Examining the Use of Traditional and Contemporary Methods for Valuing Contaminated Agricultural Lands in South-South Nigeria

Chukwudi Louis Igwenagu[1], Charles Chukwunwike Egolum[2], and Chinaza Henry Obineme[3]

Department of Estate Management, Nnamdi Azikiwe University, Awka, Nigeria
*Corresponding Author: igwenaguchukwudilouis@gmail.com

Abstract

Valuing contaminated agricultural lands poses unique challenges due to the complex interplay between environmental factors, regulatory frameworks, and market dynamics. This process involves assessing the impact of contamination on land productivity, human health, and property values. Various methods, including traditional valuation approaches and modern techniques, are employed to determine the value of contaminated agricultural lands and guide decision-making for remediation, land use planning, and investment purposes. This paper is aimed at examining the use of traditional and contemporary methods for the valuation of contaminated agricultural lands in South-South, Nigeria, with a view to determine the most adoptable and appropriate valuation methods widely used for such purpose in the study area. The methodology involved the use of questionnaires. The total collected data of 488 from respondents (Estate Surveyors and Valuers) makes up the population of the study comprising of 304 Estate Surveyors and Valuers are in Rivers State, 118 in Delta State and 66 in Bayelsa State. Data was collected from Estate Surveyors and Valuers and analyzed using tables, mean ranking. The study revealed that sales comparable method of valuation is the most used traditional method of valuing contaminated agricultural land and it is followed by investment method. The traditional methods are mostly used by the respondents. Majority of the respondents do not mostly use the contemporary/advanced methods. The Estate Surveyors and Valuers usage of the traditional methods of valuation was positive while that of advanced methods was negative. It was recommended that Estate Surveyors and Valuers should consider diversifying their usage of valuation methods by incorporating a mix of both traditional and contemporary approaches. There is a need for training and education programs aimed at familiarizing Estate Surveyors and Valuers with contemporary valuation techniques such as the hedonic pricing model, artificial neural network, and spatial analysis.

Keywords: Traditional Methods, Contemporary Method, Valuation, Land Contamination, Contaminated Agricultural Lands.

I.   Introduction

Valuation can be seen as an answer to a problem. The question may be simple and direct as to how much to pay for a given land or property. With respect to contaminated agricultural lands, it may be more involved and complex. The valuation of property holds significant importance across global real estate markets and stands as a cornerstone in determining their worth and facilitating transactions. They are influenced by a range of factors, and identifying these factors constitutes a crucial component of property valuation. Valuation is the determination of the present value of future benefits anticipated from ownership. These future benefits will be affected and shaped by the actions of general and local forces within which trends may be identified, analyzed and projected to provide relevant information. This information relates to data needed for valuation, as the accuracy of an appraisal will to a large extent depend on the accuracy of the data used. In valuation practice, there has been considerable divergence in the views of the appraisers as to the method of valuation employed in establishing values. Environmental factors are increasingly important in property valuation as the market has become more aware of the potentially detrimental effects of contaminants on air, water (surface water and groundwater), soil, and the overall environment. In certain cases, especially when incomplete information is available on the effects of a contaminant, the market may overreact, and prices may be depressed more than is rational. In other cases, knowledge about a particular contaminant is so new or limited that there is a virtual absence of market data, and effects on value are difficult to ascertain. In the real estate research domain, several

methods have been used to estimate property values, and these methods which range from traditional to advanced valuation techniques (Pagourtzi, Assimakopoulos, Hatzichristos, & French, 2003).

II.   Literature Review

Environmental factors are increasingly important in property valuation as the market has become more aware of the potentially detrimental effects of contaminants on air, water (surface water and groundwater), soil, and overall environment. Valuing contaminated properties is complex because circumstances are different for each affected property and because sufficient comparable sales may be unavailable, difficult to obtain, or subject to unreasonable or unsupportable adjustments for varying conditions and situations.

Babawale (2013) asserted that a common method adopted while valuing environmentally impaired properties is the Before and After approach which was also prescribed in the Oil Pipelines Act (Cap. 07 LFN, 2004) Section 20(3).

In practice, what is obtainable were examined by Ajibola, Peter, Babajide and Oni (2014), Akujuru (2014) and Akujuru and Ruddock (2014). For instance, Akujuru and Ruddock (2014) provided a framework for the inclusion of socio-cultural values in assessing contaminated land. They posited that the pollution of the environment damages economic, ecological and socio-cultural values that make up the total economic value (TEV) of the polluted property when combined together. The applicable approaches suggested by Akujuru (2014) indicated that the income capitalization approach and the impaired approach are appropriate for valuing contaminated properties; especially, the author's expression which expanded the various items and costs; making it understandable and applicable.

Centre for Advanced Property Economics and Appraisal Institute (2002) and Uniform Standard of Professional Appraisal Practice (2003), proposed the formula for valuation of contaminated property as thus:

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

Jackson (2003) is of the opinion that with the income and yield capitalization rate analysis, the appraiser can account for the effects of contamination by increasing the income capitalization rate by an appropriate environmental risk premium, which must be derived from the market place.

Syms (2007) focused on the procedure to be followed in preparing the report for a property that is going to remain as the existing use, which is industrial. However, if the property is not involved in change of land use, the remediation may take many years. Bond and Kennedy (2000) stated that the valuation methods for contaminated land are capitalbased method, income-based method, profits method, residual method, full discounted cash-flow method, sales comparison method and income capitalisation method. A study conducted by Antai (2003) revealed that the valuation methods used are sales comparison, income approach, cost to remediate and residual method.

Hasni and Asroun (2018) in their work on the valuation for ex-tin mining land, found that comparison method and residual method are the most preferred method of valuation while discounted cash-flow method is not preferred due to time constraints. Comparison method is the preferred method as the data for the comparable is easy to get and mostly available, and the values are precise and accurate since they are current.

The Valuer General's Policy, Sydney, 2017 as cited in Ajibola, Kabiamaowei, Oluwunmi A. O. and Owolabi, (2020) provides a guide on the methods to use and factors to consider when valuing contaminated land for rating and taxing purposes. The methods provided are the direct comparison method which involves comparing market sales with the subject property and the hypothetical development method usually adopted when there is not sufficient data on direct comparable sales.New South Wales Valuer General's Policy (2019) on Valuation methods stipulates Direct comparison and the hypothetical development method as their preferred choice.

Dixon (1995) and Richards (1996) suggest that the traditional investment valuation method should serve as the framework for this sort of valuation following an assessment of the direct costs; indirect costs; and property factors affected by the contamination. Patchin (1994), suggests a comparable sales approach and the measurement of losses resulting from contamination through the analysis of market data on contaminated properties. Syms (1996) discusses the 'risk assessment' approach by calculating and determining the unimpaired value of property and deducting from it all discounted costs of remediation and arriving at the impaired value. Bond,Kinnard, Kennedy and Worzala,(2001), are of the opinion that whatever method that is adopted in the valuation of contaminated land, some variant of income capitalization analysis is necessary to measure the deductions from unimpaired market value that are appropriate and necessary to estimate market value of the contaminated land. Property researchers also support the use of these methods, for example, the direct comparison method (Patchin, 1994), capitalisation method (Mundy, 1992, Neustein, 1992, Dixon, 1996), cost

approach (Wilson, 1994), hypothetical development method/residual method (Simm, 1992, and Liang, 1992, both cited in Syms, 1997) and discounted cash flow method (Fisher, Lentz and Tse, 1992, Gronow, 1998, Gronow, 1999).

As the conventional valuation methods rely heavily on market evidence, the use of these methods is not without problems. Firstly, there is a lack of transaction data on contaminated properties. It is thus difficult to rely on market evidence to estimate prices, rents and yields of contaminated properties (Kinnard, 1992, Syms, 1997). Secondly, as pointed out by Wilson (1992), "each environmental problem is as unique as a fingerprint". It is difficult to get true comparables to apply the direct comparison method.Accordingly, property practitioners and researchers around the world are continuing to research for suitable methods to value contaminated properties. Nevertheless, as in all other types of property valuation, according to International Association of Assessing Officers (2016) three approaches to value are recognized and should be used such as; sales comparison approach, cost approach and income approach.

Traditional and Contemporary Methods of Valuation
Traditional Methods of Valuation:

Traditional methods of valuation are comparable, cost, income, profit and residual.

According to Ogunba (2013) Comparable methods of valuation is used where there is abundant evidence of previous sales, Cost method of valuation is used for properties not usually sold on the market, Income method of valuation is used for the properties that are producing cash income flow (rent), Profit method of valuation is used for trading properties other than normal shops where evidence of rent is slightly as they are not held as investment, and Residual method of valuation is used for properties not usually sold on market. Residual method is use to determine the selling price of the property relative to its development cost.

Contemporary Methods of Valuation
i.   Hedonic Pricing Models
Hedonic pricing model (HPM) is an advanced valuation method which has been used widely both in theory and in practice (Selim, 2008).The theory of hedonic price functions provides a framework for the analysis of differentiated goods like housing units, whose individual features do not have observable market prices. The processing of HPM is premised on the principle of the regression analysis (Selim, 2009). The regression analysis is of two types, namely the multiple regression and the simple regression (Montgomery, Peck, & Vining, 2015). Multiple regression analysis (MRA) explains the regression of a dependent variable over more than one independent variable. This makes it suitable for property price analysis, because property values are determined by more than one property attribute (Chin & Chau, 2002).

ii.   Contingent valuation
Contingent valuation is a stated preference method and a survey-based approach to nonmarket valuation. A contingent-valuation question carefully describes a stylized market to elicit information on the maximum a person would pay (or accept) for a good or service when market data are not available. Contingent valuation method is a valuation based on questionnaire that offers the respondents an opportunity to make an economic decision on a good, which for no market exists. In natural resources, contingent valuation studies generally derive through the elicitation of respondents' willingness-to-pay to prevent injuries to natural resources or to restore injured natural resources (Abdul Rahim, 2005).

iii.   Artificial Neural Networks (ANN)

Artificial neural networks (ANN) commonly known as neural networks are computational methods or systems uniquely inspired by the biological networks of brains and the neurons that constitute the nervous system, hence, ANN mostly mimics the human brain. ANN model is designed to perform tasks (computation) by learning from given example without necessarily following specific rules or without specific prior knowledge of the tasks. ANN is a member of evolutionary computational methods (Okagbue, Adamu, Anake, and Wusu, 2019). Researches exploited the computational capacity and robustness of the artificial neural networks and used them in real estate valuation or appraisal.

iv.   Fuzzy Logic System

It is a common situation that appraisers have problems with insufficient information to carry out econometric modelling or they have problems determining the causal relationships between real estate variables.In land market and other real estate market value assessment, many attributes are often used to determine a property's fair value, especially for those real estate markets with a lack of data or with complex urban segmentation.The advantage of this method is that it can be used as a tool for describing knowledge that is uncertain and inaccurate. In the approach based on the fuzzy set theory, decisions are made based on "raw data" in line with the principles of Boolean logic, that is, a given decision (real estate value) is made if given conditions (real estate attributes) are fulfilled.

v.   Discounted Cash Flow Modeling

Discounted Cash Flow models measure the intrinsic value of a company and are based on the principle that the current value of an asset is equal to the present value of all expected future cash flows (Rajesh, **2016**). The sense of the discounted cash flow is based on the belief that every asset has an intrinsic value and it is possible to estimate it by looking at the asset´s fundamentals.

III.   Research Methodology
        The study used the survey research approach, which involved the collection of data from the sampled population of the study.The population of the study are the Estate Surveyors and Valuers in Bayelsa, Delta and Rivers States, Nigeria. The Estate Surveyors and Valuers as mentioned are the real property consultants professionally recognized in Nigeria to value land and landed properties. The directory of the Nigerian Institution of Estate Surveyors and Valuers indicated that 304 Estate Surveyors and Valuers are in Rivers State, 118 in Delta State and 66 in Bayelsa State. A total of 488 Estate Surveyors and Valuers makes up the population of the study.
        The sources of data include Primary and Secondary Sources of data. Primary sources of data were used as a means to collect first-hand information of themethods of valuation of contaminated agricultural lands in the study area through administration of questionnaires. Secondary sources of data used in this research were taken from various journals, seminar papers, textbooks, past projects and some other documented materials, some of which may be published or unpublished. In the presentation, analysis and interpretation of data, tabular, statistical and textual modes of data presentation were used. In this study, an ordinal measurement scale of 1 to 5 was used to determine the effect level. Respondents were asked to score their responses according to the degree of importance: where 1 = strongly agree; 2 = agree; 3 = undecided; 4 = disagree; 5 = strongly disagree. The responses for each relevant questions in the questionnaire were represented in tables and the statistical results used to compare the relative importance to various answers.

IV.   Data Presentation and Analysis

Table 1: Analysis of Distributed Questionnaire

S/N	States	Questionnaires distributed	Questionnaires retrieved	Success %
1	Bayelsa	66	54	81.8
2	Delta	118	95	80.5
3	Rivers	304	235	77.3
	Total	**488**	**384**	**78.7**

A total number of 488 questionnaires was distributed across the 3 (three) out of the (6) states in South-South Geopolitical Region Nigeria which comprises of Akwa Ibom, **Bayelsa**, Cross Rivers, **Delta**, Edo and **Rivers** and a total number of 384 were retrieved representing approximately 79%. The breakdown of the distribution and retrieval according to each state as detailed in the Table 1.
The Table 2 below displays the opinions of the respondents (Estate Surveyors and Valuers) on usage of traditional methods for valuation of contaminated agricultural land in south-south Nigeria.

Table 2: Ranking of the Variables (methods) use in the valuation of contaminated agricultural land

Valuation Methods	S. Agreed (5)	Agreed (4)	Neutral (3)	Disagreed (2)	S. Disagreed (1)	Mean	Ranking
Investment Method	176	129	39	19	21	4.09	2nd
Comparable Method	205	117	46	11	5	4.32	1st
Cost Method	155	83	65	38	43	3.70	3rd
Profit Method	107	61	74	67	75	3.15	4th

Residual Method	68	63	70	86	97	2.79	5th

Table 2 showed that Comparable Method ranked first (Mean = 4.32). This was followed by Investment Method (Mean = 4.09). And followed by Cost Method (Mean = 3.70), followed by Profit Method (Mean = 3.15), and followed by Residual Method (Mean = 2.79) as shown in the Table 2. This goes to explain that the Comparable Method that ranked first (Mean = 4.32) is the major method used followed by cost method.

The table 3 below displays the opinions of the respondents (Estate Surveyors and Valuers) on usage of contemporary methods of valuation of contaminated agricultural land in south-south Nigeria.

Table 3: Ranking of the Variables (methods) use in the valuation of contaminated agricultural land

Contemporary Valuation Methods	S. Agreed (5)	Agreed (4)	Neutral (3)	Disagreed (2)	S. Disagreed (1)	Mean	Ranking
Hedonic Pricing Model	12	18	56	68	230	1.73	3rd
Artificial Neural Network	0	12	54	110	208	1.66	6th
Spatial Analysis	1	9	55	87	232	1.59	8th
Fuzzy Logic System	0	3	67	98	216	1.63	7th
Autoregressive Integrated Moving Average	0	2	58	137	187	1.67	5th
Multiple Regression Analysis	3	22	88	94	177	1.91	1st
Discounted Cash Flow Modeling	10	18	72	91	193	1.86	2nd
Contingent Valuation	6	7	74	83	214	1.72	4th

Table 3 showed that Multiple Regression Analysis ranked first (Mean = 1.91). This was followed by Discounted Cash Flow Modeling (Mean = 1.86) and others as shown in the Table 3. This goes to explain that majority of the respondents (Estate Surveyors and Valuers) do not use the contemporary methods since there are no contemporary methods of valuation (variables) that score up to average mean as such they are all scored below average mean with Multiple Regression Analysis ranked first (Mean = 1.91) which is not up to the average mean.

V. Findings, Conclusion and Recommendations

5.1 Findings

Findings from the survey reveal that Estate Surveyors and Valuers predominantly utilize traditional methods for valuing contaminated agricultural land in the South-South Nigeria. The comparative method ranked first (Mean = 4.32), followed closely by the investment method. These findings suggest a preference for approaches that rely on direct comparisons and income potential in assessing property values.

Contemporary valuation methods are less commonly used by Estate Surveyors and Valuers. The result in Table 3 indicate a notable disparity, with a majority of respondents expressing less or lack of utilization of these modern approaches.

These findings show the prevailing reliance on traditional valuation methods despite the emergence of contemporary methods in the field. The usage of traditional and contemporary methods of valuation for valuing contaminated agricultural land highlights potential opportunities for enhancing valuation practices. Increased awareness, training, and adoption of modern valuation tools could contribute to more accurate and comprehensive assessments, thereby improving decision-making and risk management in the valuation of contaminated agricultural land.

5.2 Conclusion

The valuation of contaminated agricultural land is a complex process that requires careful consideration of various factors and methodologies. The findings from the research indicated a predominant reliance on traditional valuation methods, particularly the comparative and investment methods, among estate surveyors and valuers in the South-South Nigeria. This preference suggests a familiarity and comfort with approaches that emphasize direct comparisons and income potential when assessing property values.

However, there is a notable lack of utilization of contemporary valuation methods. This highlights a potential gap between current practices and emerging trends in valuation techniques.

Nevertheless, there is an opportunity to bridge this gap by promoting awareness, education, and training in the adoption of modern valuation tools and methodologies. By integrating contemporary approaches into their practice, Estate Surveyors and Valuers can enhance the accuracy, efficiency, and comprehensiveness of valuing contaminated agricultural land. This, in turn, will support informed decision-making, risk management, and sustainable land use practices in the management and redevelopment of contaminated sites.

5.3 Recommendations

Based on the findings and conclusions draw from the research, the following are herebyrecommended:

i. Diversify Valuation Methods: Estate surveyors and valuers should consider diversifying their usage of valuation methods by incorporating a mix of both traditional and contemporary approaches. This will enable a more comprehensive assessment of property values, taking into account various factors and methodologies.

ii. Training and Education: There is a need for training and education programs aimed at familiarizing Estate Surveyors and Valuers with contemporary valuation techniques such as the hedonic pricing model, artificial neural network, and spatial analysis. This will enhance their skills and knowledge base, enabling them to adopt and implement modern valuation tools effectively.

Reference

[1]. Abdul Rahim, K., (2005). 'Contingent Valuation Method (CVM)', Environmental Management, vol. 2005, no. 5, pp. 1-7
[2]. Ajibola M. O., Kabiamaowei A. I., Oluwunmi A. O. and Owolabi D. R., (2020). Assessing the
[3]. Methods of Valuing Contaminated Land in Rivers State, Nigeria. Retrieved from https://api-ir.unilag.edu.ng/server/api/core/bitstreams/e980c4bd-566e-4d04-aa9d-5bf7a1024890/ content
[4]. Ajibola, M. O., Peter, N. J., Babajide, O. S. & Oni, A. O., (2014). An Examination of the Basis and Methods of Wetland Valuation for Compensation in the Niger Delta, Nigeria. Covenant Journal of Research in the Built Environment (CJRBE), 1(2), 1–27.
[5]. Akujuru, V., (2014). A framework for determining the Compensable Value of Damages due to Contamination to Wetlands in the Niger Delta of Nigeria. A Thesis submitted in partial fulfilment of the requirements for the award of the Degree of Doctor of Philosophy of the University of Salford, School of the Built Environment.
[6]. Akujuru, V. & Ruddock, L., (2014). Incorporation of Socio-Cultural Values in Damage Assessment Valuations of Contaminated Lands in the Niger Delta. Land, MDPI, Open Access Journal, ISSN 2073-445X. 3(3), 675–692
[7]. Antai, I., (2003). Valuation of Contaminated Land in Sweden: A Comparative Study. (Master Thesis). Stockholm Royal Institute of Technology.
[8]. Babawale, G. K., (2013). Emerging Issues in Compensation Valuation for Oil Spillage in the Niger Delta Area of Nigeria. Journal of Reviews on Global Economics, 2, 31-45.
[9]. Bond, S. G., Kinnard, W., Kennedy, P.&Worzala, E.M., (2001). An international perspective on incorporating risk in the valuation of contaminated land. The Appraisal Journal.
[10]. Chin, T. L., & Chau, K. W., (2002). A critical review of literature on the hedonic price model. International Journal for Housing Science and Its Applications, 27(2), 145–165.
[11]. CUSPAP, (2003). Uniform Standard of Professional Appraisal Practice. Washington DC: Appraisal Foundation.
[12]. Dixon, T., (1995). Comment: Contaminated land and property, Journal of Property Valuation and Investment, 13.5, 4-5.
[13]. Dixon, T., (1996). Contaminated Land: a changing landscape, Estate Gazette, Issue 9608, 136 –138.
[14]. Fisher, J.D., Lentz, G.H. &Tse, K.S.M. (1992) Valuation of Commercial Properties Contaminated with Asbestos, Journal of Real Estate Research, Vol. 7, 331 - 350.
[15]. Gronow, S. (1998). Contaminated land - the inevitability of an explicit appraisal model. Property Management, 16(1), pp. 24–32. retrieved from https://doi.org/10.1108/ 02637479810202919
[16]. Gronow, S., (1999). Contaminated land – quantifying the inputs to an explicit appraisal model, Property Management, Vol. 17, No.2, 169 – 185.
[17]. Hasni & Asroun, (2018). Valuation of Ex-Mining Lands: The Preferred Methods. 3rd Undergraduate Seminar on Built Environment and Technology. UiTM Perak Branch.
[18]. Jackson, T.O., (2003). Appraisal standards and contaminated property valuation, The Appraisal Journal 71(2), 127–133
[19]. Kinnard, W.N. (1992) Measuring the Effect of Contamination on Property Values: The Focus Of The Symposium In The Context Of Current Knowledge, Technical Report: Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications, Appraisal Institute, 1 – 22
[20]. Montgomery, D. C., Peck, E. A., & Vining, G. G. (2015). Introduction to linear regression analysis (5th ed.). Hoboken, NJ: Wiley.
[21]. Mundy, B. (1992), Stigma and Value, The Appraisal Journal, January 1992, pp. 7-13.
[22]. Neustein, R. A. (1992). Estimating Value Diminution by the Income Approach; Appraisal Journal
[23]. Ogunba, O. A. (2013). Principle & practice of property valuation in Nigeria. Ile-Ife: Atlantis Books.
[24]. Okagbue, H.I., Adamu, M.O., Anake, T.A. & Wusu, A.S. (2019). Nature inspired quantile estimates of the Nakagami distribution. Telecommunication Systems, 72(4), 517-541
[25]. Pagourtzi, E., Assimakopoulos, V., Hatzichristos, T., & French, N. (2003). Real estate appraisal: A review of valuation methods. Journal of Property Investment & Finance, 21(4), 383–401.
[26]. Patchin, P.J., (1994). Contaminated Properties and the Sales Comparison Approach, The Appraisal Journal, July 1994, LXH. 3, 402-409.
[27]. Rajesh K., (2016). Discounted cash flow valuation models. Retrieved from https://www.research gate.net/publication/301260188_Discounted_cash_flow_valuation_models**. 2024, March 11.**
[28]. Richards, T., (1996). Contaminated land stigma, letter in Estates Gazette, The Estates Gazette, London, 9614, p28.
[29]. Selim, H., (2009). Determinants of house prices in Turkey: Hedonic regression versus artificial neural network. Expert Systems with Applications, 36(2), 2843–2852.
[30]. Selim, S., (2008). Determinants of house prices in Turkey: A hedonic regression model. Doğuş ÜniversitesiDergisi, 9(1), 65–76.
[31]. Syms, P., (2007). Contaminated land and other forms of environmental impairment: an approach to valuation. Journal of Property Valuation and Investment, 14(2), pp. 38–47. https://doi.org/10.1108/14635789610112655
[32]. Syms, P., (1996). Perceptions of risk in the valuation of contaminated land. Journal of Property Valuation Investment, 15 (1):27–39.
[33]. Valuer-Generals Policy, (2019). 'Valuation of Contaminated Land'. Office of the Valuer General NSW Available: Retrieved from https://www.valuergeneral.nsw.gov.au /__data/assets/pdf_file/0002/ 200000/Valuation_of_contaminated_land.pdf
[34]. Wilson, A.R., (1992). Environmentally Impaired Valuation: A Team Approach To a Balance Sheet Presentation, Technical Report: Measuring the Effects of Hazardous Materials Contamination on Real Estate Values: Techniques and Applications, Appraisal Institute, 23 – 42.
[35]. Wilson, A.R., (1994). The Environmental Opinion: basis for an impaired value opinion, The Appraisal Journal, LXH.3, 410-423.