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# Appraising the State of Knowledge of the Valuation of Contaminated Freshwater Ecosystem of the Niger Delta

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***Authors' contributions***

*This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.*

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## ABSTRACT

The valuation practice utilised in valuing natural resources in the Niger Delta has shown signs of the paucity of professional knowledge, thus necessitating an appraisal of the state of knowledge possessed by valuers practicing in the Niger Delta. This paper assesses the state of knowledge among Niger Delta valuers in contaminated freshwater on the applicability of the methods of valuation for assessing damaged freshwater resources. With reference to freshwater ecosystem valuation, a survey of practicing valuation firms was conducted on 102 valuation firms using census sampling, and (11) expert valuers were interviewed purposively. Findings indicate a poor knowledge of environmental valuation techniques and a constant recourse to using a predetermined compensation rate in valuing contaminated natural resources. It thus recommends the intensive training and education of practicing valuers on methods of environmental valuation and the valuation of contaminated natural resources.

*Keywords: Appraisal; valuation practice; contamination; freshwater ecosystem.*

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## 1. INTRODUCTION

The activities of the oil companies have put increasing pressure on the freshwater in the Niger Delta. As a result, there have been numerous conflicts between the indigenous people of the region and the major oil companies operating therein over the years. The region claims that the activities of the oil companies, instead of improving, have worsened poverty among its residents by causing a serious decline in their freshwater and agricultural resources, which are their main sources of income. Igu & Marchant [1] confirmed that the households and communities in the Niger Delta region of Nigeria derived a significant portion of their sustenance from freshwater, which they used for provisional services, though they varied in their socio-economic status, level of remoteness, availability of alternate sources of livelihood, landscape, degrees of dependence on fresh water, and patterns of degradation.

Freshwater supplies a variety of goods and services to human society and is found in lakes, rivers, marshes, and streams. The myriads of goods and services provided by freshwater can be classed as direct market goods and non-market goods. Drinking water, transportation, electricity generation, pollution disposal, and irrigation are examples of direct market goods or services, whereas biodiversity, support for terrestrial and estuarine ecosystems, habitats for plant and animal life, and the satisfaction people feel from knowing that a lake or river ecosystem exists are examples of non-market goods or services [2,3,4]. Amoatey & Baawain [5] indicate that freshwater bodies like lakes, rivers, and wetlands ecosystems provide habitats and food for several species of organisms, as well as fishes, algae, phytoplankton, zooplankton, cyanobacteria, and birds. Freshwater ecosystems are important resources and necessities for the domestic sustenance of households across the African continent. Igu & Marchant [1] observed that the communities within the Niger Delta derived a significant part of their sustenance from the freshwater ecosystem which they used for provisional services.

In the Niger Delta region and throughout Africa, the dynamics comprising resource consumption and the ensuing degradation are poorly understood and have largely remained under-estimated, unexplored, and undocumented. Most freshwater ecosystems are exposed to multiple threats [6]. Due to poor management guidelines and weak policies, the rate at which ecosystems, especially freshwater, are frequently damaged is increasing proportionally. Across the Niger Delta region, an inventory of original causes has been recognized. Adekola & Mitchell [7] catalogued a number of human activities, such as oil and gas exploration, dredging, invasive plant infestations, wetland reclamation, extended population, and poor governance, that increased the causes of freshwater pollution, fish migration, and shrinkage in the wetland region of the Niger Delta. They say that ongoing human activities have led to a big drop in biodiversity in the freshwater ecosystems of the Niger Delta.

To forestall further degradation of the environment, it is necessary to quantify the value of environmental resources in general, and freshwater ecosystems in particular. There are a number of valuation methods that have been widely used both in theory and in practice. These approaches have been categorised into "traditional" and "environmental" valuation methods [8]. The traditional methods are based on some form of comparison with other comparable properties in arriving at a market value and usually require a small number of comparable properties in their application [9]. Assigning monetary values to changes in environmental services and functions as well as stocks of environmental assets is the focus of environmental valuation approaches [10]. According to the US Environmental Protection Agency (EPA) [11], environmental valuation methods are an attempt to assign quantitative values to the goods and services provided by environmental resources as an estimation of the importance, or worth, of one or additional services to society. The valuation of freshwater ecosystems thus necessitates that consideration be given to the varied importance attached to them. This has conventionally been achieved through the use of non-market valuation models such as contingent, hedonic, travel cost valuation models, etcetera. Wilson and Carpenter [4] looked at 30 refereed articles published in the US and found that the travel cost method, hedonic pricing, and the contingent valuation method are often used for the valuation of freshwater services. There exists a significant relationship between the theory and practice of any profession, which should be harnessed in order to achieve sustainable growth [12]. However, quite a number of studies have examined the applications of various property valuation methods in the literature, whereas, investigations

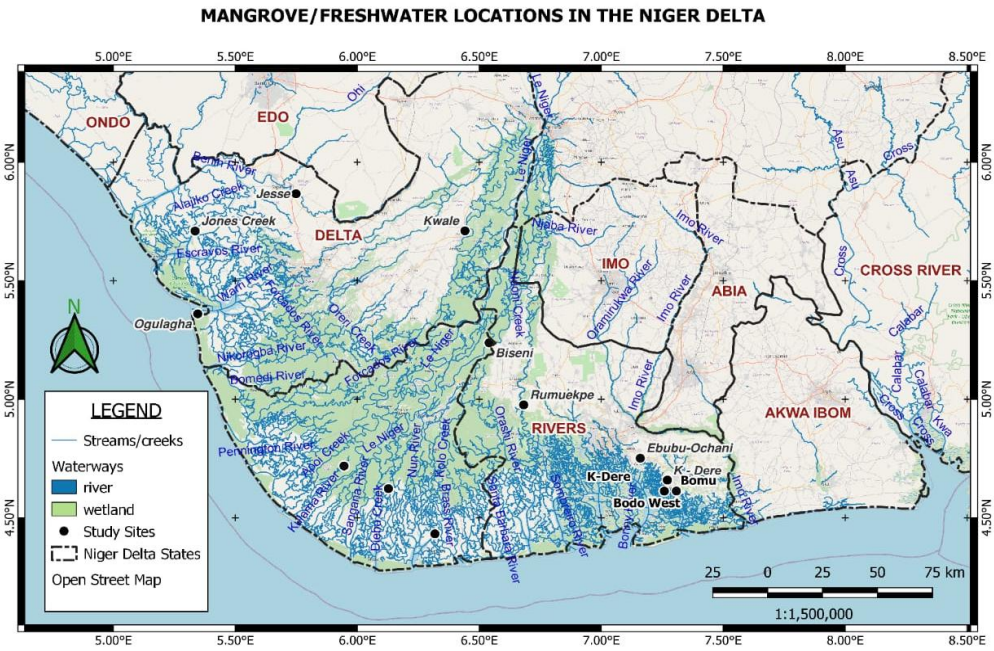
into the property valuation methods being adopted in practice in different countries around the world have been limited.

There is an increasing recognition that valuers in the Niger Delta do not have the requisite skills in the use of these valuation models, resulting in uncertainty over the correct approaches to take and methods to use when appraising property affected by contamination and under-valuation of damaged freshwater resources for compensation. This study aims to investigate how valuers involved in offering advice and appraising contaminated freshwater ecosystem incorporate these models into such advice and calculations. This study, which was undertaken within the Niger Delta, attempts to critically evaluate the usage of the valuation approach in the determination of damaged freshwater resources.

The report is organised as follows: Reviews of freshwater in the Niger Delta, freshwater contamination, the rationale of freshwater for valuation, and environmental valuation methods and procedures are provided in Sections 2, 3, 4, and 5, respectively. The findings of surveys on the methods used by experts and practitioners in the Niger Delta to value damaged freshwater ecosystem services are presented in Section 6. The findings are discussed in Section 7, and the conclusion and recommendations for the future of damaged freshwater valuation are made in Section 8.

## 2. NIGER DELTA FRESHWATER

Freshwater ecosystems, including lakes, ponds, rivers, streams, springs, and wetlands, are home to approximately 126,000 species. To put it simply, "fresh" water is water that doesn't contain salt, which distinguishes these habitats from marine, or saltwater, ecosystems. Freshwater is a water resource that is mostly used for domestic purposes, including drinking, bathing, cooking, etc. The areas with freshwater resources are often referred to as "freshwater swamps." Within the freshwater swamps, other habitats such as riparian and arable farmland are common. In the Niger Delta, several studies have reported biodiversity in some freshwater swamps. The freshwater swamp is an essential habitat for fisheries, particularly during the flooding period. The freshwater is also an important habitat for crayfish, prawns, crabs, and crocodiles [1]. The Niger Delta region has several freshwater creeks and creeklets, and they are called by several names [13]. Izah, [13] documents some notable water bodies in Bayelsa state, which include Epie Creek, Sagbama Creek, Ikoli Creek, Kolo Creek, Taylor Creek, and Nun River, among others**.** Most fresh water resources in the area are linked to the estuary from where they empty into the ocean.




**Map 1. Map showing mangrove/freshwater locations in the Niger Delta, Nigeria, 2022**
*Source: URP GIS Laboratory, Rivers State University, Port Harcourt*

## 3. FRESHWATER CONTAMINATION

The concept of contaminated sites has no uniform definition in the various scientific disciplines and national environmental and soil protection laws [14], citing Bartke (2011). This means the absence of a uniform definition. It can thus be interpreted to mean the same thing as pollution. Collins Dictionary [15] supports this synonymy by defining it as follows: "Contamination is the act or process of contaminating or the state of being contaminated." Deeyah & Akujuru [16] citing [14] defines contaminated land as "land that contains substances that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man, the environment, or on occasion to other targets." Freshwater contamination can therefore be said to mean the act or process of contaminating freshwater or the introduction of substances into a freshwater ecosystem that, when present in sufficient quantities or concentrations, are likely to cause harm, directly or indirectly, to man and the freshwater environment.

One of the greatest threats to the biota on the planet is pollution of freshwater habitats. Freshwater sources, both surface and groundwater, are contaminated with different kinds of pollutants discharged from different sources. Various human activities are the main factors contributing to the decline in the quality of freshwater. Depending on the pollution type as well as the primary source of pollution, a variety of effects occur in the freshwater bodies, affecting various physical, chemical, as well as biological parameters [17]. Nigeria is one of the major producers of oil in the world, with over 90% of the oil produced from the Niger Delta. Oil spillages have been reported on production platforms and tank farms. In addition to the many production platforms, tank farms, and loading terminals, the Niger Delta has a complex network of oil pipelines running across the region and its freshwater ecosystem. A huge quantity of oil spill incidents have occurred through the pipelines and storage failures [18]. According to the Department of Petroleum Resources, about 88% of the oil spill incidences are traceable to equipment failure. However, [19] attribute vandalism, oil blowouts from flow stations, unintentional and intentional releases, and oil tankers at sea as the causes of oil spills in the Niger Delta. Over the last 50 years, an estimated 9 million-13 million (1.5 million tons) of oil has been spilled into the Niger Delta ecosystem, which is 50 times the approximate volume spilled in the 1989 Exxon Valdez oil spill [20].

## 4. JUSTIFICATION OF FRESHWATER VALUATION

The services provided by freshwater ecosystems are very important to the wellbeing and survival of people. Society depends on the continuous provision of freshwater ecosystem services for wellbeing, especially in poor countries where ecosystem services are fundamental to many people's livelihoods. According to Millennium Ecosystem Assessment (MEA) [21], these services include:

1. Provisioning services such as food, fresh water, wood, fuel and fibre;
2. Regulating services that affect climate, flood, disease, and water purification;
3. Cultural services that provide recreational, educational, aesthetic, and spiritual benefits; and
4. Supporting services such as soil formation, photosynthesis (primary production) and nutrient cycling.

The recognition and valuation of each of the above ecosystem services vary greatly depending on whether the impact is direct or indirect. The freshwater ecosystem provides several different goods and services that are significantly vital for people's sustenance [22]. The values of these goods and services still need to be assessed, especially when there is a need to compensate the affected persons, even though they are not traded in the open markets and therefore regarded as having no marketplace prices since man's continuous survival depends on the goods and services provided by the natural environment [23].

Foods that are measurable in physical quantities over time, such as fish, water, food, and fiber, are relatively easy to value economically. However, benefits such as improved water quality, flood control, aesthetic value, and nutrient cycling cannot be measured simply by physical amount over time [24]. These services, by their nature, cannot be privatised; they are "public goods and services". Flood protection is one example of a service that is "public." That is, you cannot exclude a single landowner from flood protection if he or she does not pay.

**Ajibola, Ogungbemi, & Adenipekun [25]** note that valuation helps to compare the real costs

and benefits of ecosystem use and degradation, and allows more balanced decision-making regarding the protection and restoration versus degradation of ecosystem services. It also facilitates optimal decision-making which maximises societal well-being. They opined that if monetary values of ecosystem services are not estimated, many of the major benefits of aquatic (freshwater) ecosystems will be excluded in benefit-cost computations. Notwithstanding, the provisions of the laws did not capture the full value of natural resources as they did not place an accurate value on them [26]. Similarly, [27] argues that there is no policy or legal framework for determining the true economic value of each species based on its economic functions.

Akujuru, [14] citing Howarth and Farber (2002), opined that "valuation is particularly useful in settings where institutional arrangements like markets are not functioning well to reflect the social costs of environmental degradation and decisions about conservation or restoration can lead to misuse of resources when not guided by some concept of value". Ajibola**,,** Oluwunmi, Kabiamaowei, Owolabi, & Akinwale [23] assert that, even though such are not traded in the open markets and therefore are regarded as having no marketplace prices, the values of natural goods and services still need to be assessed, especially when there is a need to compensate affected persons, because man's continuous survival is dependent on the goods and services provided by the natural environment. They also say that damage to the environment, especially contamination of the land from oil spills, which happen often in the study area, threatens future economic growth and development.

## 5. ENVIRONMENTAL VALUATION METHODOLOGY AND PROCEDURES

Acceptance of incorporating ecosystem service values into decision-making increases the need for a range of robust methods to value ecosystem services [21]. There are a number of different methods that can be used, with the approach most appropriate or useful being dependent on the decision context. For example, if the context requires a ranking or choice based on a single criterion (e.g., net benefits), a valuation approach that yields a single (aggregate) metric is needed. In contrast, in a decision context where multiple values are involved (e.g., human health, threatened species, aesthetics, social equity, and other civil obligations) and the decision makers themselves are charged with appropriately weighing and balancing competing interests and resolving tradeoffs, a multi-attribute approach is preferable. Depending on the situation, this weighing and balancing could be done through political discourse or a thoughtful process that helps people make decisions [28].

Whatever the context, the basis for the valuation of the goods and services provided by an ecosystem is the "total economic value". Simply put, "total economic valuation distinguishes between use values and non-use values, the latter referring to those current or future (potential) values associated with an environmental resource which rely merely on its continued existence and are unrelated to use" [29]. But how is "total economic value" determined? In the appraisal theory, total economic value can be established by using the methods of environmental valuation, namely the contingent valuation method (CVM), the Hedonic Pricing Method, travel cost method, restoration cost method, damage cost avoided, productivity function, participatory approach, and benefit transfer. These valuation methods look at the benefits derived from services and their value to humans, as well as their non-utilitarian value, and the benefits are often expressed in monetary metrics as discussed below:

### 5.1 Contingent Valuation Method (CVM)

The CVM is one of the most widely used techniques for estimating the economic values of non-market goods and services [30,31] as it allows for the incorporation of non-use or passive values. The majority of contingent valuation (CV) applications have been undertaken for the purpose of assisting in policy evaluations [30]. The CV technique is a method that relies on using well-crafted and administered sample surveys to directly elicit value from each respondent [32,33]. By figuring out what people would be willing to pay (WTP) for specific changes in the quantity or quality of such goods, or what they would be willing to accept (WTA) in exchange for well-specified degradations in the provision of such goods, CV surveys are "designed to create the missing market for public goods" [34]. The focus of CVM is on hypothetical transactions rather than actual market transactions.

### 5.2 Hedonic Pricing Method

People's willingness to pay for goods and services may be a reflection of the demand for

those services. For instance, house costs on beaches are typically higher than those of equivalent homes in interior areas with less appealing landscapes [35]. The hedonic pricing method (HPM) is used to value environmental attributes such as clean air or water by looking at real markets in which those characteristics are effectively traded [36]. Hedonic analysis, according to Woodward, & Wui [37], "captures amenity benefits supplied by closeness to the environment." This method's drawback is that it simply measures usage values. Analysis is often expensive and time consuming. Primary data collection can be cumbersome.

### 5.3 Travel Cost Method

Use of ecosystem services may require travel. The travel costs can be seen as a reflection of the implied value of the service. The travel cost method attempts to value changes in environmental quality based upon recreational experiences. An example is the amount of money that visitors are willing to pay to travel to a place or an area that they want to visit. TC involves using travel costs as a proxy for the price of visiting outdoor recreational sites [38]. The rationale is that a recreationist undertakes a visit to a recreational site if the recreational benefit or utility from such a visit is at least equal to the cost of the visit; that is, marginal benefits equals marginal cost. The visit to the site is treated as a single transaction and the travel cost as the price for that transaction [4], just like what happens in a market for a private good.

### 5.4 Restoration Cost Method

The restoration cost approach values an environmental good benefit in relation to the expense involved in bringing it back to its pre-damaged condition. The restoration cost method applies accounting and engineering principles to derive actual costs to restore, rehabilitate, replace, and/or acquire equivalent resources. The cost of restoring the affected environment to its pre-spill condition may be considered a proxy for the value of the environmental injuries [39,40,41]. Restoration costs, according to [40], do not provide a technically accurate assessment of economic values since they do not depend on the person's desire to pay. Furthermore, some damage might not be restorable.

### 5.5 Damage Cost Avoided Technique

Services allow society to avoid costs that would have been incurred in the absence of those services. This method estimates the economic benefits of the costs people incur to prevent losses or harm to ecosystems [42]. Examples include waste treatment (which avoids health costs) and flood control (which avoids property damage) by wetlands. The technique seeks to determine what protection is being provided by ecosystems and what this protection is worth. A healthy freshwater forest protects against storm damage. What would be the cost of damage if the freshwater didn't exist? How much spending was avoided because of the ecosystem service provided? As a cost method, it does not provide strict measures of willingness to pay for a product or service, but rather assumes that the cost of avoiding environmental damage provides useful estimates of the value of restoring these ecosystems or services.

### 5.6 Productivity Function

This method estimates the economic values of ecosystem products or services that contribute to the production of commercially marketed goods. The production approach can be useful to estimate the partial value of freshwater when there is a clear link between wetlands and the production of an economically valuable commodity. The existence of market prices for commodities produced (e.g., commercially harvested fish) makes production-based valuation of use values for wetlands less controversial than most non-market methods [43]. How much is the value-added by the ecosystem service based on its input to production processes?

### 5.7 Participatory Approach

This method is used to elicit values by asking people to explain or discuss why they behave in a particular way or hold a particular view [44]. The focus is on what people think society should do, rather than on their own personal behaviour. The method involves asking members of a community to determine the importance of a non-marketed ecosystem service relative to goods or services that are marketed. Stefea, & Circa [45] document examples of the methods to include:

1. Qualitative semi-structured surveys, often undertaken face-to-face or by telephone, to explore rationales as well as opinions.
2. Group deliberative discussions, including focus groups or deliberative forums, which spend time listening to the opinions of others with the aim of forming a collective view (which can be on monetary values).

These groups can be expert/stakeholder groups or can represent the general public.
3. Citizens' juries, in which participants give an informed opinion after considering evidence from experts or stakeholders and discussing the proposed issue.

### 5.8 Benefits Transfer

Benefits transfer (BT) is the process of transferring data about benefits from one context (the "study site") and applying it to a different context (the "policy site"). It means borrowing, or transferring a value from an existing study to provide a ballpark estimate for a current decision. The technique is frequently applied in the valuation of environmental goods and services and consists of transferring the value of a certain non-market good from a former to a current study [45]. The primary benefit of this approach is that it can shorten the time and cost required to create original value estimates for the policy site [46]. These estimates can be used to determine the necessity of compensation when, for instance, harmful substances like oil are discharged into the environment and to assess the value of policies implemented in the past and the attractiveness of potential public policies [47].

The process of benefits transfer is complex, as noted by [46] and [48], and additional research is required to determine how transferrable these estimates are to countries with different preferences, limitations, and institutions. According to [49], there are a number of issues with benefit transfer, including the difficulty in finding good quality studies of similar situations and the possibility for features to change over time and space.

It is evident from the discussion above that there is no one method for valuing all environmental damage but a plethora of suggested methods from which a valuer may choose based on the peculiar circumstances and the nature of environmental damage surrounding each particular case. Due to the effect of legislation, valuers in the Niger Delta are not given the professional flexibility to choose the most appropriate method [16]. Deeyah & Akujuru [16] citing [14] observe that valuers in the Niger Delta have relied on property-based valuation models and the statutory valuation models in solving valuation problems, which have proven inadequate for environmental damage caused by pollution. As a result, choosing an appropriate existing economic valuation technique for assigning values to complex and multidimensional situations such as the freshwater ecosystem raises some concerns, thus necessitating further research into how Niger Delta valuers apply valuation techniques in freshwater ecosystem damage assessment.

## 6. RESEARCH METHODOLOGY

Data collected during the field research for this study was from both secondary and primary sources. First, from relevant literature. Primary data was from questionnaires and structured interviews (primary data) targeted at valuation firms and some expert valuers in the Niger Delta region. The questionnaire addressed the following issues:

1. The Frequency of Contaminated Natural Resources Valuation Task in the Niger Delta.
2. Application of environmental valuation methods in valuing damaged freshwater resources in the study area.
3. The level of knowledge of Niger delta valuers in environmental valuation approaches.
4. The valuation method is used in practice for Damaged Freshwater Resources

The information obtained from the structured interviews with some expert valuers was compared with the responses obtained from the respondents of the questionnaires distributed to some selected valuation firms practicing in the Niger Delta region. The sample size for the questionnaire administration was 102 Niger Delta valuation firms in practice [50]. The study used census sampling for questionnaire administration, so a total of 102 questionnaires were distributed to all respondents working in valuation firms, with 63 questionnaires (67 percent) validly answered and returned. Bryman, and Bell [51] say that in the field of research, a response rate of 30–94% is acceptable.

## 7. SURVEY RESULTS

The survey results are thus provided below:

### 7.1 Educational Level of Respondents

A person's level of education is directly related to his or her knowledge and understanding of issues. Findings about respondents' educational levels are important in this study because they influence how respondents relate their feelings and perceptions of phenomena around them. Table 1 shows the responses of respondents:

**Table 1. Educational level of respondents**

| Educational Level | Expert Valuers | | Valuation Firm | |
|---|---|---|---|---|
| | Freq. | Percent | Freq. | Percent |
| University Education level | 9 | 81.8% | 51 | 81.0% |
| Polytechnic Education Level | 2 | 18.2% | 12 | 19.0% |
| Basic Education level | 0 | 0.0% | 0 | 0.0% |
| No Formal education | 0 | 0.0% | 0 | 0.0% |
| Total | 11 | 100.0% | 63 | 100.0% |

*Source: Author's Field Survey, 2022*

The Table 1 shows that 81.0% (51Nr) of the respondents' valuers in Valuation Firm has University Education as their highest qualification, while 19.0% (12Nr) of them has Polytechnic Education. The table further show that 81.8% (9Nr) of the respondents' expert valuers interviewed has University Education as their maximum qualification, while 18.2% (2Nr) of them has Polytechnic Education.

The findings confirm that all the practicing valuers have tertiary educational background. This level of education attainment of the respondents of the practicing valuers is ideal for the study and their contribution will help in the progress of this work.

## 7.2 Professional Membership of Respondents Estate Surveyors and Valuers

Professional certification acknowledges that a person is fit and qualified to practice a profession and that his opinion can be trusted. The question about professional membership was asked to ensure that respondents are legally permitted to practice under the enabling statute. Fig. 1 depicts the responses to this question.

Fig. 1 shows the professional membership levels of the respondents. It reveals that 54.5% (6Nr) of the respondents' expert valuers were associate members, while 45.5% (5Nr) of them were fellows of the Nigerian Institution of Estate Surveyors and Valuers. It further revealed that 77.8% (49Nr) of the respondents practicing valuers in valuation firms for questionnaire administration were associate members; 11.1% (7Nr) of them were fellows of the Nigerian Institution of Estate Surveyors and Valuers, 7.9% (5Nr) of the respondents were graduate members; only 3.2% (2Nr) were probationers. This confirms that all the respondents are professionally qualified (Fellows and Associates) to practice which implies that they could give dependable information required for the study.

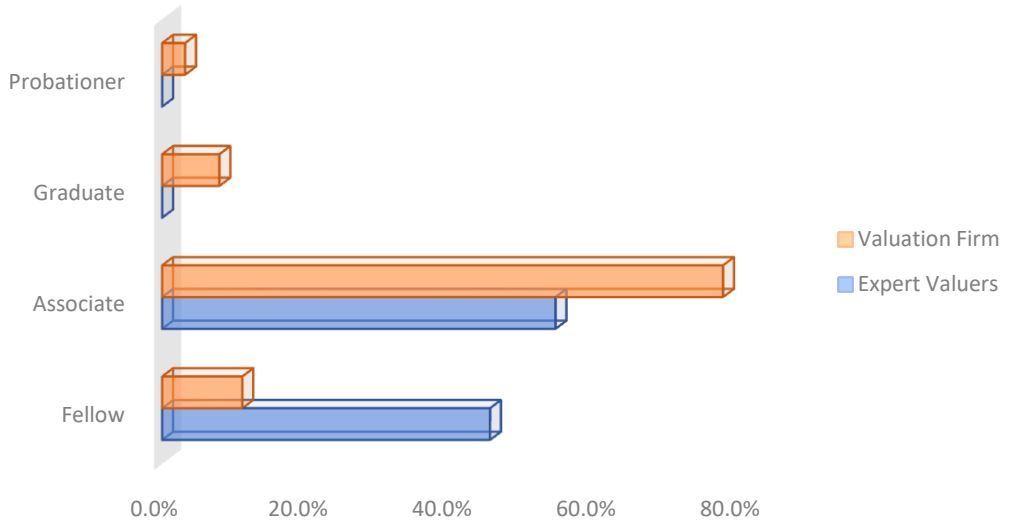



**Fig. 1. Professional membership of respondents valuers**
*Source: Author's Field Survey, 2022*

### 7.3 Frequency of Contaminated Natural Resources Valuation Task

This theme investigated the frequency with which the respondents' firms performed valuation tasks on contaminated natural resources. The consistency with which a valuation firm performs a valuation task on contaminated natural resources is evident in their experience and value judgement about appropriate methods for any valuation assignment. As a result, the frequency with which the respondent firms of estate surveyors and valuers perform valuation tasks was sought, and the data collected was analyzed, as shown in Fig. 2.

Fig. 2 shows that 37 respondents, representing 58.7%, said they often carry out valuation tasks, 11 respondents representing 17.5% said always, 10 respondents representing 15.9% said they sometimes carry out valuation tasks, and only 5 respondents representing 7.9% said they rarely carry out a valuation task. It can also be deduced that the majority of the respondents' firms have experience in the valuation of contaminated respondents, and their opinion on the issue of contaminated freshwater in the Niger Delta is convincing.

### 7.4 Usage of Environmental Valuation Methods for Damaged Freshwater by Niger Delta Valuers

Respondents were asked to indicate the method (s) they used in their natural resource valuation in order to identify the methods of environmental valuation used in the valuation of damaged freshwater resources in the study area. This is meant to provide a more detailed answer to the usage of environmental valuation methods in the Niger Delta. The weights used for this question are 5 = always, 4 = often, 3 = occasionally, 2 = rarely, and 1 = never. The results of the questionnaire survey are shown in Table 2.

For the usage of the environmental valuation methods in practice, the information in Table 2 shows that the commonly used method is the contingency valuation method because 26 respondents representing 41.3% said they always adopt the contingency method of valuation in practice, 29 respondents representing 46.0% said they often use the method, 2 respondents representing 3.2% said they sometimes use it, while 3 respondents representing 4.8% said they rarely use it, and only 3 respondents representing 4.8% said they never use it. The cumulative combined percentage shows that 90.5% of respondents always use this method, while only 09.5% never use it. It can be concluded that a significant proportion of respondents always use the contingency valuation method in the valuation of freshwater resources damaged by oil spills and that strong evidence also exists in support of the statement.

When asked concerning the use of the Travel cost method of valuation in natural resources damaged by oil, 13 respondents representing 20.6% said they always use the Travel cost method of valuation, 14 respondents representing 22.2% said they often use the method, 9 respondents representing 14.3% said

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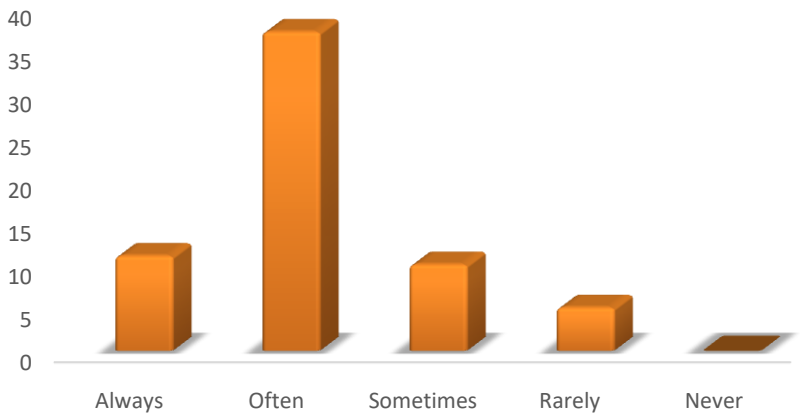


**Fig. 2. Frequency of contaminated natural resources valuation task**
*Source: Authors' Field Survey, 2022*

**Table 2. Usage of environmental valuation method for damaged natural resources**

| Environmental Valuation Method for damaged natural resources | Always | Often | Sometimes | Rarely | Never |
|---|---|---|---|---|---|
| Contingency valuation method | 26<br>41.3% | 29<br>46.0% | 2<br>3.2% | 3<br>4.8% | 3<br>4.8% |
| Travel cost method | 13<br>20.6% | 14<br>22.2% | 9<br>14.3% | 13<br>20.6% | 14<br>22.2% |
| Hedonic pricing model | 12<br>19.0% | 11<br>17.5% | 6<br>9.5% | 17<br>27.0% | 17<br>27.0% |
| Damage cost avoided | 0<br>0.0% | 0<br>0.0% | 16<br>25.4% | 14<br>22.2% | 33<br>52.4% |
| Restoration cost method | 21<br>33.3% | 17<br>27.0% | 4<br>6.3% | 14<br>22.2% | 7<br>11.1% |
| Benefit transfer | 0<br>0.0% | 2<br>3.2% | 15<br>23.8% | 31<br>49.2% | 15<br>23.8% |
| Productivity function | 4<br>6.3% | 8<br>12.7% | 6<br>9.5% | 24<br>38.1% | 21<br>33.3% |
| Participatory approach | 2<br>3.2% | 7<br>11.1% | 7<br>11.1% | 26<br>41.3% | 21<br>33.3% |

*Source: Authors' Field Survey, 2022*

they sometimes use it, while 13 respondents representing 20.6% said they rarely use it, and only 14 respondents representing 22.2% said they never use it. The cumulative combined percentage shows that the majority of respondents (57.1%) have always used the travel cost method, while only 42.9% have never used it. It can be concluded that a significant proportion of respondents used the travel cost method in the valuation of natural resources damaged by the oil spill in the Niger Delta and that strong evidence also exists in support of the statement.

Regarding the use of the hedonic pricing model, 12 respondents representing 19.0% said they always use the hedonic pricing method of valuation, 11 respondents representing 17.5% said they often use the method, 6 respondents representing 9.5% said they sometimes use it, and 17 respondents representing 27.0% said they rarely use it. Only 17 respondents representing 27.0% said they never use it. The cumulative combined percentage shows that the majority of respondents (54.0%) have never used this method, while only 46.0% have. It can be concluded that a significant proportion of respondents do not use the hedonic pricing model in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

According to responses on the use of damage cost avoidance, 33 respondents representing 52.4% said they never use the damage cost avoidance method of valuation; 14 respondents representing 22.2% said they rarely use the method; and only 16 respondents representing 25.4% said they sometimes use it. The cumulative combined percentage shows that the vast majority of respondents, 74.6%, have never used this method, while only 25.4% have. It can be concluded that a significant proportion of respondents do not use the damage cost avoidance in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

About 21 respondents representing 33.3% reported that they always apply the restoration cost method of valuation. 17 respondents representing 27.0% said they often use the method, 4 respondents representing 6.3% said they sometimes use it, while 14 respondents representing 22.2% said they rarely use it. Only 7 respondents representing 11.1% said they never use it. According to the cumulative combined percentage, the majority of respondents (66.6%) have used this method, while only 34.4% have never used it. It can be concluded that a significant proportion of respondents use the restoration cost method in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

Regarding the use of benefit transfer, 31 respondents representing 49.2% said they rarely

use the benefit transfer method of valuation; 15 respondents representing 23.8% said they have never used the method; 15 respondents representing 23.8% said they sometimes use it; and 2 respondents representing 3.2% said they often use it. According to the cumulative combined percentage, the majority of respondents (73.0%) have never used this method, while only 37.0% have. It can be concluded that a significant proportion of respondents do not use the benefit transfer in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

Similarly, on the use of productivity function, 4 respondents representing 6.3% said they always use the hedonic pricing method of valuation, 8 respondents representing 12.7% said they often use the method, 6 respondents representing 9.5% said they sometimes use it, while 24 respondents representing 38.1% said they rarely use it, only 21 respondents representing 33.3% said they never use it. According to the cumulative combined percentage, the majority of respondents (71.4%) have never used this method, while only 28.5% have. It can be concluded that a significant proportion of respondents do not use the productivity function in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

Finally, on the use of the participatory approach, 2 respondents representing 3.2% said they always use the participatory approach method of valuation, 7 respondents representing 11.1% said they often use the method, and 7 respondents representing 11.1% said they sometimes use it, while 26 respondents representing 41.3% said they rarely use it, and only 21 respondents representing 33.3% said they never use it. The cumulative combined percentage shows that the vast majority of respondents (74.6%) have never used this method, while only 25.4% have. It can be concluded that a significant proportion of respondents do not use the participatory approach in the valuation of natural resources damaged by oil spills and that strong evidence also exists in support of the statement.

The results of the questionnaire survey were compared with the interview responses of the expert valuers in order to find out whether their views were the same or not. Findings indicate that there is similarity in their opinion on the environmental valuation method used for damaged freshwater valuation. The interview responses show that 81.8% (9) of the interviewees stated that they use the contingency valuation method and restoration cost method in valuing freshwater damage; only 18.2% (2) of the expert valuers disagreed with the use of the methods.

## 7.5 Knowledge of Environmental Valuation Approaches

This theme seeks to unravel the level of knowledge about environmental valuation techniques amongst Niger Delta valuers. Awareness or knowledge of methods of valuation can trigger their adoption in practice. Lack of awareness or knowledge of environmental methods could be responsible for their non-usage in practice. For this question, the weights used are 5 = very adequate, 4 = adequate, 3 = neutral, 2 = poor, and 1 = very poor. Table 3 shows the results of the questionnaire survey.

Table 3 showed that 80.95% of valuation firms surveyed confirmed that valuers in the Niger Delta do not have adequate knowledge of environmental valuation approaches. This directly correlates with the fact, as reflected in Table 2, that a substantial number of respondent valuation firms do not use the majority of the environmental valuation methods in their contaminated freshwater valuation practice. The follow-up interview revealed that they were not conversant with the use of environmental valuation as RESPONDENT 7 said:

**Table 3. Knowledge of environmental valuation approaches**

| Options | Frequency | Percentage |
|---|---|---|
| Very adequate | 3 | 04.76 |
| Adequate | 4 | 06.35 |
| Neutral | 5 | 07.94 |
| Poor | 37 | 58.73 |
| Very poor | 14 | 22.22 |
| **Total** | **63** | **100%** |

*Source: Author's Field Survey, 2022*

*"I have limited knowledge because our firm are not always involved in damage natural resource valuation but are usually asked by the oil company to vet such valuation"*

When another interviewee RESPONDENT 9 was asked to explain what they usually vet, he responded and said

"we *looked at the method they use particularly if they use the OPTS rate or not. if it is not OPTS rate then we will counter the valuation.*

This is absurd and appalling that someone who had not sufficient knowledge would be the one to vet
valuation figures that he never had a clear understanding of.

## 7.6 Traditional Valuation Method Used in Practice for Damaged Freshwater Resources

Valuers in the Niger Delta are familiar with conventional valuation methods, and it is possible that they used such methods in the valuation of freshwater resources damaged by the oil spill. This section presents the quantitative results of the research conducted to determine the valuation method used for damage assessment of freshwater resources in Nigeria's Niger Delta region. It also includes a data triangulation method. The data for the analysis was gathered through a questionnaire survey and a semi-structured interview.

Respondents were asked to specify the valuation method they use in the valuation of freshwater resources for which they have provided valuation advice. Response options to valuation methods: Comparison sales technique, Replacement value technique, Profit/account method, Residual method, Income capitalisation method, and Statutory method (Pre-determined rate) show that all respondents employed varying methods of conventional valuation in natural resource damage. For this question, the weights used are 5 = always, 4 = often, 3 = sometimes, 2 = rarely, and 1 = never. The findings are presented in Table 4 and the RII for each good or service was computed using the formula after the items were ranked from 1 to 16.

**RII = (5a + 4b +3c + 2d + 1e) / jN (0 < index <1)**

Where;

a = number of respondents who answered ''Always'',
b = number of respondents who answered ''Often''
c = number of respondents who answered ''Sometimes''
d = number of respondents who answered ''Rarely''
e = number of respondents who answered ''Never''
N = sample size = 63
j = number of response categories = 5

Table 4 provides the results of the quantitative.

The result as presented in Table 4 indicates that the statutory method (pre-determined rate) emerged as the most frequently used method of valuation in natural resource damage assessment in the Niger Delta with an RII of 0.84. This implies that valuers in the Niger Delta

**Table 4. Valuation method used in practice**

| Valuation Method used in practice | Always | Often | Sometimes | Rarely | Never | Sum | RII | Ranking |
|---|---|---|---|---|---|---|---|---|
| Comparison sales technique | 5 | 5 | 13 | 28 | 12 | 152 | 0.48 | 4th |
| Replacement cost technique | 28 | 22 | 4 | 5 | 4 | 254 | 0.81 | 2nd |
| Profit/ account method | 4 | 9 | 13 | 16 | 21 | 315 | 0.47 | 5th |
| Residual method | 3 | 9 | 13 | 22 | 16 | 150 | 0.48 | 4th |
| Income capitalisation method | 14 | 22 | 10 | 8 | 9 | 213 | 0.68 | 3rd |
| Statutory method (Pre-determined rate) | 37 | 13 | 6 | 4 | 3 | 266 | 0.84 | 1st |

*Source: Author's Field Survey, 2022*

consider the statutory method (pre-determined rate) as the best. This method was closely followed in order of ranking by the replacement cost technique with RII of 0.81, the income capitalisation method with RII of 0.68, the comparison sales technique with RII of 0.48, the residual method with RII of 0.48, and the profit/account method with RII of 0.47, which ranked 5th and 6th respectively.

The choice of the predetermined rate by respondents to the questionnaire as their first choice is not surprising because valuers generally think that damage valuation is statutory, hence the adoption of the method prescribed by the land use Act.

To corroborate the questionnaire survey findings, the respondents to the expert interviews were asked to state the conventional method of valuation used in the valuation of natural resources. RESPONDENT 11 responded thus:

> "*The predetermined rate was preferred, followed by replacement costs, Income capitalisation method and the comparison sales technique".*

When they were asked why these methods of valuation used in damaged natural resource? RESPONDENT 2 said:

> *"These methods of valuation were used in order to ensure compliance with statutory provision and potential use of the natural resource; Methodologies based on willingness to pay, and environmental valuation techniques are prone to hypothetical bias and often considered as difficult to use by valuers in the Niger Delta because they are not conversant with it"*

.

Supporting the use of these method for damaged natural resources, RESPONDENT 5 said

> "*The predetermined rate and replacement cost method is a method commonly used by other valuation firms in the region"*

Also, RESPONDENT 4 said:

> *"Income capitalisation method is used particularly to value the assumed loss of income stream to determine the unimpaired value since the valuation method relies on market data"*

Further, the expert valuers were asked to confirm the damaged freshwater ecosystem services that warrant the use of current methods. RESPONDENT 8

> *"ecosystem services that are always assessed for damaged using current method of valuation are loss of water for drinking purposes, loss of fisheries, loss of farming rights and loss of income from non-timber forest products, loss of spiritual values and loss of vegetation".*

The selection of the above listed methods for freshwater ecosystem service valuation, which can only value a few provisional and cultural services but exclude regulatory and supportive services, implies that valuers in the Niger Delta are yet to understand the functioning of freshwater ecosystems and the associated human wellbeing.

## 8. DISCUSSION OF FINDINGS

The findings show the thinking of Niger Delta valuers that statute is restricting the use of suitable methods for damaged natural resource valuation. This implies that valuers rely on statutory dictated method rather than methods justified by economic considerations for natural resource valuation. The results of the study show that there is no uniformity in the standards and methods used in natural resource valuation and indicate serious concerns regarding the poor knowledge of natural resource valuation methods used by Niger Delta valuers. The study found that knowledge concerning natural resource valuation was not adequate, with only a few practicing Niger Delta valuers having proper knowledge of damaged natural resource valuation methods. These findings thus justify the application of the conventional methods of valuation in the valuation of natural resources damaged by oil spills in the Niger Delta for which they are conversant with.

According to the study, environmental valuation techniques are difficult for valuers in the Niger Delta to use due to their limited knowledge of the techniques. The only method of environmental valuation that appears to be most commonly used in natural resource damage valuation in the Niger Delta is the contingency valuation method and restoration cost. If given the chance, valuers in the Niger Delta would prefer to use familiar traditional valuation methods such as the statutory method. If given the opportunity,

valuers in the Niger Delta would rather use the familiar traditional methods of valuation, such as the statutory method. This confirms earlier findings by [14] that valuers are not given the professional flexibility to choose the most appropriate method due to the influence of legislation and that valuers in the Niger Delta have used property-based valuation models and the statutory valuation models in solving valuation problems, which have proven inadequate for environmental damage caused by pollution.

In the context of this research, all the findings in the data triangulation on the methods currently used for damaged natural resource valuation in the Niger Delta might not be unconnected with limited understanding about the functioning of freshwater ecosystems and the trade-offs between human activities and ecosystem functioning and; institutional and market failure for freshwater resources that provide incentives for unsustainable use of these resources.

## 9. CONCLUSION AND RECOMMENDATIONS

The need to discover the knowledge base of valuation practice and services provided by valuers to individuals and corporate bodies led to the conduct of this study. The usage of environmental valuation and that of other traditional valuation methods among valuers practicing in the Niger Delta was investigated so as to provide an understanding of the relationship between valuation practice and theory. The study examined how the Niger Delta valuers have been valuing natural resources damaged by oil pollution. The study discovered that when valuing contaminated freshwater in the Niger Delta region, most valuers use the predetermined rate that has been severally criticised as a method whose purpose, basis, and methodology are statutorily regulated [52]. and its procedure is guided by the provisions of the law and not the valuers' guidance standard. Findings show very few applications of the replacement costs, income capitalisation method and the comparison sales technique for damages. Thus, the resulting amount from the use of a predetermined rate for the purpose of compensation was perceived as inadequate and below the communities' expectations. Findings attributed the wrong choice of methods to poor knowledge of environmental valuation methods for damaged natural resources among Niger Delta valuers and an understanding of the functioning of freshwater ecosystems and the associated human wellbeing. In view of these findings, it is recommended that:

1. During the Mandatory Continuous Professional Development programme (MCPD), workshops, and conferences organized by the Nigerian Institution of Estate Surveyors and Valuers (NIESV) and the Estate Surveyors and Valuers Registration Board of Nigeria (ESVARBON), there should be intensive and prioritized education of practicing valuers on topical issues dealing with environmental valuation and the like.
2. Valuers should be given the freedom to choose appropriate and suitable valuation methods based on the loss of ecosystem services caused by oil pollution.

## CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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