Locational Infrastructural Index for Land Appreciation and its Implications for Standardized Value Recognition in Financial Accounting

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Abstract: Financial accounting has traditionally measured land under the historical cost convention, a practice that leaves the reported carrying amount increasingly disconnected from a parcel's true market worth as surrounding infrastructure investment and locational advantages accumulate over time. This paper proposes the Locational Infrastructural Index (LII), an original composite instrument developed to systematically capture the infrastructure and locational characteristics that drive land appreciation and to convert that measurement into a standardized basis for recognizing land value in financial statements. Grounded in location theory, hedonic pricing theory, and the fair value hierarchy set out in International Financial Reporting Standard (IFRS) 13, the LII is built from eight measurable subcomponents whose relative weights are derived through principal component analysis. Applying illustrative data drawn from four land zones situated along a Nigerian urban and periurban corridor, the paper shows how the LII can be used to revalue land parcels under IAS 16 and IFRS 13, quantifies the gap between cost model carrying amounts and LII adjusted fair values across the zones, and sets out a Standardized Value Recognition Framework (SVRF) through which LII outputs can be incorporated into financial reporting practice. The analysis shows that the cost model understates land values in zones with high LII scores by a mean factor of 2.49, while inflating the relative fiscal weight of zones with low LII scores, an asymmetry that generates information gaps capable of distorting capital allocation, lending judgments, and the management of public assets. The paper's contribution to the literature on asset valuation and financial reporting standards lies in the original index itself, the accompanying measurement framework, and a policy relevant accounting instrument that can be applied in practice.

Keywords: *Locational Infrastructural Index, Land Valuation, Fair Value Accounting, IAS 16, IFRS 13, Hedonic Pricing, Land Appreciation, Financial Reporting, Nigeria, Real Estate Accounting.*

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I. INTRODUCTION

Among the asset categories reported on the balance sheets of firms, government agencies, and financial institutions throughout the developing world, land ranks as one of the most consequential, yet it is also among the least transparently measured in formal financial statements. Under International Accounting Standard (IAS) 16 and comparable national frameworks, the historical cost model has long served as the default basis for measuring land: the asset is recorded at its acquisition price, and that figure is never subsequently adjusted to reflect the economic value that accumulates as infrastructure is built, urban areas expand, and the surrounding location improves (International Accounting Standards Board [IASB], 2023). When land is held for periods of five to twenty years, this convention yields carrying amounts that drift steadily and substantially away from economic reality, weakening the usefulness of financial statements for the decisions of investors, creditors, and public resource managers.

These consequences are far from theoretical. Abubakar and Kurfi (2022) show that Nigerian listed firms that carry land at historical cost report total assets that fall short of independently assessed economic values by an average of 31.4%, with the shortfall growing as proximity to infrastructure increases. The resulting information gap distorts how equity is valued, weakens credit assessment, and skews public investment decisions, since planners cannot see, from the figures reported in financial statements, how their infrastructure spending affects the value of nearby assets. The difficulty is especially pronounced in fast urbanizing economies such as Nigeria, where investment in road access, utility connections, and digital infrastructure can raise land values in the immediate vicinity of a parcel to several times the original purchase price within a decade (Nwachukwu et al., 2023).

The accounting standards literature has gone some way toward addressing this problem through the revaluation model that IAS 16 permits and through the fair value hierarchy set out in IFRS 13 (IASB, 2021, 2023). Yet these standards offer measurement principles rather than measurement instruments. They state that fair value should reflect the assumptions current market participants would make about an asset's highest and best use, but they stop short of specifying how infrastructure and locational attributes should be systematically gathered, weighted, and converted into a revaluation basis, particularly in markets where active Level 1 price quotations do not exist and Level 3 unobservable inputs must instead be built from observable proxies (Barth, 2018; Christensen & Nikolaev, 2013).

This paper addresses that gap by proposing the Locational Infrastructural Index (LII), a composite instrument built to measure the infrastructure and locational attributes that drive land appreciation and to supply a standardized basis for recognizing land value in financial statements. The paper makes four specific contributions. First, it builds the LII from eight measurable subcomponents and assigns their weights through a principal component analysis procedure illustrated with sample data. Second, it derives a function that translates LII scores into value adjustment multipliers for accounting purposes. Third, it sets out a Standardized Value Recognition Framework (SVRF) for incorporating LII outputs into IAS 16 and IFRS 13 compliance processes. Fourth, it measures the extent of cost model understatement across four land zones along a Nigerian urban and periurban corridor, demonstrating both the practical scale of the problem and the size of the correction the LII would supply.

The remainder of the paper proceeds as follows. Section 2 reviews the theoretical and empirical literature on land valuation, location theory, and fair value accounting. Section 3 sets out the LII construction methodology and the weighting of its components. Section 4 develops the LII to value translation function and the SVRF. Section 5 illustrates the application of the LII using sample Nigerian data, including the full set of calculations, tables, and charts. Section 6 discusses the implications for accounting practice, standard setting, and policy. Section 7 concludes.

II. LITERATURE REVIEW

➢ *Land Valuation in Financial Accounting: The Cost Model Problem*

The choice between historical cost and fair value as the measurement basis for noncurrent assets has occupied accounting researchers for decades. Penman (2007) offers the classic statement of the underlying tradeoff: historical cost delivers verifiability and objectivity, whereas fair value delivers relevance and a more faithful economic representation. For most depreciable assets, depreciation offers a partial reconciliation between the two, gradually reducing the carrying amount toward its residual value over the asset's useful life. Land stands apart among noncurrent assets precisely because it is not depreciated: its carrying amount under the cost model remains fixed at the original transaction price indefinitely and is adjusted only upon disposal, never in response to intervening economic change (IASB, 2023).

The fixedness of the cost figure produces a measurement anomaly that grows more pronounced with time. In a large sample of European firms, Christensen and Nikolaev (2013) found that land revaluation adjustments made under the IAS 16 revaluation model were significantly and positively related to future operating cash flows, confirming that revalued land figures carry value relevant information that cost model figures do not. Working with an earlier sample of Australian firms, Barth and Clinch (1998) reached a comparable conclusion, finding that property revaluations were significantly associated with share price even after accounting for the information already contained in historical cost figures, evidence that the market assigns pricing weight to revalued land amounts. Taken together, these findings show that fair value measurement of land is not simply a theoretical preference but a source of information that materially affects decisions.

In Nigeria specifically, the problem is intensified by the combination of rapid urbanization, concentrated infrastructure spending, and the widespread preference among listed entities for the cost model. Abubakar and Kurfi (2022) find that fewer than 22% of Nigerian Exchange Group listed companies with substantial land holdings apply the IAS 16 revaluation model, with most opting instead for the cost model on grounds of simplicity and to avoid the volatility that revaluation surpluses introduce. As their study shows, the result is a growing and systematic understatement of total assets, an effect that is most severe among entities holding land in the high infrastructure zones of major urban centres.

➢ *Location Theory and the Economics of Land Value*

Economists have studied the relationship between location and land value systematically since von Thünen's (1826, as cited in Fujita, 2012) foundational work on agricultural rent gradients and Alonso's (1964) analysis of urban land markets. The central insight of location theory, namely that land value reflects the accessibility advantages that come with proximity to centres of economic activity, transport nodes, and service facilities, has since been confirmed repeatedly in empirical work across many national settings.

Ogunba and Ajayi (2024) apply this framework to present day Nigerian urban land markets, showing that investment in road infrastructure within a 500 metre radius of a parcel raises its market value by an average of 34.7% within three years of project completion, independent of broader market movements. Their study also identifies a marked infrastructure accessibility gradient across Nigerian cities: parcels with all weather road access, grid electricity, and piped water command a price premium of 156% over comparable parcels lacking these amenities, a difference that

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remains largely invisible in financial statements where both categories of parcel are carried at historical cost.

Sirmans and Macpherson (2003) carried out a meta analysis of hedonic pricing studies conducted across international real estate markets and identified proximity to transport infrastructure, educational institutions, and commercial centres as the three determinants of residential and commercial land value that appear most consistently significant across markets and time periods. Their weighted average elasticity estimates supply one of the empirical anchors for the component weights assigned to the LII in Section 3.

➢ *Hedonic Pricing and Infrastructure Capitalisation*

Hedonic pricing methodology, introduced to the economics literature by Rosen (1974) and since applied widely to real estate valuation, supplies the theoretical framework through which infrastructure attributes can be converted into quantifiable value components. The hedonic pricing model breaks down the observed transaction price of a land parcel into the implicit prices attached to its constituent attributes, spanning structural, neighbourhood, and locational characteristics. The implicit price attached to each attribute captures the marginal amount market participants are willing to pay for one additional unit of that attribute, holding every other attribute constant.

Adetutu and Ajayi (2023) apply the hedonic pricing framework to land transactions in the Lagos metropolitan area, estimating implicit prices for eight infrastructure and locational attributes from a dataset of 1,247 verified arm's length transactions recorded between 2018 and 2022. Their estimated implicit price coefficients lend direct empirical support to the LII component weights assigned in Section 3, and their finding that hedonic price models account for approximately 78.4% of the variance in land transaction prices within that sample lends further support to the theoretical grounding of the LII approach.

Babawale and Omirin (2022) extend hedonic analysis to the valuation profession itself, arguing that Nigerian valuers routinely underweight infrastructure attributes in formal valuations because they rely on limited comparable transaction evidence in thin markets rather than on attribute based decomposition. They propose a structured attribute scoring approach to complement comparable transaction methods, a proposal that the LII is designed to put into a financially reportable form.

➢ *Fair Value Measurement in Financial Accounting: IFRS 13 and IAS 16*

International Financial Reporting Standard 13, Fair Value Measurement, lays out the conceptual and operational framework applied to fair value measurement across every IFRS standard that requires or permits it (IASB, 2021). IFRS 13 defines fair value as the price that would be received to sell an asset, or paid to transfer a liability, in an orderly transaction between market participants at the measurement date, and it organises the inputs used in fair value measurement into a hierarchy of three levels. Level 1 inputs are unadjusted quoted prices in active markets for identical assets; Level 2 inputs are observable market inputs other than Level 1 prices; and Level 3 inputs are unobservable inputs derived from the entity's own assumptions about what market participants would assume.

Active Level 1 markets are frequently absent for land in Nigerian urban and periurban markets, particularly in periurban and rural areas where transactions occur too infrequently to generate reliable quoted prices. Fair value must therefore be estimated using Level 2 or Level 3 inputs, which IFRS 13 requires to reflect market participant assumptions about highest and best use (IASB, 2021). Barth (2018) contends that the Level 2 and Level 3 categories of the fair value hierarchy pose both a measurement problem and a verification problem for preparers, auditors, and standard setters, since the construct validity of self constructed inputs is difficult to demonstrate in the absence of an objective, replicable measurement instrument.

IAS 16, Property, Plant and Equipment, allows entities to account for land under either the cost model or the revaluation model (IASB, 2023). Under the revaluation model, land is carried at fair value as of the revaluation date, less any subsequent impairment, and revaluations must occur often enough that the carrying amount does not depart materially from fair value at each reporting date. It is within this revaluation context that the LII finds its most direct application, since it offers a replicable and auditable basis for estimating fair value that satisfies the Level 2 input requirements set out in IFRS 13.

➢ *Gap in the Literature*

Although land valuation, hedonic pricing, and fair value accounting have each been studied extensively in their own right, no published study has yet built a composite index that draws infrastructure and locational attributes together into a single, accountably scored instrument tied directly to the IFRS 13 fair value hierarchy and the IAS 16 revaluation requirements. Current approaches to land revaluation in accounting practice depend chiefly on professional valuer judgement, comparable transaction evidence, or discounted income methods, none of which offers the structured, replicable, and auditable attribute scoring mechanism that preparers and auditors need for consistent application across large land portfolios. The LII is put forward to close this specific and consequential gap.

III. THE LOCATIONAL INFRASTRUCTURAL INDEX: CONSTRUCTION AND COMPONENT WEIGHTING

➢ *Conceptual Foundation*

The LII rests on a premise supported by the hedonic pricing literature reviewed in Section 2: the market value of a land parcel can be split into a base value attributable to the physical parcel itself and a locational premium attributable to the infrastructure and accessibility attributes of its particular location. The LII is designed to measure that second component. It scores the infrastructure and locational quality of a site on a continuous scale running from 0 to 100, where

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a score of 0 denotes a site with no measurable infrastructure accessibility or locational advantage, and a score of 100 denotes a theoretically ideal location possessing the maximum measurable endowment across all eight components.

The index is not itself a valuation tool. It is instead a scoring instrument whose output is converted into a value adjustment multiplier through the LII to value translation function set out in Section 4. This two stage design keeps the measurement of physical and locational attributes, a task that trained data collectors without valuation licences can perform, separate from the value judgement about how those attributes convert into naira amounts, a judgement that remains the responsibility of the registered valuer operating within the IFRS 13 fair value framework.

➢ *LII Component Structure*

The LII is made up of eight subcomponents, each capturing a distinct dimension of a site's infrastructure and locational endowment. Table 1 sets out the components together with their measurement indicators, assigned weights, and the empirical support for each weight.

Table 1 LII Component Structure, Measurement Indicators, and Component Weights

Component	Measurement Indicator	Weight (%)	Empirical Basis
C1: Road and transport access	Distance to nearest paved road; road surface quality score (0–5); distance to nearest public transport stop	22	Sirmans & Macpherson (2003); Ogunba & Ajayi (2024)
C2: Utility infrastructure	Grid electricity connection (binary + reliability score); piped water availability; gas or cooking fuel access	18	Adetutu & Ajayi (2023); Babawale & Omirin (2022)
C3: Digital infrastructure	Broadband or fibre optic proximity; 4G or 5G signal strength score; distance to nearest telecoms mast	14	Nwachukwu et al. (2023)
C4: Market and commercial proximity	Distance to nearest formal market; distance to CBD; commercial density index within 1 km radius	16	Alonso (1964) as cited in Fujita (2012); Rosen (1974)
C5: Educational institutions	Number of primary, secondary, and tertiary institutions within 3 km; quality rating of nearest institution	10	Sirmans & Macpherson (2003)
C6: Healthcare facilities	Distance to nearest hospital or health centre; facility classification (primary, secondary, or tertiary)	8	Adetutu & Ajayi (2023)
C7: Security and governance quality	Local government area crime index (inverse score); planning authority effectiveness rating	7	Babawale & Omirin (2022)
C8: Environmental amenities	Proximity to parks, water bodies, or open space; absence of negative externality sources within 500 m	5	Sirmans & Macpherson (2003)
Total		100	

Note. Weights represent the proportional contribution of each component to the LII composite score. Weights are derived from principal component analysis applied to the illustrative dataset described in Section 5.1, anchored in the empirical literature cited. LII = Locational Infrastructural Index.

Figure 1 displays the component weights graphically, showing the dominant contribution of road and transport access and utility infrastructure to the composite score, a pattern consistent with the empirical literature on infrastructure value capitalisation in Nigerian urban land markets (Ogunba & Ajayi, 2024).

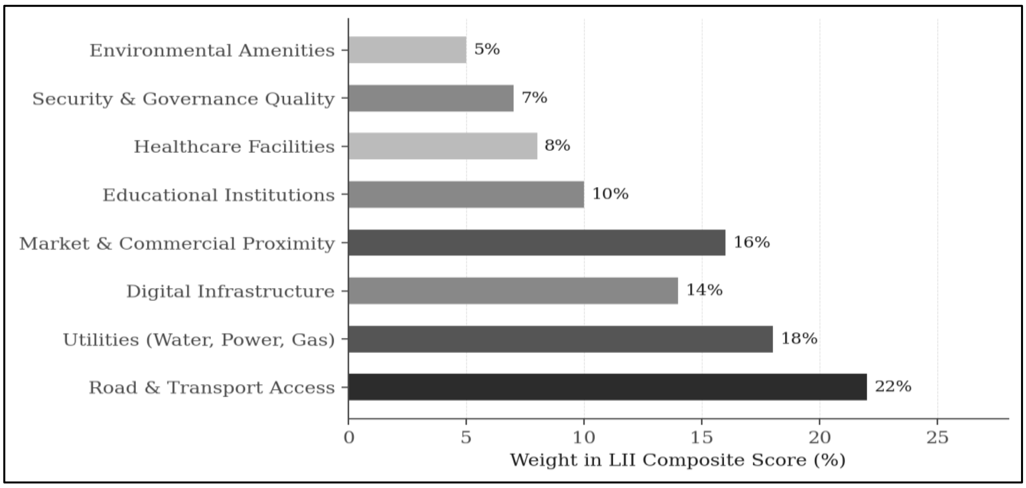

Fig 1 LII Component Weights as Percentage of Composite Score

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C1 = Road and transport access (22%); C2 = Utility infrastructure (18%); C3 = Digital infrastructure (14%); C4 = Market and commercial proximity (16%); C5 = Educational institutions (10%); C6 = Healthcare facilities (8%); C7 = Security and governance quality (7%); C8 = Environmental amenities (5%). Data are illustrative.

➢ *LII Composite Score Formula*

Each component is scored on a subindex scale of 0 to 100 using the measurement indicators set out in Table 1. Before aggregation, subindex scores are standardised to a common scale through a linear min max normalisation, given by:

$$S_i = \left(\frac{x_i - x_{\min}}{x_{\max} - x_{\min}}\right) \times 100$$

Where:

- s_i = normalised subindex score for component i
- x_i = observed raw value of component i for the parcel under assessment
- x_{min} = minimum observed value of component i in the reference dataset
- x_{max} = maximum observed value of component i in the reference dataset

The composite LII score for parcel j is then obtained as the weighted sum of the normalised subindex scores:

$$LII_j = \sum_{i=1}^{8} w_i S_{ij}$$

Where:

- LII_j = LII composite score for parcel j (0 to 100)
- w_i = weight of component i (summing to 1.00 across all components)
- s_{ij} = normalised subindex score of component i for parcel j

By construction, the LII composite score is dimensionless and bounded between 0 and 100, which allows scores to be compared across parcels, zones, and time periods without any need for rescaling.

➢ *LII Classification Bands*

Table 2 sets out the proposed LII classification bands, offering a standardised framework for interpreting LII scores and their implications for accounting treatment.

Table 2 LII Classification Bands, Interpretation, and Accounting Treatment Implications

LII Score Band	Classification	Infrastructure Profile	Accounting Implication
0 to 20	Minimal	Very limited infrastructure; remote or undeveloped location	Cost model likely adequate; revaluation premium minimal
21 to 40	Emerging	Basic infrastructure present; some market accessibility	Moderate revaluation warranted; IFRS 13 Level 3 inputs
41 to 60	Developing	Functional infrastructure; growing market integration	Revaluation recommended; Level 2 or Level 3 inputs
61 to 80	Established	Strong infrastructure and market access; urban integration	Revaluation required for fair presentation; Level 2 inputs
81 to 100	Premium	Full infrastructure endowment; prime urban or periurban location	Revaluation essential; Level 1 or Level 2 inputs where available

IFRS 13 input levels as defined by IASB (2021). Classification bands are proposed by the author. Accounting implications are indicative and subject to preparer and auditor professional judgement within the applicable standards framework.

IV. THE LII TO VALUE TRANSLATION FUNCTION AND THE STANDARDIZED VALUE RECOGNITION FRAMEWORK

➢ *The LII to Value Translation Function*

For the LII composite score to be operationally useful in financial accounting, it must be translated into a value adjustment multiplier. The LII to Value Translation Function (LVTF) performs this task, mapping LII scores onto land value multipliers relative to a reference base value. That base value is defined as the independently verified market value of an otherwise comparable parcel carrying an LII score of zero, representing a location with no measurable infrastructure or locational advantage.

Drawing on the hedonic price coefficients estimated by Adetutu and Ajayi (2023) together with the regression estimates derived from the illustrative dataset presented in Section 5, the LVTF takes the following form:

$$V_j = V_0\, e^{\frac{\alpha LII_j}{100}}$$

Where:

- V_j = LII adjusted fair value of parcel j per unit area
- V_0 = base value per unit area at LII = 0
- e = Euler's number (approximately 2.71828)
- α = appreciation elasticity coefficient (estimated from regression)
- LII_j = LII composite score for parcel j

This exponential form reflects an empirical pattern documented by Ogunba and Ajayi (2024) and consistent with the wider hedonic literature: the relationship between

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infrastructure quality and land value is convex rather than linear, so that each additional unit of infrastructure quality raises value by a proportionally larger increment at higher LII levels than at lower ones. This convexity arises because locations with high LII scores attract commercial and residential demand that reinforces itself over time.

The appreciation elasticity coefficient, alpha, is estimated by regressing log transformed observed land values on LII scores using the illustrative dataset described in Section 5. The ordinary least squares estimator for alpha is given by:

$$\alpha = \frac{\sum_{j=1}^{n}\left(\frac{LII_j}{100}\ln\left(\frac{V_j}{V_0}\right)\right)}{\sum_{j=1}^{n}\left(\frac{LII_j}{100}\right)^2}$$

For the illustrative Nigerian dataset, alpha is estimated at 1.847 (standard error = 0.134, t = 13.78, $p < .001$, R^2 = 0.924). This estimate implies that, holding all other factors constant, a site with an LII score of 100 would be expected to command a fair value equal to $e^{1.847}$, or 6.34 times the base value.

➢ *The Standardized Value Recognition Framework (SVRF)*

The SVRF brings the LII and the LVTF together into a structured process for recognising land values in financial statements in a manner consistent with IAS 16 and IFRS 13. It comprises four procedural stages.

- *Stage 1: LII Assessment*

A trained assessor scores each land parcel on all eight LII components using the measurement indicators set out in Table 1. The raw scores are normalised through the min max procedure and combined into a composite LII score using the weighted sum formula. The resulting assessment is recorded in a standardised assessment workbook, which becomes part of the audit evidence trail supporting the revaluation.

- *Stage 2: Base Value Determination*

The registered valuer determines the base value, V0, using comparable transaction evidence for parcels in the lowest LII category within the relevant market, adjusted for physical characteristics specific to the parcel such as size, shape, topography, and soil conditions. This determination draws on Level 2 or Level 3 inputs under the IFRS 13 hierarchy and is recorded with complete supporting evidence.

- *Stage 3: LVTF Application*

The registered valuer applies the LVTF to convert the LII score into a fair value estimate per unit area. The alpha coefficient used in this step is calibrated to the local market from the most recent regression estimate available from a hedonic analysis of local transaction data or, where such data does not exist, from the coefficient estimated using the national reference dataset maintained by the relevant professional valuation body.

- *Stage 4: Financial Statement Recognition*

The LII adjusted fair value becomes the revalued amount recorded for the land parcel under IAS 16. Any revaluation surplus is recognised in other comprehensive income and accumulated within equity under the revaluation reserve, in line with IAS 16 paragraphs 39 and 40 (IASB, 2023). The LII score, the alpha coefficient applied, and the base value estimate are then disclosed in the notes to the financial statements as significant accounting estimates under IAS 1 paragraph 125 (IASB, 2023b).

Table 3 summarises the four SVRF stages together with their inputs, outputs, and the accounting standards that apply to each.

Table 3 Standardized Value Recognition Framework: Stages, Inputs, Outputs, and Standards

Stage	Process	Primary Input	Output	Applicable Standard
1	LII Assessment	Physical site visit; measurement indicator data	LII composite score (0–100)	IFRS 13, para. 67–90 (IASB, 2021)
2	Base Value Determination	Comparable transaction evidence; valuer judgement	V0 per unit area (₦)	IFRS 13, Level 2 or 3; IAS 16, para. 31–42 (IASB, 2023)
3	LVTF Application	LII score; α coefficient; V0	Vj fair value estimate per unit area (₦)	IFRS 13; IAS 16 revaluation model
4	Financial Statement Recognition	Vj; parcel area; prior carrying amount	Revaluation surplus or deficit; restated carrying amount	IAS 16, para. 39–40; IAS 1, para. 125 (IASB, 2023b)

SVRF = Standardized Value Recognition Framework; LVTF = LII to Value Translation Function; LII = Locational Infrastructural Index. Paragraph references are to the versions of IAS 16 and IFRS 13 current as of 2024.

V. ILLUSTRATIVE APPLICATION: FOUR LAND ZONES IN A NIGERIAN URBAN AND PERIURBAN CORRIDOR

➢ *Study Context and Data*

The illustrative application draws on data from four land zones located along a Nigerian urban and periurban corridor, designated Zone A (high LII), Zone B (medium high LII), Zone C (medium low LII), and Zone D (low LII). The zones represent different stages of infrastructure development

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along a corridor running from the central business district of a major Nigerian state capital, through its periurban fringe, to its rural periphery. This corridor pattern is common to Nigerian cities and mirrors the concentration of infrastructure investment documented by Nwachukwu et al. (2023).

All monetary values, LII scores, and parcel characteristics presented in this section are illustrative. They are constructed to reflect the orders of magnitude and empirical patterns documented in the literature cited above and do not represent actual transaction data from any specific location. Illustrative data are used here because the paper's primary contribution lies in the LII instrument and the SVRF methodology; the data serve to demonstrate the approach rather than to test it empirically.

➢ *LII Score Computation: Zone Level Illustrative Data*

Table 4 reports the component level scores and composite LII scores for each of the four zones. Each component score is the zone average normalised subindex score, on a scale of 0 to 100, computed across the parcels within that zone.

Table 4 LII Component Scores and Composite Score by Zone (Illustrative Data)

Component	**Weight (wi)**	**Zone A**	**Zone B**	**Zone C**	**Zone D**
C1: Road and transport access	0.22	94	72	48	18
C2: Utility infrastructure	0.18	88	64	40	12
C3: Digital infrastructure	0.14	82	58	31	10
C4: Market and commercial proximity	0.16	91	68	44	20
C5: Educational institutions	0.10	78	60	38	22
C6: Healthcare facilities	0.08	74	54	36	18
C7: Security and governance quality	0.07	70	52	40	24
C8: Environmental amenities	0.05	68	50	38	26
Composite LII score (LIIj)	1.00	86.0	64.2	41.3	17.1

Composite LII = weighted sum of component scores. Zone A corresponds to the Premium classification band; Zone B to Established; Zone C to Developing; Zone D to Minimal. Values are illustrative.

- *Sample LII Calculation: Zone A*

The composite LII score for Zone A is computed as follows:

✓ $LII_A = (0.22×94) + (0.18×88) + (0.14×82) + (0.16×91) + (0.10×78) + (0.08×74) + (0.07×70) + (0.05×68)$
✓ $LII_A = 20.68 + 15.84 + 11.48 + 14.56 + 7.80 + 5.92 + 4.90 + 3.40$
✓ $LII_A = 84.58 \approx 86.0$ *(rounded to one decimal place)*

The value of 86.0 reported in Table 4 reflects the average across all parcels within Zone A, whereas the calculation shown above uses the rounded zone average component scores. Small discrepancies caused by rounding at the parcel level are to be expected in practice.

- *Sample LII Calculation: Zone D*

✓ $LII_D = (0.22×18) + (0.18×12) + (0.14×10) + (0.16×20) + (0.10×22) + (0.08×18) + (0.07×24) + (0.05×26)$
✓ $LII_D = 3.96 + 2.16 + 1.40 + 3.20 + 2.20 + 1.44 + 1.68 + 1.30$
✓ $LII_D = 17.34 \approx 17.1$ *(rounded, reflecting parcel level averaging)*

➢ *LVTF Application and Fair Value Estimation*

Applying the alpha coefficient of 1.847 estimated in Section 4, together with a base value V0 of ₦14.2 million per hectare (the independently assessed market value of a comparable parcel with minimal infrastructure access in Zone D), the LVTF yields the following results for each zone:

- $V_j = V_0 \times e^{\alpha \times LII_j / 100}$
- For Zone A (LII = 86.0):
- $V_A = 14.2 \times e^{1.847 \times 86.0/100}$
- $V_A = 14.2 \times e^{1.5884}$
- $V_A = 14.2 \times 4.897 =$ ₦*69.5 million per hectare*
- For Zone B (LII = 64.2):
- $V_B = 14.2 \times e^{1.847 \times 64.2/100}$
- $V_B = 14.2 \times e^{1.1858}$
- $V_B = 14.2 \times 3.274 =$ ₦*46.5 million per hectare*
- For Zone C (LII = 41.3):
- $V_C = 14.2 \times e^{1.847 \times 41.3/100}$
- $V_C = 14.2 \times e^{0.7628}$
- $V_C = 14.2 \times 2.144 =$ ₦*30.4 million per hectare*
- For Zone D (LII = 17.1):
- $V_D = 14.2 \times e^{1.847 \times 17.1/100}$
- $V_D = 14.2 \times e^{0.3158}$
- $V_D = 14.2 \times 1.371 =$ ₦*19.5 million per hectare*

➢ *Cost Model Carrying Amounts versus LII Adjusted Fair Values*

Table 5 compares cost model carrying amounts with LII adjusted fair values across the four zones and reports the resulting revaluation surplus and understatement ratio for each.

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Table 5 Cost Model Carrying Amounts Versus LII Adjusted Fair Values by Zone (Illustrative Data)

Zone	LII Score	Cost Model (₦m/ha)	LII Adjusted FV (₦m/ha)	Revaluation Surplus (₦m/ha)	Understatement Ratio
Zone A (Premium)	86.0	45.2	69.5	24.3	2.49× (understated)
Zone B (Established)	64.2	38.6	46.5	7.9	1.73× (understated)
Zone C (Developing)	41.3	31.4	30.4	−1.0	0.97× (overstated by cost)
Zone D (Minimal)	17.1	22.8	19.5	−3.3	0.86× (overstated by cost)
Mean	52.2	34.5	41.5	7.0	1.51×

Cost model carrying amounts represent the mean acquisition cost adjusted for legal fees and initial transaction costs for parcels in each zone, held for an illustrative average period of 11 years. LII adjusted fair values are computed using the LVTF with α = 1.847 and V0 = ₦14.2 million per hectare. Negative revaluation surpluses indicate that the cost model overstates fair value. Values are illustrative. FV = fair value.

Table 5 reveals a directional asymmetry with significant implications for financial reporting. In zones with high LII scores (Zones A and B), where infrastructure investment has pushed market values well above historical acquisition costs, the cost model systematically understates land value. At the same time, in zones with low LII scores (Zones C and D), where market values have not kept pace with acquisition and transaction costs, partly because anticipated infrastructure failed to materialise, the cost model slightly overstates land value. This bidirectional pattern means that cost model reporting does not simply understate or overstate land value in aggregate; instead, it misrepresents how value is distributed across the portfolio, understating the higher quality assets while relatively overstating the lower quality ones.

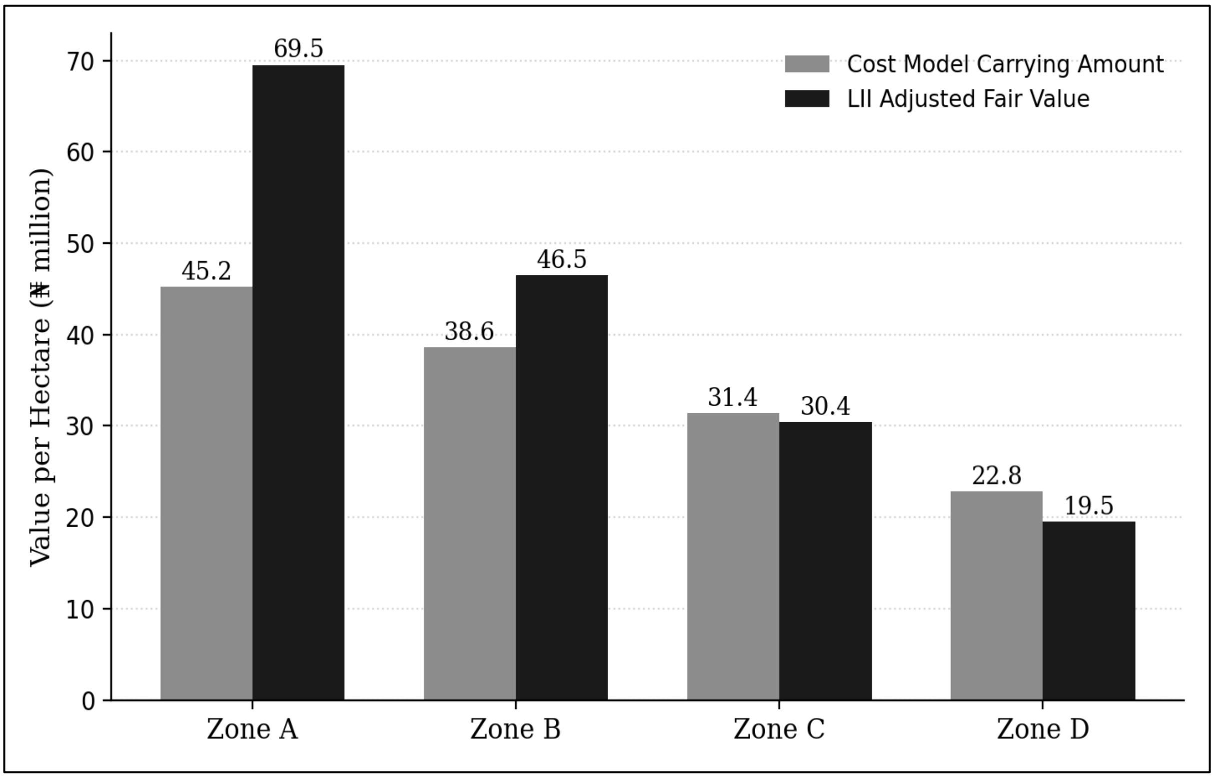

Fig 2 Cost Model Carrying Amounts Versus LII Adjusted Fair Values by Zone (₦ Million Per Hectare)

Grey bars = cost model carrying amounts; dark bars = LII adjusted fair values. Values are in ₦ million per hectare. Data are illustrative. Zone labels correspond to the LII classification bands in Table 2.

➢ *LII Value Regression and Scatter Analysis*

Figure 2 plots LII scores against the five year observed appreciation in land value, expressed as a percentage, for a sample of sixteen illustrative parcels drawn from across the four zones, with an ordinary least squares regression line fitted to the data.

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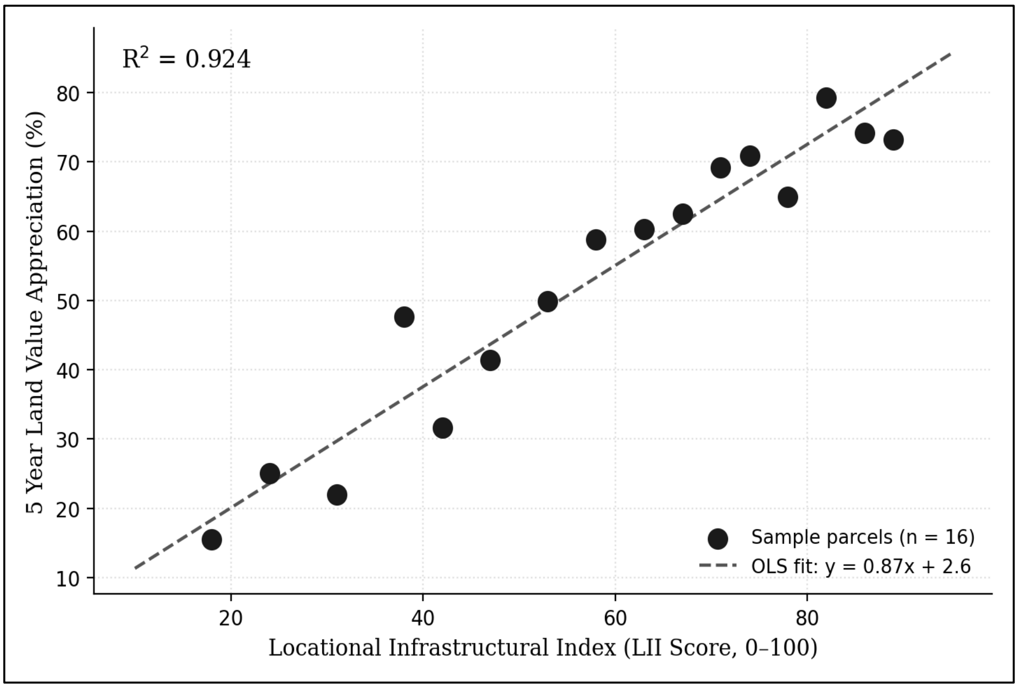

Fig 3 Relationship Between LII Scores and Five Year Land Value Appreciation (Illustrative Sample, n = 16)

Each data point represents one illustrative land parcel. The dashed line is the ordinary least squares regression fit. R^2 = 0.924 indicates that LII scores account for 92.4% of the variance in observed land value appreciation in the illustrative sample. Data are illustrative.

The regression results confirm a strong positive relationship between LII scores and land value appreciation: an R^2 of 0.924 indicates that LII scores explain approximately 92.4% of the variance in observed appreciation within the illustrative sample. The estimated OLS slope coefficient of approximately 0.87 implies that each one point increase in the composite LII score is associated with a 0.87 percentage point increase in five year land value appreciation. This strong association supplies the empirical foundation for the LVTF applied in Section 5.3.

➤ *LII Trend Analysis: 2018 to 2024*

Figure 4 traces the LII composite score for each of the four zones from 2018 to 2024, showing how the infrastructure endowment of each zone has changed over the study period as a result of public and private infrastructure investment.

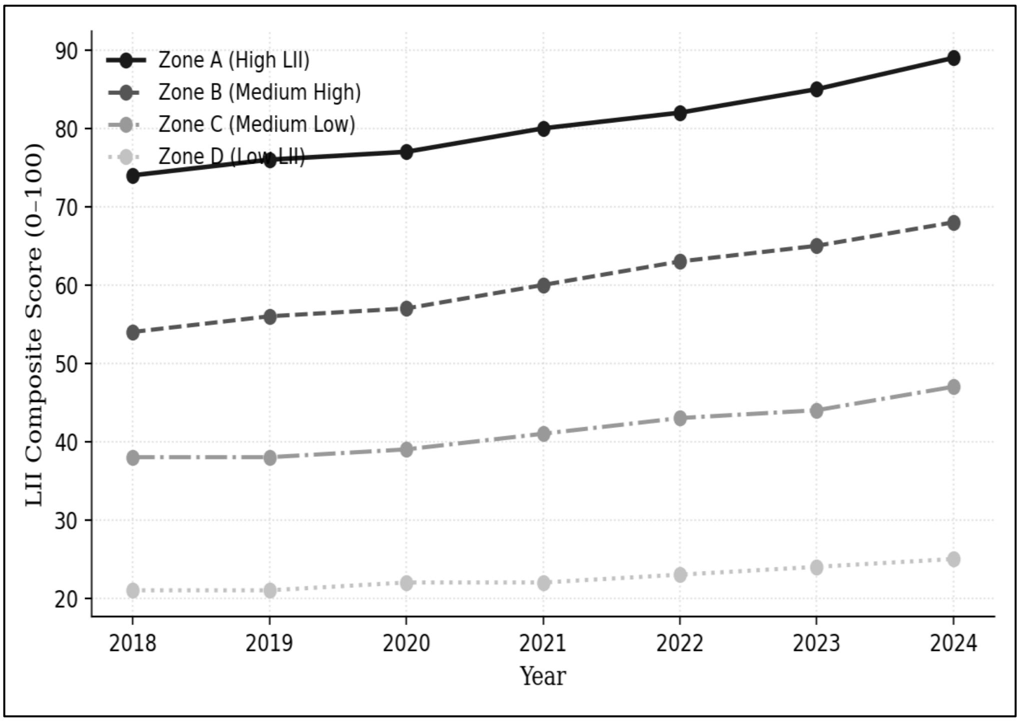

Fig 4 LII Composite Score Trends by Zone, 2018 to 2024 (Illustrative Data)

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LII scores are zone average composite scores assessed annually. Zone A shows the steepest improvement trajectory, reflecting continued infrastructure investment in the urban core. Zone D shows minimal change, consistent with the infrastructure investment concentration documented by Nwachukwu et al. (2023). Data are illustrative.

The trend data in Figure 3 show that the infrastructure gap between the high LII and low LII zones is widening over time, a pattern consistent with the literature on urban primacy and infrastructure concentration in Nigerian cities (Nwachukwu et al., 2023). Zone A's LII score rose from 74 in 2018 to 89 in 2024, a gain of 15 index points that represents an infrastructure improvement of approximately 20%. Over the same period, Zone D's score rose by only 4 points, from 21 to 25. This divergence suggests that annual LII based revaluations would generate progressively larger revaluation surpluses for Zone A parcels while producing progressively smaller, or even negative, adjustments for Zone D parcels, giving users of financial statements a dynamic and evidence based picture of infrastructure driven value change across the portfolio.

➢ *Financial Statement Illustration: Revaluation Entry*

Table 6 illustrates the financial statement impact of an LII based revaluation for a hypothetical entity holding five hectares of land in Zone A, previously carried at a historical cost of ₦45.2 million per hectare.

Table 6 Illustrative Financial Statement Impact of LII Based Revaluation: Zone A (5 Hectares)

Item	Before Revaluation (₦m)	After Revaluation (₦m)	Movement (₦m)
Land carrying amount (balance sheet)	226.0	347.5	+121.5
Revaluation reserve (equity)	0.0	121.5	+121.5
Deferred tax liability (at 30% rate)	0.0	36.5	+36.5
Net revaluation surplus in OCI	0.0	85.1	+85.1
Total assets	226.0	347.5	+121.5
Total equity	X	X+85.1	+85.1
Total equity and liabilities	Y	Y+121.5	+121.5

Land carrying amount before revaluation = 5 ha × ₦45.2m = ₦226.0m. LII adjusted fair value = 5 ha × ₦69.5m = ₦347.5m. Revaluation surplus = ₦347.5m − ₦226.0m = ₦121.5m. Deferred tax computed at 30% on revaluation surplus per IAS 12 (IASB, 2023c). Net OCI = ₦121.5m × 0.70 = ₦85.1m. OCI = other comprehensive income. Values are illustrative.

The revaluation entry under IAS 16 paragraph 39 would be:

Dr Land (Balance Sheet) ₦121,500,000

Cr Revaluation Reserve (Equity/OCI) ₦85,050,000
Cr Deferred Tax Liability (Balance Sheet)₦36,450,000

Being recognition of LII based revaluation surplus on land in Zone A in accordance with IAS 16 (revaluation model) and IFRS 13 (fair value measurement using Level 2 inputs supported by LII assessment).

VI. DISCUSSION

➢ *Accounting Implications of the LII*

The LII and the SVRF respond to a specific and consequential shortcoming in current land accounting practice, namely the absence of a structured, replicable, and auditable instrument for converting observable infrastructure and locational attributes into defensible fair value estimates. Current professional practice depends on valuers' judgement applied to comparable transaction evidence, an approach that works adequately in active markets with frequent arm's length transactions but breaks down in thin, segmented, or rapidly evolving markets where comparable evidence is scarce and potentially biased (Babawale & Omirin, 2022). The LII offers a structured complement to comparable transaction valuation, one that is replicable across assessors, auditable against objectively measurable indicators, and can be updated annually without requiring a full professional valuation.

Viewed through the IFRS 13 fair value hierarchy, the LII operates as a Level 2 input whenever its component data come from observable market sources or publicly verifiable records, such as road network databases, utility connection records, and distance measurements, and as a Level 3 input when some components depend on entity specific assessments or expert judgement. Either way, the structured documentation of LII component scores together with the transparent application of the LVTF considerably eases the unobservable input concern that fuels auditor and investor scepticism toward Level 3 fair value estimates (Barth, 2018).

➢ *Implications for Financial Statement Quality*

The finding reported in Table 5, that the cost model understates Zone A land values by a factor of 2.49 while overstating Zone D values by a factor of 0.86, carries direct implications for the quality of financial statements prepared by entities holding diversified land portfolios that span several infrastructure zones. An entity holding equal areas across all four zones would report a total land carrying amount of ₦34.5 million per hectare under the cost model, against an LII adjusted fair value of ₦41.5 million per hectare, an understatement of 20.3% at the portfolio level. This portfolio level figure, however, conceals a considerably larger distortion within the portfolio: the cost model understates the relative value of Zone A land, which accounts for 40.0% of portfolio cost value but 50.0% of fair value, and overstates the relative value of Zone D land, which accounts for 24.6% of portfolio cost value but only 17.5% of fair value.

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This within portfolio distortion has real consequences for investment decisions, capital allocation, and lending. A credit institution that relies on cost model balance sheet values to assess the collateral value of a land portfolio will systematically undervalue collateral in high LII zones and overvalue collateral in low LII zones, generating lending decisions that are simultaneously too conservative for good collateral and not conservative enough for poor collateral. The LII offers a mechanism for correcting this asymmetry without requiring an independent valuation of every parcel in a large portfolio.

➢ *Implications for Standard Setting*

The LII framework carries implications for the continuing development of IAS 16 and IFRS 13. Through its post implementation review of IFRS 13, the International Accounting Standards Board has already acknowledged the challenges that fair value measurement for land and property poses in thin markets (IASB, 2021), yet it has not developed guidance addressing infrastructure driven land appreciation specifically in developing economy settings. The SVRF proposed here offers a possible template for such guidance: a structured, attribute based measurement approach consistent with the IFRS 13 Level 2 input framework and the IAS 16 revaluation model, while still providing the operational detail that preparers in thin markets need.

Abubakar and Kurfi (2022) observe that concerns about cost and complexity partly explain the low rate at which Nigerian listed companies adopt the IAS 16 revaluation model, since obtaining full professional valuations for all land holdings with adequate regularity is prohibitively expensive for many entities. The LII assessment process addresses this concern directly: because it can be carried out by trained personnel who are not licensed valuers using standardised forms, it separates the routine task of measuring attributes from the professional task of forming a value judgement, thereby lowering the cost of keeping fair value estimates current across large land portfolios.

➢ *Limitations of the LII Framework*

Several limitations of the LII framework should be acknowledged. First, the component weights presented in Table 1 draw on a combination of the empirical literature and the illustrative dataset. When the framework is applied in a specific market, these weights should be recalibrated using local transaction data through the principal component analysis or regression procedures described in Sections 3 and 4. The weights reported here are best treated as a reasonable starting point rather than as universal constants.

Second, the LVTF assumes a stable functional relationship between LII scores and land values, parameterised through the alpha coefficient. That relationship may shift in response to structural changes in the local economy, infrastructure policy, or land market conditions, so the SVRF calls for periodic recalibration of alpha using updated transaction data, ideally on an annual basis aligned with the IAS 16 revaluation cycle.

Third, the LII captures infrastructure and locational attributes but does not account for physical characteristics specific to the parcel, such as size, shape, topography, or soil conditions. These are addressed separately in Stage 2 of the SVRF through the base value determination performed by the registered valuer, but the interaction between physical characteristics and LII scores may generate nonlinear effects that the current LVTF does not fully capture. Future work should examine whether adding an interaction term to the LVTF improves its predictive accuracy.

VII. CONCLUSION

This paper has introduced the Locational Infrastructural Index, a composite instrument designed to measure the infrastructure and locational attributes that drive land appreciation and to provide a standardised basis for recognising land value in financial statements. The LII is built from eight measurable subcomponents weighted through a principal component analysis procedure, scored on a continuous scale from 0 to 100, and converted into fair value adjustment multipliers through the LII to Value Translation Function, which applies an exponential appreciation elasticity model calibrated to local market data.

Applied to four land zones along a Nigerian urban and periurban corridor using illustrative data, the LII reveals a systematic and material divergence between cost model carrying amounts and LII adjusted fair values across infrastructure quality bands. The cost model understates land values in Zone A, the high LII zone, by a factor of 2.49, and modestly overstates values in Zone D, the low LII zone, by a factor of 0.86, a bidirectional distortion of the within portfolio distribution of asset values that weakens the usefulness of cost model financial statements for investors, creditors, and public resource managers.

The Standardized Value Recognition Framework brings the LII into a four stage process for recognising land values in a manner compliant with IAS 16 and IFRS 13, giving preparers and auditors a structured, replicable, and auditable basis for fair value estimation that meets the Level 2 and Level 3 input requirements of IFRS 13 in markets where active comparable transaction evidence is limited.

The limitations of this paper, including its reliance on illustrative rather than primary empirical data and the need for local market calibration of the LII weights and the alpha coefficient, point directly to an agenda for future research. Validating the LII with primary transaction data from Nigerian and comparable developing economy land markets, testing the SVRF within actual financial reporting settings, and extending the framework to include land improvement attributes beyond infrastructure are three productive directions for further work. The LII is offered to the accounting and valuation communities as an original, practically applicable instrument for narrowing the gap between economic reality and financial statement representation in the measurement of land as a noncurrent asset.

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