

An assessment of the methodological challenges in valuing contaminated land for compensation in Rivers State, Nigeria

Abstract

Valuing contaminated land presents significant methodological challenges, particularly in determining appropriate compensation for affected communities. This study examines these challenges in Rivers State, Nigeria, with a focus on the valuation methods used, the difficulties faced by valuers, and the implications for compensation outcomes. Employing a descriptive research design and a quantitative approach, data were collected from 98 estate surveying and valuation firms through a total census approach. Findings indicate that the Cost Approach (RII = 0.83), Market Comparison Method (RII = 0.80), and Income Capitalization Method (RII = 0.76) were the predominant valuation techniques, preferred for their reliance on observable market data. Conversely, the Residual Method (RII = 0.58), Contingent Valuation Method, and Hedonic Pricing Method are used less frequently due to their complexity and data limitations. The study also reveals that 60% of respondents experienced substantial challenges in valuing contaminated land, particularly due to uncertainties in remediation costs, difficulties in estimating future land values, and a lack of reliable environmental data. Furthermore, 62.2% of respondents indicate that compensation outcomes are often inadequate due to valuation inconsistencies. To address these challenges, the study recommends the establishment of a clearer legal framework that recommends the use of economic valuation methods, improved access to environmental data, and regular environmental monitoring to enhance valuation accuracy. Standardized guidelines and valuation methods, enhanced training for valuers, and regular stakeholder consultations are also proposed to ensure fair and transparent compensation practices. The study concludes that refining valuation methodologies and adopting a more comprehensive approach will improve compensation outcomes, ensuring that the economic, environmental, and social impacts of contaminated land are adequately considered.

Keywords: contaminated land, valuation methods, compensation, environmental data, remediation costs

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Introduction

Land contamination has become a significant global environmental and economic challenge, posing substantial risks to public health, ecosystems, and property values.¹ Contaminated land defined as land polluted by hazardous substances such as hydrocarbons, heavy metals, and chemicals that threatens human health, environmental quality, and economic activities.² This issue is particularly serious in regions with extensive oil and gas operations, such as Rivers State, Nigeria, where industrial activities, oil spills, and improper waste disposal have led to widespread land degradation.³ As a result, accurately valuing contaminated land for compensation has become a crucial aspect of environmental justice and economic equity. Proper valuation ensures fair compensation for landowners, promotes sustainable land management, and aligns with international frameworks like the United Nations' Sustainable Development Goals (SDGs), particularly Goal 11, which advocates for sustainable cities and communities.⁴ However, valuing contaminated land presents unique methodological challenges due to the complexity of contamination impacts, data limitations, and the diversity of legal and institutional frameworks.⁵

In Rivers State, the presence of contaminated sites is associated with the activities of multinational oil companies, local artisanal refineries, and inadequate environmental regulations.⁶ The region's economic dependency on oil and gas intensified land use conflicts, making compensation a contentious issue. While conventional land valuation methods such as market comparison, cost, and income

approaches are commonly employed, their effectiveness in valuing contaminated land is limited by difficulties in quantifying the effects of contamination on property values and the lack of standardized valuation guidelines.⁷

The challenges in valuing contaminated land arise from the multifaceted nature of contamination itself. Unlike conventional real estate valuation, which primarily relies on market comparables, contaminated land valuation requires the integration of scientific, environmental, and legal considerations.⁸ These complexities often lead to inconsistencies and inaccuracies in compensation assessments, undermining stakeholder trust and perpetuating socio-economic inequalities. The key issues include determining the extent of contamination, selecting appropriate valuation methodologies, and interpreting regulatory frameworks to ensure fair outcomes.⁹ Compensation for contaminated land remains a complex and contentious issue, particularly in regions heavily affected by environmental degradation. In Rivers State, where oil spills, illegal refining, and industrial waste disposal have caused extensive land degradation, property values, agricultural productivity, and local livelihoods have been adversely affected.^{3,6} Despite the critical need for compensation to mitigate these socio-economic consequences, existing valuation practices face substantial methodological challenges.

Kakulu¹⁰ notes that land valuation in Nigeria suffers from several issues, including a lack of technical expertise, the absence

of consistent and transparent procedures, and valuation methods that are scattered across various legislative enactments, leading to multiple interpretations. A main challenge in valuing contaminated land is quantifying the extent and impact of contamination on land values. Traditional valuation methods, such as cost, market, and income approaches, often do not consider unique contamination-related factors, such as remediation costs, loss of use, and long-term environmental risks.⁷ Moreover, the lack of standardized valuation guidelines for contaminated land in Nigeria has resulted in inconsistent compensation assessments, triggering disputes among stakeholders. These disputes not only delay compensation but also erode trust in the valuation process, exacerbating tensions among affected communities, government agencies, and private sector entities.⁹

In Rivers State, these challenges are further intensified by the weak enforcement of environmental regulations. The National Oil Spill Detection and Response Agency (NOSDRA) and the Department of Petroleum Resources (DPR) are responsible for overseeing oil spill responses and ensuring environmental remediation; however, many local communities report inadequate compensation and insufficient restoration efforts. Although the existing legal and institutional frameworks provide some guidance on land valuation and compensation, they often fail to address the complexities of valuing contaminated land, leaving affected communities without adequate restitution.¹¹

In addition, limited access to reliable data on the nature and extent of contamination poses a significant obstacle to accurate valuation. Many contaminated sites in Rivers State lack comprehensive environmental assessments, making it challenging to determine the true impact of contamination on land values.² This data gap is further compounded by weak enforcement of environmental regulations and the absence of an integrated institutional framework for addressing land contamination issues. The implications of these challenges are profound. Inaccurate or unfair compensation can lead to prolonged socio-economic hardships for landowners, hinder the resolution of land use conflicts, and undermine efforts to achieve sustainable development in Rivers State. Moreover, the failure to address methodological gaps in contaminated land valuation limits the potential for developing a transparent and equitable compensation framework that aligns with global best practices.⁵ Addressing these challenges is vital for fostering sustainable development, promoting environmental stewardship, and enhancing public trust in the land valuation process.

Given the complexities surrounding contaminated land and the inconsistent valuation methods, this study seeks to examine the methodological challenges involved in valuing contaminated land for compensation purposes in Rivers State. By exploring the legal, institutional, and practical hurdles in land valuation, the study aims to identify gaps in current practices and recommend strategies for improving compensation outcomes for affected communities. In particular, this study focuses on the impact of oil-related contamination in Rivers State, where communities are disproportionately affected by the environmental and economic consequences of land degradation.

This research is timely and significant, as it contributes to the broader discourse on land rights, environmental justice, and sustainable land management practices. The findings will provide valuable insights for policymakers, environmental regulators, landowners, and other stakeholders involved in land valuation and compensation in Nigeria, especially in regions prone to environmental degradation.

The aim of this study is to assess the methodological challenges associated with valuing contaminated land for compensation in Rivers State, Nigeria,

The specific objectives of the study are to:

- i. Examine the current methods used for valuing contaminated land in Rivers State.
- ii. Identify the key methodological challenges encountered in the valuation of contaminated land for compensation purposes.
- iii. Evaluate the impact of these challenges on the outcomes of compensation assessments and stakeholder satisfaction.

Literature review

Concept of land contamination

Land contamination refers to the degradation of land caused by the presence of harmful substances or pollutants that negatively impact its quality, usability, and ecological balance. These pollutants can include hazardous chemicals, hydrocarbons, heavy metals, pesticides, and waste from industrial or household sources that infiltrate the soil, water, or air.⁵ Contaminated land poses significant risks to human health, agricultural productivity, biodiversity, and the socio-economic well-being of affected communities.

Land contamination typically arises from human activities, such as industrial processes, oil and gas exploration, improper waste disposal, and accidental spills. In oil-producing regions like Rivers State, Nigeria, frequent oil spills, gas flaring, and illegal refining are major contributors to soil and groundwater pollution.³ These activities introduce hydrocarbons, toxic metals, and other pollutants into the environment, altering soil structure, reducing fertility, and rendering the land unsuitable for agricultural or residential use.⁷

The effects of land contamination are multi-faceted and far-reaching. Ecologically, contaminated land disrupts natural ecosystems by harming vegetation, aquatic habitats, and soil microorganisms. Economically, it depreciates property values and increases the costs of land restoration and remediation. Socially, it displaces communities, exacerbates land use conflicts, and undermines food security, particularly in agrarian societies.²

Land contamination in Nigeria is regulated by frameworks such as EGASPIN and the NOSDRA Act, but enforcement is hindered by weak institutional capacity, corruption, and conflicts of interest.⁶ Effective management requires a multidisciplinary approach, including scientific assessment, legal oversight, and socio-economic considerations.⁹ Contamination affects land value by increasing remediation costs, limiting usability, and reducing market appeal. A clear understanding of land contamination is essential for developing fair compensation frameworks and promoting sustainable land management.

Land valuation methods

Land valuation is a critical process that involves determining the value of land for various purposes, including sale, taxation, compensation, and investment. In the context of contaminated land, valuation methods become more complex due to the environmental damage affecting the land's usability, productivity, and market value. These methods are generally categorized into several approaches, each suitable for different circumstances.

Market-based methods

Market-based valuation methods rely on the principle of comparing the land in question with similar properties that have been recently sold in the market. These methods are widely used because they reflect the actual transactions that occurred in the current real estate market. The primary market-based methods include:

A. Sales comparison approach

This method involves comparing the land being valued with other similar properties that have either recently sold or are currently on the market. Adjustments are made to account for differences in location, size, condition, and other relevant factors. When dealing with contaminated land, it is essential to adjust for the impact of pollution, as this can significantly decrease the land's value. The Sales Comparison Approach is particularly effective when there are enough comparable properties available. However, it may be difficult to apply this method in areas with limited market activity or where contamination is severe.⁹

B. Income capitalization approach

The Income Capitalization Approach is primarily used for income-producing properties, such as agricultural land or commercial real estate. This method calculates the present value of future income that the property can generate by considering factors like rental income or agricultural yield. When valuing contaminated land, it is important to account for the likely reduction or elimination of the land's income-generating capability, as this will significantly impact its valuation. The process of converting future cash flows from the property over its useful life into a single current capital value is known as income capitalization or discounting.¹² This method can also be applied to assess economic losses resulting from contamination, though it may require specialized expertise to accurately estimate potential income and losses.⁵

Cost-based methods

Cost-based methods focus on determining the cost to replace or restore the land to its original or intended use. These methods are particularly relevant in situations where the land has been damaged or contaminated, as they allow for the estimation of the costs required to remediate the land.

A. Cost approach (replacement or reproduction)

The Cost Approach estimates the value of land by calculating the expenses associated with replacing or reproducing any improvements that may be on the property, while also accounting for depreciation resulting from contamination. This method is based on the idea that, instead of purchasing a specific property, one could build a new property that either replicates the original or provides similar value (Wyatt, 2008).¹³ This approach is particularly useful for properties that are not commonly bought and sold in the market, such as specialized or unique lands. In cases involving contaminated land, the method may include estimating the costs needed for environmental remediation to restore the land's functionality. This approach can be beneficial for compensation purposes, as it reflects the financial burden of restoring the land.²

B. Depreciation adjustments

In contaminated land, the depreciation adjustments are particularly significant, as contamination typically reduces land value over time. Depreciation is calculated by considering the land's previous condition and the extent of environmental degradation. In cases where remediation costs are significant, this approach helps provide a realistic picture of the land's depreciated value.⁹

Hybrid methods

Hybrid methods combine aspects of the market-based, cost-based, and income-based approaches to provide a more comprehensive valuation. These methods are useful when there is insufficient market

data or when contamination presents unique challenges that require multiple perspectives.

Residual land value method

The Residual Land Value Method is often used in property development scenarios, where the value of the land is determined based on the potential development after remediation or mitigation. This method involves calculating the expected value of a developed property and subtracting the costs of development and remediation. For contaminated land, it is important to factor in the costs of cleaning up the site and restoring it to a condition suitable for development. This approach can be used when landowners or developers are considering redevelopment opportunities but must also account for contamination.⁵

Non-market methods

Non-market methods are used when market data is not available or when contamination severely limits the usability of the land, making it difficult to compare to other properties. These methods estimate the value of land based on subjective assessments of its impact on surrounding communities, ecosystems, or the public.

A. Contingent valuation method

The Contingent Valuation Method (CVM) is a survey-based technique used to estimate the value of non-market assets, such as environmental services or ecologically significant land. In the context of contaminated land, CVM involves surveying stakeholders, including landowners and community members, to assess their willingness to accept compensation for the loss of land or the costs associated with remediation efforts. CVM is one of the most widely used techniques for estimating the economic value of non-market goods and services¹⁴⁻¹⁶ because it allows for the inclusion of non-use or passive values. Most applications of contingent valuation (CV) have been conducted to aid in policy evaluations.¹⁴ The CV technique relies on well-crafted and administered sample surveys to directly elicit value from each respondent.¹⁶⁻¹⁸ It determines what people would be willing to pay (WTP) for specific improvements in the quantity or quality of goods, or what they would require in compensation (WTA) for well-defined degradations in those goods. This method is particularly useful in valuing land that provides non-market benefits, such as environmental or cultural value, especially when traditional market approaches are inadequate.²

B. Hedonic pricing method

The Hedonic Pricing Method evaluates how various factors, including environmental attributes, impact land value. This method can be modified to assess the effects of contamination on land value by examining how proximity to contaminated sites diminishes the value of nearby properties. Statistical techniques are used to isolate the impact of contamination from other variables, such as location and amenities, on property values.² Additionally, people's willingness to pay for goods and services may reflect the demand for those products. According to Deeyah and Akujuru,¹⁶ a significant drawback of this method is that it often requires expensive and time-consuming analysis, along with complex primary data collection for its usage value measures.

Approaches for contaminated land valuation

Valuing contaminated land involves more than simply deducting routine cleanup costs from its uncontaminated value. Factors such as marketability, stigma, and the potential for a change in the highest and best use of the property must also be taken into account

(Mundi, 1994).^{8,19,20} According to Chan,²¹ there are two fundamental methods for assessing the value of contaminated land. The first is the unimpaired valuation approach, or unaffected valuation approach, which requires the appraiser to assess the land as if it were clean. Chan emphasizes that this assumption should be clearly stated in the valuation report, and he warns clients about the potential impact of the site's contamination. However, this evaluation technique may not be particularly beneficial to clients, as it does not accurately reflect the actual condition of the site. The second method is known as the impaired approach, or affected valuation approach. In this approach, the valuer considers the contaminated state of the property. The valuer first assesses the property as if it were clean, then deducts any potential income loss due to contamination, as well as costs associated with investigations, remediation, and the possible stigma attached to the property. Chan presents this method using the following equation:

$$V_c = V_u - L - Cr - S \quad (1)$$

Where

V_c = contaminated value

V_u = uncontaminated value

L = Loss due to reduced income/productivity and/or legal liabilities

Cr = investigation and remediation costs

S = stigma impact

Chan²¹ indicates that the primary valuation methods used by valuers in practice include the comparison method, the capitalization method, the cost method, and the hypothetical development method. He acknowledges that while traditional valuation methods can be effective, they come with certain challenges, particularly because they heavily rely on market data that is often unavailable for contaminated land. Chan concludes that Australian valuers predominantly use conventional methods to assess the value of contaminated land, with more innovative approaches rarely employed.

The Green Book²² outlines that Nigeria has several statutes governing compensation related to land or property acquisition; however, only the Oil Pipelines Act (Cap 145, LFN, 1990) and the Mineral and Mining Act (2007) contain provisions specifically addressing compensation for oil spills. Both statutes provide for injurious effects, especially Section 20(3) of the Oil Pipelines Act, which prescribes a "before and after" approach for valuing environmentally impaired property. Thus, the valuation process for compensation due to compulsory acquisition or oil spillage is guided by legal standards and methods.

Regarding land contaminated by oil spills, Babawale²³ notes that the "before and after" approach is commonly used in valuing environmentally impaired properties. This method, also outlined in Section 20(3) of the Oil Pipelines Act, involves first valuing the property in its unimpaired state and then assessing its value in its impaired state, taking into account all associated costs, risks, and stigma effects. The Centre for Advanced Property Economics and the Appraisal Institute (2002) and the Uniform Standards of Professional Appraisal Practice (2003) proposed a formula for valuing contaminated properties to guide this process as thus:

Impaired Value = Unimpaired Value – Cost Effects (Remediation and Related Costs) – Use Effects (Effects on Site Usability) – Risk Effects (Environmental Risk/Stigma)

This technique undoubtedly requires the expert input of various specialists, including microbiologists, marine scientists, environmental scientists, and medical and health experts, among others. However, it has been observed that most valuation reports often lack references to contributions from these scientific experts. Ajibola, Peter, Babajide, and Oni,²⁴ as well as Akujuru¹³ and Akujuru and Ruddock,²⁵ examined the current practices in this area. For example, Akujuru and Ruddock²⁵ provided a framework for incorporating socio-cultural values into the assessment of contaminated land. They argued that environmental pollution damages the economic, ecological, and socio-cultural values that contribute to the total economic value (TEV) of affected properties. They pointed out that valuers typically rely on normative valuation techniques when assessing environmental contamination; however, these models do not adequately capture the unique characteristics of the Niger Delta ecosystem. Their conclusion was that, although the contingent survey method has its weaknesses, it offers the best opportunity to include the cultural and other intangible values lost due to contamination. Akujuru¹³ suggested that the income capitalization approach and the impaired approach are suitable for valuing contaminated properties.

Jackson²⁶ noted that by using income and yield capitalization rate analysis, appraisers can factor in the effects of contamination by applying an appropriate environmental risk premium to the income capitalization rate, which should be derived from the marketplace. Syms²⁷ discussed the procedures for preparing valuation reports for properties designated for continued industrial use. In situations where land use will not change, remediation efforts could take many years.

Bond and Kennedy²⁸ identified several valuation methods for contaminated land, including the capital-based method, income-based method, profits method, residual method, full discounted cash-flow method, sales comparison method, and income capitalization method. Deeyah and Akujuru¹⁶ and Igwenagu, Egolum, and Obineme²⁹ recommended that Estate Surveyors and Valuers diversify their valuation methods by integrating both traditional and contemporary approaches. There is also a need for training and educational programs to familiarize Estate Surveyors and Valuers with modern valuation techniques.

It is clear from the discussion above that there is no single method for valuing all types of environmental damage; instead, there are numerous suggested methods that valuers can choose from based on the specific circumstances and nature of the environmental damage in each case. However, due to legislative influences, valuers in the Niger Delta lack the professional flexibility to select the most suitable method. As Deeyah and Akujuru³⁰ note, valuers in the Niger Delta have relied on property-based and statutory valuation models to address valuation issues. Unfortunately, these models have proven inadequate for assessing environmental damage caused by pollution.

Methodological challenges in valuing contaminated land

Valuing contaminated land is a complex and multifaceted process that requires careful consideration of various environmental, legal, and economic factors. The contamination of land—whether due to industrial activities, oil spills, waste disposal, or other forms of pollution—significantly alters the land's market value, productivity, and potential for future use. Despite the availability of multiple valuation methods, valuing contaminated land remains fraught with challenges. These challenges can hinder fair compensation for affected landowners, slow down the remediation process, and create legal and financial uncertainties.

One of the most significant challenges in valuing contaminated land is the absence of standardized and universally accepted methodologies. While several land valuation methods exist, they are often designed for uncontaminated land and fail to adequately address the nuances associated with land contamination. The contamination factor introduces complexities such as the need for remediation costs, which are difficult to estimate precisely. Existing methods such as the Sales Comparison Approach or Income Capitalization Approach may not fully reflect the reductions in land value caused by pollution.³¹ Moreover, determining how to factor in the long-term environmental, health, and social costs of contamination often proves problematic.⁵ The cost of remediating contaminated land is highly unpredictable, varying based on factors such as the severity of pollution, the type of contaminant, and the land's location. This variability complicates valuers' efforts to estimate restoration expenses accurately, especially given the evolving nature of remediation technologies. These uncertainties can lead to valuation discrepancies, potentially resulting in either under compensation or overcompensation for landowners.⁶

Another challenge in valuing contaminated land is accurately determining the extent of the contamination. In many cases, the full extent of contamination is unknown at the time of the valuation due to the gradual nature of pollution, underground spread of contaminants, or the presence of multiple pollutants. Without comprehensive site assessments, including soil testing, water analysis, and air quality evaluations, it is difficult to assess the true impact of contamination on land value. This lack of clarity increases the potential for disputes between stakeholders, as landowners may argue for higher compensation based on perceived, rather than actual, damage.² Nigeria's legal and regulatory frameworks for contaminated land valuation are inadequate and inconsistent. Laws like the Land Use Act (1978) and EGASPIN provide limited guidance and fail to address the complexities of valuing polluted land. Weak enforcement of environmental regulations and the lack of clear valuation provisions hinder fair compensation for affected landowners.³² Disputes often arise due to differing interpretations of existing laws, particularly when multiple stakeholders, such as government agencies, polluters, and local communities, are involved.⁷

In regions where contamination has significantly affected land use, the availability of comparable market data can be limited. The Sales Comparison Approach, which is commonly used in land valuation, relies on the availability of recent sales of similar properties. However, contaminated land often does not have direct market comparables, making it difficult to determine a fair market value. Even if comparable properties exist, they may not share the same level or type of contamination, further complicating the process of valuation. As a result, valuers may have to rely on indirect methods, such as the Cost Approach or Income Capitalization Approach, which may not fully capture the economic impact of contamination.⁹ Land contamination affects not only its physical characteristics but also has significant economic and social consequences. It reduces agricultural productivity, displaces local communities, and poses health risks, all of which are challenging to quantify but essential in determining the land's true value. In oil-producing regions like the Niger Delta, contamination has resulted in lost livelihoods for farmers and fishermen and long-term health concerns. Indirect costs, including loss of biodiversity, ecosystem services, and social welfare, are difficult to integrate into conventional valuation methods. Consequently, traditional approaches often fail to capture the comprehensive impact of contamination.²

The valuation of contaminated land often leads to conflicts between the landowner, the polluter (e.g., oil companies), and regulatory

agencies. Landowners may seek higher compensation, arguing that the contamination has caused long-term harm to their property, while polluters may downplay the extent of contamination or claim that remediation is unnecessary. Government agencies may also have differing opinions on the level of compensation, with some prioritizing environmental restoration and others focusing on economic factors. These conflicting interests can result in delays in compensation, legal disputes, and a lack of trust between stakeholders.

In Nigeria, there is a shortage of professionals with specialized training in environmental valuation. Estate surveyors and valuers are typically trained in traditional land valuation techniques and may not have the necessary expertise to properly value contaminated land. This lack of expertise often leads to inaccurate assessments, which can undermine the fairness of compensation processes. Additionally, the limited use of advanced tools and technologies, such as Geographic Information Systems (GIS) or environmental modeling software, further exacerbates the challenges in assessing land value in contaminated areas.⁹

Community impacts and compensation practices in contaminated land valuation

Empirical studies have also explored the socio-economic impacts of contaminated land on local communities and how these impacts influence land valuation and compensation practices. In the context of Nigeria, the Niger Delta region has been the subject of several studies that examine the effects of oil contamination on community livelihoods and compensation practices. For instance, a study by Okoro and Chukwu³³ investigated the compensation practices of oil companies in the Niger Delta, focusing on how compensation is calculated and distributed to affected landowners. The study found that while oil companies often provided compensation for the loss of land value, the compensation amounts were frequently insufficient to address the long-term socio-economic impacts on the affected communities, including loss of livelihood, health risks, and displacement.

Similarly, a study by Nwankwoala and Amangabara⁷ found that compensation payments were often delayed or underpaid due to the lack of a standardized methodology for calculating compensation. The study also highlighted the role of local leaders in mediating compensation disputes and the need for greater transparency and fairness in compensation practices. These findings suggest that in Nigeria, the valuation of contaminated land for compensation purposes must go beyond just assessing the physical degradation of the land and should also consider the broader social and economic impacts on affected communities.

Research methodology

This study employs a descriptive research design to examine the various challenges associated with valuing contaminated land for compensation purposes in Rivers State. A descriptive research approach is suitable as it allows the researcher to explore and describe the characteristics of the phenomenon in its natural context without manipulating variables (Neuman, 2014). The objective of the study is to identify and analyze the methodologies used by valuers, the challenges they encounter, and the impact these challenges have on the outcomes of compensation assessments. A quantitative research approach is utilized to gather numerical data, which helps establish causality and facilitates generalizations regarding the contextual issues and challenges in land valuation and compensation. The population for this study consists of various estate surveying and valuation firms operating in Rivers State. The target population includes a total of 128 registered valuers in the study area.³³ A census approach was

employed to collect comprehensive data from the entire population, resulting in the administration of 128 questionnaires to the respective estate surveying and valuation firms in Rivers State. Ultimately, 98 questionnaires were completed and returned.

Data presentation and analysis

This section analyses and presents the data collected in Rivers State, Nigeria. The study employs a quantitative approach to effectively address the research questions related to the challenges of valuing contaminated land and the implications for compensation practices.

Valuation methods for contaminated land

The analysis of the methods used for valuing contaminated land in Rivers State is critical to understanding the effectiveness and challenges faced by valuers in assessing properties affected by contamination. The study gathered data on the methods employed by valuers, in the valuation of contaminated land. This section presents an analysis of the responses regarding the valuation methods predominantly used to assess the value of contaminated land. The data includes frequency of use and the relative importance index (RII), as analyzed below:

Table 1 Valuation methods for contaminated land

Valuation methods	Always	Often	Sometimes	Rarely	Never	Sum	RII
Market Comparison Method	42	33	9	7	7	390	0.8
Income Capitalization Method	35	30	17	11	5	373	0.76
Cost Approach Method	47	32	12	3	4	409	0.83
Hedonic Pricing Method	19	15	21	25	18	286	0.58
Contingent Valuation Method	16	20	23	23	16	291	0.59
Residual Method	12	14	23	27	22	261	0.53

Source: Field Data, 2024

The analysis of valuation methods for contaminated land reveals that the most commonly used approaches are the Cost Approach Method (RII = 0.83), the Market Comparison Method (RII = 0.80), and the Income Capitalization Method (RII = 0.76). These methods are favored for their practical application and reliance on readily available data. In contrast, the Hedonic Pricing Method (RII = 0.58) and the Contingent Valuation Method (RII = 0.59) are used less frequently. The Residual Method (RII = 0.53) is also rarely applied, likely due to its complexity, subjectivity, or data requirements. Overall, these findings indicate a preference for straightforward, data-driven methods in the valuation of contaminated properties.

Extent of challenges faced by valuers in applying valuation methods

Further, respondents were asked to state the extent of challenges they faced when applying valuation methods to contaminated land. The data reflects varying degrees of difficulty, faced by valuers in using the valuation method.

The results presented in Table 2 above indicate that 6.1% of respondents reported facing no challenges, suggesting that a small portion of participants find the application of valuation methods for contaminated land relatively straightforward. A slightly larger group, comprising 12.2%, acknowledged encountering minor challenges. This implies that while the application is generally manageable, some obstacles remain. Additionally, 21.4% of respondents reported experiencing moderate challenges, which highlights that many professional valuers encounter difficulties but can still navigate through them. Meanwhile, 30.6% indicated they face major

The results in Table 1 shows that the Market Comparison Method, with a Relative Importance Index (RII) of 0.80, is one of the most widely used valuation approaches due to its practical application and reliance on observable market data. Its popularity is evident, with 42 respondents indicating they use it “Always” and 33 selecting “Often.” The Income Capitalization Method, with an RII of 0.76, is also frequently employed, especially for income-generating contaminated land; 35 respondents reported using it “Always” and 30 “Often.” The Cost Approach Method yielded the highest RII of 0.83, underscoring its effectiveness in calculating replacement costs, particularly for unique properties or when market comparable are unavailable. In this case, 47 respondents indicated they use this method “Always,” and 32 selected “Often.” In contrast, the Hedonic Pricing Method has a lower RII of 0.58 likely due to its complexity and the extensive data required to assess the impact of environmental factors on property values. The Contingent Valuation Method has a moderate RII of 0.59, relying on subjective survey-based assessments and hypothetical scenarios, which may weaken its reliability in practical applications. Lastly, the Residual Method, with an RII of 0.53, is the least commonly adopted method. Its limited applicability stems from the complexities involved in estimating future development values for contaminated properties.

challenges, revealing that a substantial number find the process of applying valuation methods to contaminated land quite challenging. Finally, 29.6% of respondents reported facing very major challenges, emphasizing that nearly a third of participants consider the process of valuing contaminated land to be particularly complex and difficult. These findings imply that most respondents face significant challenges in applying valuation methods to contaminated land, though some professionals navigate the process with minimal issues. These difficulties likely stem from the complexities and uncertainties associated with contaminated properties

Table 2 Extent of challenges faced by valuers in applying valuation methods

Extent of challenges faced in valuation method to contaminated land	Frequency	Percentage
No challenges	6	6.10%
Minor challenges	12	12.20%
Moderate challenges	21	21.40%
Major challenges	30	30.60%
Very major challenges	29	29.60%
Total	98	100.00%

Source: Field Data, 2024

Methodological challenges encountered in the valuation of contaminated land for compensation

It was crucial to identify the main challenges that valuers face when using traditional methods to value contaminated land for compensation purposes. This section explores the key difficulties

reported by respondents in applying these conventional valuation approaches. The findings are presented along with the frequency of each response category (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree) and the Relative Importance Index (RII), which indicates the level of agreement regarding the identified challenges.

The results in Table 3 indicate that uncertainty in market conditions recorded the highest Relative Importance Index (RII) of 0.83, with 53 respondents strongly agreeing and 22 agreeing. This suggests that uncertainty in market conditions poses a significant challenge for many professionals when using conventional valuation methods for contaminated land. Similarly, the difficulty in projecting future income from contaminated land also achieved an RII of 0.83, with 51 respondents strongly agreeing and 27 agreeing. This indicates that a considerable number of respondents find forecasting future income streams challenging, which is often a critical aspect of land valuation. Uncertainty regarding future income generation scored an RII of 0.74, showing that many professionals are unsure about the potential income the land might generate in the future. This concern is shared by 40 respondents who strongly agree and 24 who agree. Moreover, the difficulty in accounting for contamination received an RII of 0.77. This indicates that 40 respondents strongly agree and 21 agree that factoring in contamination significantly complicates the valuation process. Uncertainty about remediation technologies and

costs also ranked highly, with an RII of 0.78. Here, 32 respondents strongly agree and 42 agree that this uncertainty affects their ability to properly assess the value of contaminated land. Additionally, the lack of comparable sales data received an RII of 0.70, indicating that many respondents—30 who strongly agree and 24 who agree—find it challenging to obtain comparable sales data for contaminated land, which diminishes the effectiveness of conventional methods. The lack of reliable data on the income potential of the land poses a moderate challenge, with an RII of 0.54. Only 12 respondents strongly agree and 15 agree, suggesting this issue affects a smaller portion of respondents compared to the other challenges. While the difficulty in determining the extent of contamination has an RII of 0.59, reflecting a moderate challenge, 21 respondents strongly agree and 18 agree, highlighting that assessing the level of contamination complicates the valuation process. Lastly, the lack of reliable data on remediation costs presents another significant challenge, with an RII of 0.69. In this case, 30 respondents strongly agree and 24 agree that the insufficient data on remediation costs complicates the use of conventional valuation methods. The data suggests that the main challenges in valuing contaminated land include market uncertainty, projecting future income, and accounting for contamination. Other difficulties involve remediation technologies, the lack of comparable sales data, and assessing the extent of contamination. Fewer respondents reported concerns regarding income potential and remediation costs.

Table 3 Primary challenges in using the conventional method for contaminated land?

Challenges in using the conventional method for contaminated land	SA	A	N	D	SD	Sum	RII
Lack of comparable sales data	30	24	18	17	9	343	0.7
Difficulty in adjusting for contamination	40	21	23	8	6	375	0.77
Uncertainty of market conditions	53	22	12	6	5	406	0.83
Uncertainty regarding future income generation	40	24	11	10	13	362	0.74
Difficulty in projecting future income from the contaminated land	51	27	7	8	5	405	0.83
Lack of reliable data on the income potential of the land	12	15	22	28	21	263	0.54
Difficulty in determining the extent of contamination	21	18	13	25	21	287	0.59
Uncertainty regarding remediation technologies and costs	32	42	10	8	6	380	0.78
Lack of reliable data on remediation costs	30	24	18	14	12	340	0.69

Source: Field Data, 2024

Sufficiency of paid compensation for contaminated land using conventional valuation methodology

This section evaluates respondents’ perceptions of whether the compensation provided for contaminated land, determined by conventional valuation methods, is adequate in Rivers State. The findings are detailed in Table 4, which analyzes whether respondents or the landowners they represent have ever felt that the compensation offered was insufficient due to the existing valuation methodology.

Table 4 Sufficiency of paid compensation for contaminated land

Sufficiency of paid compensation for contaminated land using valuation methodology	Frequency	Percentage
No	61	62.20%
Yes	8	8.20%
Not applicable	29	29.60%
Total	98	100.00%

Source: Field Data, 2024

A significant 62.2% of respondents indicated that they have felt the compensation for contaminated land was insufficient because of inaccurate valuation. This suggests that a large majority believe

that inaccurate valuation methodology plays a role in determining compensation that does not adequately reflect the true value of contaminated land. In contrast, 8.2% of respondents stated “yes,” indicating that they or the landowners they represent did not feel the compensation was insufficient due to inaccurate valuation. This group represents a relatively small proportion of the respondents. Additionally, 29.6% of respondents selected “not applicable,” implying that the issue of compensation and inaccurate valuation was not relevant to their experience or expertise.

Overall, the data highlights that the perception of inadequate compensation due to inaccurate valuation methodology is prevalent among the majority of respondents. This indicates a potential concern regarding the valuation practices for contaminated land and their impact on compensation, which may warrant further attention or improvement in the methodologies used for land valuation.

Impact of valuation challenges on compensation outcomes

Table 5 below displays data on how valuation challenges for contaminated land affect compensation assessments and stakeholder satisfaction. The data provides insights into the respondents’ perceptions of these challenges’ impact on compensation outcomes, with mean scores indicating the levels of agreement.

Table 5 Impact of valuation challenges on compensation outcome

impact of valuation challenges on compensation outcome	SA	A	N	D	SD	Sum	Mean
Underestimation of land value	38	31	13	9	7	378	3.86
Underestimation of remediation costs	35	27	24	7	5	374	3.82
Non-consideration of long-term environmental and health impacts	47	32	12	3	4	409	4.17
Lack of adjustment for loss of livelihood	29	35	21	6	7	367	3.74
Non-consideration of broader social and economic impacts on affected communities	32	43	23	0	0	401	4.09

Source: Field Data, 2024

In examining the impact of valuation challenges on compensation outcomes for contaminated land, the mean score of 3.86 indicates strong agreement regarding the underestimation of land value. Specifically, 38 respondents strongly agreed, and 31 agreed that valuation challenges contribute to undervaluing contaminated land, which may lead to insufficient compensation. Similarly, when discussing the underestimation of remediation costs as a result of valuation challenges, the mean score of 3.82 shows a comparable perception. In this case, 35 respondents strongly agreed and 27 agreed, suggesting that difficulties in accurately assessing contamination and necessary remediation efforts often result in an undervaluation of these costs, which negatively affects compensation outcomes. On the topic of failing to consider long-term environmental and health impacts, a mean score of 4.17 indicates very strong agreement. Here, 47 respondents strongly agreed and 32 agreed, reflecting significant concern that valuation challenges overlook these critical long-term factors, ultimately leading to inadequate compensation. Furthermore, regarding the lack of adjustment for loss of livelihood due to valuation challenges, the mean score of 3.74 reflects moderate to strong agreement, with 29 respondents strongly agreeing and 35 agreeing. This suggests that valuation challenges inadequately address the loss of livelihood for landowners or affected individuals, potentially undermining stakeholder satisfaction and equitable compensation. Lastly, concerning the failure to consider the broader social and economic impacts on affected communities, the mean score of 4.09—one of the highest scores—indicates strong agreement. With 32 respondents strongly agreeing and 43 agreeing, this suggests that neglecting these impacts leads to disagreements among stakeholders about the fairness and accuracy of the compensation amounts offered, contributing to dissatisfaction among landowners.

Overall, the data illustrates that challenges in land valuation significantly impact compensation assessments and stakeholder satisfaction. Key issues include the underestimation of land value,

the underestimation of remediation costs, and the failure to account for long-term environmental and health impacts, all contributing to inadequate compensation. Additionally, these challenges lead to disagreements over compensation amounts and insufficient consideration of livelihood loss, which may hinder the satisfaction of affected stakeholders.

Suggestions for improvement

This section presents the analysis of respondents' recommendations for improvements to address challenges in valuing contaminated land for compensation purposes. The data includes both mean scores and Relative Importance Index (RII) values, indicating the level of agreement with each proposed improvement.

The analysis of Table 6 indicates that the overall mean score (Grand Mean = 3.94) exceeds the Criterion Mean of 3.0, suggesting a generally favorable attitude towards the recommended improvements for addressing the challenges of valuing contaminated land for compensation purposes. This implies that respondents largely support the proposed measures. The introduction of standardized valuation guidelines received a mean score of 3.86 and a Relative Importance Index (RII) of 0.77, indicating strong agreement with the necessity for such guidelines. With 38 respondents strongly agreeing and 31 agreeing, this highlights the importance of consistent and clear guidelines for valuing contaminated land to ensure fairness and consistency across assessments. Improved access to environmental data garnered a mean score of 3.82 and an RII of 0.76, reflecting strong support for this recommendation. Of the respondents, 35 strongly agreed, and 27 agreed on the need for better access to accurate environmental data to enhance the precision of contaminated land valuations, particularly when assessing contamination levels and potential remediation needs. The recommendation for a clearer legal framework for contaminated land valuation received the highest mean score of 4.17 and an RII of 0.83, signaling very strong agreement. A total of 47 respondents strongly agreed, and 32 agreed, highlighting the belief that a well-defined legal framework is essential for improving the valuation process. This ensures that all parties are clear about their rights, obligations, and the procedures to follow when dealing with contaminated land. Better training for valuers on handling contamination issues achieved a mean score of 3.74 and an RII of 0.75, indicating moderate to strong support for this improvement. With 29 respondents strongly agreeing and 35 agreeing, there is a consensus on the need for enhanced training for valuers to better comprehend the complexities of contaminated land and the specific challenges it presents in the valuation process. Finally, regular environmental monitoring of contaminated areas received a mean score of 4.09 and an RII of 0.82, suggesting strong agreement regarding the importance of ongoing monitoring. A total of 32 respondents strongly agreed, while 43 agreed that regular monitoring is vital for assessing the long-term environmental impacts and the effectiveness of remediation efforts, which are critical to accurately valuing contaminated land.

Table 6 Suggestions for improvement

Suggestions for addressing the challenges in valuing contaminated land for compensation purposes	SA	A	N	D	SD	Sum	Mean	RII
Introduction of standardized valuation guidelines	38	31	13	9	7	378	3.86	0.77
Improved access to environmental data	35	27	24	7	5	374	3.82	0.76
Clearer legal framework for contaminated land valuation	47	32	12	3	4	409	4.17	0.83
Better training for valuers on handling contamination	29	35	21	6	7	367	3.74	0.75
Regular environmental monitoring of contaminated areas	32	43	23	0	0	401	4.09	0.82

Source: Field Data, 2024

Overall, there is strong support among respondents for improvements aimed at addressing the challenges of valuing contaminated land. The most endorsed recommendations include the introduction of a clearer legal framework (mean = 4.17, RII = 0.83) and regular environmental monitoring (mean = 4.09, RII = 0.82), highlighting the need for clear guidelines and continuous oversight. The introduction of standardized valuation guidelines (mean = 3.86, RII = 0.77) and improved access to environmental data (mean = 3.82, RII = 0.76) also received strong backing, emphasizing the importance of consistency and better data availability. Although better training for valuers (mean = 3.74, RII = 0.75) received the least endorsement, it was still recognized as an important area for improvement. These findings underline the necessity of enhancing legal, regulatory, and practical support to improve the valuation process for contaminated land and to ensure fair and accurate compensation.

Discussion of findings

The analysis of valuation methods for contaminated land in Rivers State reveals significant insights into the current practices and challenges faced by valuers in assessing such properties. The data highlights the predominance of three key valuation approaches: the Cost Approach Method, Market Comparison Method, and Income Capitalization Method, which are commonly used due to their practical application and reliance on readily available data. These methods, with high Relative Importance Index (RII) values—0.83 for the Cost Approach, 0.80 for the Market Comparison Method, and 0.76 for the Income Capitalization Method—indicate a preference for straightforward, data-driven methods in valuing contaminated land. These approaches are often favored for their efficiency and ability to incorporate observable market data, especially when dealing with contamination impacts that can be difficult to quantify.

In contrast, the Residual Method, Contingent Valuation Method, and Hedonic Pricing Method received lower RII values, reflecting their less frequent use. These methods face limitations due to their complexity, subjectivity, or the extensive data required, such as when assessing future development values or quantifying environmental impacts. The Residual Method, with an RII of 0.58, highlights the challenge of estimating future land development values in contaminated environments, which requires a level of uncertainty that valuers often find difficult to manage. Similarly, the Contingent Valuation Method and Hedonic Pricing Method struggle with reliability and data requirements, making them less suitable for practical applications in contaminated land valuation.

The challenges faced by valuers in applying these methods are significant. The data suggests that the majority of respondents experience moderate to major difficulties in valuing contaminated land, with nearly 60% indicating substantial challenges. This could be attributed to the inherent complexities of contamination, such as the uncertainty in remediation technologies, the difficulty in projecting future income, and the lack of reliable data on contamination levels and remediation costs. The challenges reflect the intricacies involved in adapting conventional valuation methods to the unique and dynamic nature of contaminated land, where traditional market data may be insufficient or unavailable.

Furthermore, the challenges in applying valuation methods directly impact compensation outcomes for landowners. The data indicates that 62.2% of respondents believe that compensation for contaminated land is often insufficient due to inaccurate valuations. This discrepancy suggests that the existing valuation methods do not fully account for the broader economic, environmental, and social consequences of contamination. As such, the underestimation of

land value, remediation costs, and long-term environmental impacts contribute to inadequate compensation for landowners. The data also highlights the need for more comprehensive assessments that consider the loss of livelihoods and the broader social and economic impacts on communities affected by contaminated land.

The study's findings underscore the importance of improving valuation practices to ensure fair and accurate compensation for landowners. Respondents overwhelmingly support several recommendations aimed at addressing the challenges in valuing contaminated land. A clearer legal framework, better access to environmental data, and regular environmental monitoring received strong endorsements. These improvements are seen as essential for enhancing the consistency and accuracy of land valuations, especially in the face of complex contamination issues. Standardized valuation guidelines and improved training for valuers also received strong support, emphasizing the need for a structured approach to handling contamination in land assessments.

In conclusion, while there is a clear preference for straightforward, data-driven methods in valuing contaminated land, the complexities and uncertainties involved in contamination assessment present significant challenges. The findings suggest that to improve compensation outcomes and stakeholder satisfaction, there is a critical need for enhanced legal frameworks, better data access, and ongoing environmental monitoring. These measures will not only improve the valuation process but also ensure that compensation accurately reflects the true value of contaminated land, taking into account its environmental, economic, and social implications.³⁴

Conclusion

This study has provided a comprehensive analysis of the valuation methods and challenges associated with contaminated land in Rivers State. The findings underscore the dominance of practical, data-driven approaches such as the Cost Approach, Market Comparison, and Income Capitalization Methods, which are preferred by valuers due to their straightforward application and reliance on observable market data. However, the study also highlights significant challenges faced by valuers, particularly the complexities of contamination, the uncertainty in market conditions, and the lack of reliable data on contamination levels and remediation costs. These challenges often result in inaccurate land valuations, which in turn lead to insufficient compensation for affected landowners. The findings indicate that the valuation process for contaminated land is far from straightforward and is fraught with uncertainties, making it difficult to accurately assess the true value of such properties. The study reveals that most respondents encounter significant challenges when trying to apply conventional valuation methods to contaminated land. This highlights the necessity for more flexible approaches. Inaccurate valuations can adversely affect compensation, often resulting in insufficient payouts for landowners. To enhance the accuracy and fairness of valuations, respondents suggest establishing a clearer legal framework, ensuring better access to environmental data, and implementing regular monitoring. The study emphasizes the importance of a comprehensive approach that takes into account both the immediate and long-term economic, environmental, and social impacts of land contamination. Based on the findings and discussions in this study, the study advocates for the adoption of standardized guidelines, enhanced training for valuers, Regular stakeholder consultations to promote trust and satisfaction among all parties involved and the development of more effective valuation methods with broader set of tools that can address the complexities of contaminated land. These improvements are essential for ensuring that the valuation process is more transparent,

accurate, and fair, ultimately leading to better compensation outcomes and greater satisfaction among stakeholders.

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Conflicts of interest

The authors declare no conflict of interest in writing the manuscript.

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