and concrete panels by Silva and Gomes (2024), who found that PVC's reduced maintenance needs translate into sustained whole-life cost benefits in domestic settings. Several constraints of the WLC model need to be recognized. To start, the cost of disposal was not considered because there was no reliable market data in Osogbo; adding disposal costs could slightly change the difference, but is not expected to reverse it given the size of the difference (₦393,860.90). Second, the 12% discount rate and 3% sinking fund rate, although aligned with Nigerian financial conditions, are assumptions that would need updating for use in other economic settings or at other times.

Third, PVC maintenance costs were estimated using a 20 percent rule of thumb rather than actual market observations; future research should determine this parameter by tracking maintenance costs over time. Fourth, the 15-year analysis period, which is similar to the respondent-reported life expectancy for both materials, may be shorter than the actual service life of well-maintained PVC, which can be up to 20 years.

D. What Ten Years of Market Change Tells Us

A reasonable objection to any study of POP and PVC is that the materials are familiar and the comparison has been made informally many times. The results suggest otherwise, for two reasons. First, familiarity has not produced evidence. Market commentary still presents POP as the durable, premium option and PVC as the cheap one, and it is widely assumed that the cheap option will cost more over time. Neither the base case nor any stress test supports that assumption. Second, the ranking has stayed stable through a period that changed almost everything else about Nigerian construction costs. Between 2015 and 2026, the naira lost most of its value, policy rates nearly doubled, and labor and material prices were reset several times. If the WLC ranking of the two finishes had been a product of 2015 prices, the 2026 re-pricing should have weakened it. It grew instead.

The reason is structural. The price-parity analysis shows that the outcome depends mainly on one number, the ratio of POP to PVC installed rates, and that ratio has stayed well above the parity threshold because POP is the more labor-intensive finish. Skilled site labor has become relatively more expensive in Nigeria over the decade, and POP carries more of it. This has a use beyond ceilings. For any pair of competing finishes with similar maintenance profiles, a quantity surveyor can screen the whole-life choice using the ratio of installed rates alone and needs a full WLC model only when that ratio falls close to the threshold. None of this makes POP a poor choice. It makes it a priced one. At 2026 central rates, a household choosing POP for a 176.8 m² ceiling pays, in present-value terms, about ₦879,000 more over 15 years, or roughly ₦94,000 a year, for better appearance, design freedom, acoustic quality and fire performance. Some clients will think that is good value. The point is that they should make the decision with the figure in mind.

VII. THE CEILING FINISH WHOLE-LIFE VALUE (CF-WLV) FRAMEWORK

The findings expose a gap between what WLC analysis can show and how ceiling finishes are actually specified. Most residential clients in Osun State do not appoint a cost consultant for a ceiling, and a full WLC model for a bungalow is rarely worth the fee. What is needed is a short, structured procedure that brings the key evidence into the conversation between client, quantity surveyor and installer.

The CF-WLV framework (Figure 4) was built for that purpose. Each of its five stages rests on a specific result from this study, and their order follows the behavioral argument in Section 2. Clients start from what they value, so the framework starts there too, and the financial evidence is introduced as a price attached to those values rather than as a verdict against them.

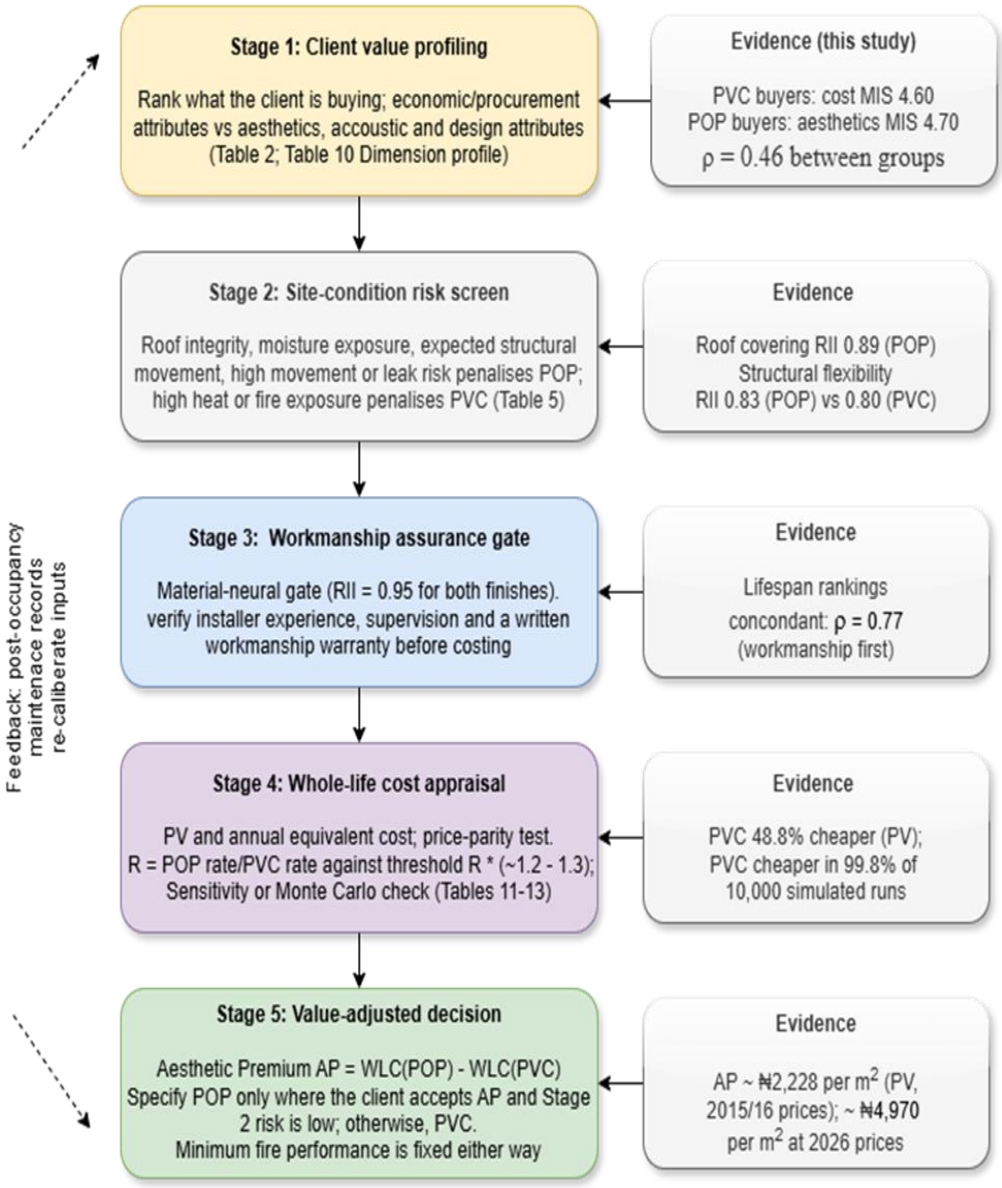

Figure 4: The Ceiling Finish Whole-Life Value (CF-WLV) decision framework

A. Client value profiling.

The client's priorities are recorded against the six value dimensions in Table 10. A client whose priorities sit mainly in the economic and procurement dimension is, in effect, a PVC buyer; one who weights aesthetics, acoustics and design freedom is a POP buyer. Making this explicit early avoids the situation visible in Table 1, where the installer rather than the client ends up choosing the finish.

B. Site-condition risk screen.

Roof condition, likely moisture exposure and expected structural movement are checked. Installers rated roof covering type (RII = 0.89) and structural flexibility (RII = 0.83) as more important to POP lifespan than to PVC, so a leaking roof or a building prone to differential movement is a reason to lean away from POP, or to repair the roof first. Rooms

exposed to high heat, such as kitchens, or where fire performance is critical, weigh against PVC.

C. Workmanship assurance gate.

Workmanship was the leading lifespan factor for both finishes (RII = 0.95) and the lifespan rankings were highly concordant ($\rho = 0.77$), so this stage is material-neutral. Before any costing, the client should confirm the installer's experience with the specific finish, agree who will supervise the work and obtain a written workmanship warranty. A cheaper installer who fails this gate should not be carried forward, whatever the material.

D. Whole-life cost appraisal.

The quantity surveyor first applies the price-parity screen, comparing the ratio of local installed rates, R, with the threshold R* (about 1.2-1.3 for the maintenance profiles observed here). If R is well above R*, PVC is the lower whole-life cost option and no further modelling is needed. If R is close to R*, a full present-value calculation with a sensitivity check, as in Section 5.7, is carried out.

E. Value-adjusted decision.

The difference between the two whole life costs is presented to the client as an aesthetic premium, expressed per square meter and per year. POP is specified where the client accepts that premium and Stage 2 has not flagged a high risk; otherwise, PVC is specified. Either way, the chosen product meets a minimum fire performance standard, since neither user group ranked fire resistance highly (Table 2).

Feedback loop. Maintenance records collected after occupation are used to recalibrate intervals and costs. This step is most often missing in Nigerian practice, and it is the main reason the PVC maintenance cost in this study had to be estimated rather than observed.

For example, consider a client in Osogbo specifying ceilings for a bungalow with 176.8 m² of ceiling area in 2026, with a sound roof and no unusual movement risk. At central rates of ₦8,000/m² for POP and ₦3,000/m² for PVC, R = 2.67, more than twice R* at a 6.6 per cent real discount rate (1.27). Stage 4 therefore confirms PVC as the lower whole-life cost option without a full model. At Stage 5 the client is told that POP will cost about ₦4,970 per m² more in present-value terms, or around ₦94,000 a year over 15 years. If the client values the finish of POP above that figure, POP is specified with a vetted installer; if not, PVC is specified. Either way, the decision rests on a known price rather than an assumption. The framework is derived from the evidence in this study and has not yet been tested with practitioners. Its thresholds reflect the maintenance profiles observed in Osun State and should be recalibrated where local data differ. Validation through expert review or a set of live projects is the natural next step.

VIII. CONCLUSIONS

This study presents a systematic comparative whole-life cost analysis of POP and PVC ceiling finishes in residential construction in Nigeria, using primary survey data from 80 end-users and 40 installers/retailers in Osogbo, Osun State, collected between 2014 and 2016, and a 15-year present-value WLC model that was stress-tested and re-priced at 2026 conditions. There are four main conclusions.

First, ceiling-finish choices in the Nigerian residential market are driven by initial cost, followed by aesthetics, with little weight given to whole-life cost evidence. This procurement behavior has a significant monetary cost for clients who choose POP: the present value of POP ownership (15 years) (₦806,851.55) is nearly twice that of PVC ownership (₦412,990.65). Expressed as an annual equivalent, POP costs ₦140,392.17 per year versus ₦71,860.37 for PVC, a difference of ₦68,531.80 per year on a 176.8 m² ceiling area. Second, workmanship is the dominant factor in the ceiling finish service life for both materials (RII = 0.95). This confirms that installer selection is at least as important as selecting material types. The professional standards for ceiling installation and client education on contractor choice are viable interventions with material implications for whole-life building performance.

Third, PVC's whole-life cost efficiency holds under every sensitivity, break-even, and probabilistic test applied in this study. Its lower initial cost, lower per-intervention maintenance cost, and reasonable aesthetic performance in most residential applications make it the most financially optimal solution for cost-sensitive clients. POP has a reason to exist when the priorities are acoustic performance, design adaptability, and high-quality aesthetic value and when the client can bear the related whole-life costs. Fourth, the result has stood the test of a decade of market disruption. Re-priced at 2026 rates and financing conditions, PVC’s whole-life saving rose from 48.8 to about 52 per cent on central estimates, and the ratio of POP to PVC installed rates (about 2.7) remains roughly double the parity threshold of 1.2-1.3. The economic ranking of the two finishes appears to be a structural feature of their cost make-up, particularly POP's labor intensity, rather than a feature of any one year’s prices.

To practice, this study suggests that WLC analysis should be integrated into the set of ceiling material specifications undertaken by quantity surveyors and project managers, especially in residential projects where budget constraints are present. The CF-WLV framework offers a practical way of doing so. It starts from what the client values, screens site risk and installer competence, and then presents the extra cost of POP as a clear per-square-meter premium that the client can accept or decline.

Future work should

- validate the CF-WLV framework with practicing quantity surveyors and facility managers; (ii) replace estimated maintenance costs with recorded post-occupancy data;
- extend the comparison to whole-life carbon and end-of-life impacts, where the chlorine content of PVC and the recyclability of gypsum may shift the balance (Baitz et al., 2004); and
- Test the price-parity approach on other competing finishes, such as gypsum board and fiber-cement panels.

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