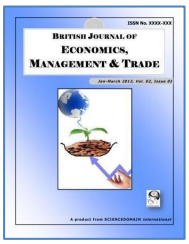

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# Factors Influencing the Choice of Wetland Valuation Methods in the Niger Delta, Nigeria

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***Author's contribution***

*This work was carried out solely by the author MOA who designed the study, performed the statistical analysis, wrote the protocol, wrote the first draft, managed the analyses of the study, managed the literature searches, read and approve the final manuscript.*

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## ABSTRACT

The focus of wetland valuation is on determining the compensation payable to the expropriated individuals or communities. In the conduct of wetland valuation, the Estate Surveyor and Valuer is faced with choosing the appropriate method(s) to adopt, hence this study examined the various factors considered by the Estate Surveyor and Valuer in choosing the method(s) he adopts. Seventy – two (72) questionnaires were retrieved, collated, analysed and presented using frequency distributions and percentages, relative importance index (RII) and principal component analysis (PCA). The study revealed that in valuing wetland resources, data availability and accessibility (RII = 4.16), availability of substitute sites (RII = 3.49), limitations of valuation methods (RII = 3.47) and people's perception (RII = 3.00) are the major factors considered in the choice of wetland valuation method(s). The study further revealed that only 5.5% of the respondents took any course in environmental valuation while in school. Also, the course has not been included in the professional examinations conducted by the Nigerian Institution of Estate Surveyors and Valuers (NIESV). The paper recommends that both NIESV and higher institutions offering Estate Management courses should include environmental valuation in their curriculum, to ensure that Valuers are properly trained in the use and application of appropriate techniques of environmental valuation.

*Keywords: Compensation; Niger delta; Lagos metropolis; valuation methods; wetlands.*

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## 1. INTRODUCTION

Wetland valuations are used in a variety of contexts for regulatory, planning, management, and educational purposes among others. The first step in addressing the full economic picture of wetland benefits is to recognise that the non-market benefits produced by wetlands are as important as traditional commodity (good) values. The idea behind putting an economic value on some of these wetland benefits before ecosystem-altering decisions are made is to recognise these potential costs up-front so as to put wetland-related decisions on a more economically sound footing. Functional performance provides goods and services that are of value to society, therefore the value of these functions reflects human preferences for sets of goods and services in demand. Although it is difficult to value wetland functions, as there is no direct demand for them yet, it is possible to value their corresponding goods and services. In making a choice of a valuation method to be adopted in the valuation of land and buildings, the Estate Surveyor and Valuer needs to take into consideration the type of property, availability of data and purpose of valuation. In ascribing value to wetland resources, a variety of factors equally call for the attention of the Estate Surveyor and Valuer. Therefore, this study examined the factors that influence the choice of wetland valuation methods in the Niger Delta, Nigeria.

## 2. FEATURES OF THE NIGER DELTA

The delta is an oil-rich region, and has been the centre of international controversy over devastating pollution [1]. Within Nigeria it is the richest area in terms of natural resources endowment with large oil gas deposit, extensive forests, good agriculture and abundant fish resources. It is one of the world's largest coastland and the largest in Africa. Although, the Niger Delta region is the richest source of natural resource in Nigeria, the region's potentials for sustainable development is increasingly threatened by environmental devastation and worsening economic conditions. The Niger Delta region of Nigeria is the world's third largest wetland coming after Holland and Mississippi [2].

Historically and cartographically, Niger-Delta area of Nigeria consists of present day Bayelsa, Delta and Rivers States (Fig. 1). The region is one of the most blessed deltas in the world, in both human and material resources but the unfavorable manner in which these resources are harnessed overtime, is the bane of the region's predicament. The Niger Delta covers 20,000 km² within wetlands of 70,000 km² formed primarily by sediment deposition. It is one of the world's ten (10) most important wetland and coastal marine ecosystems and is home to some thirty-one (31) million people. This floodplain makes up 7.5% of Nigeria's total land mass. It is the largest wetland and maintains the third-largest drainage basin in Africa. About 60% of Niger Delta land is wetland.

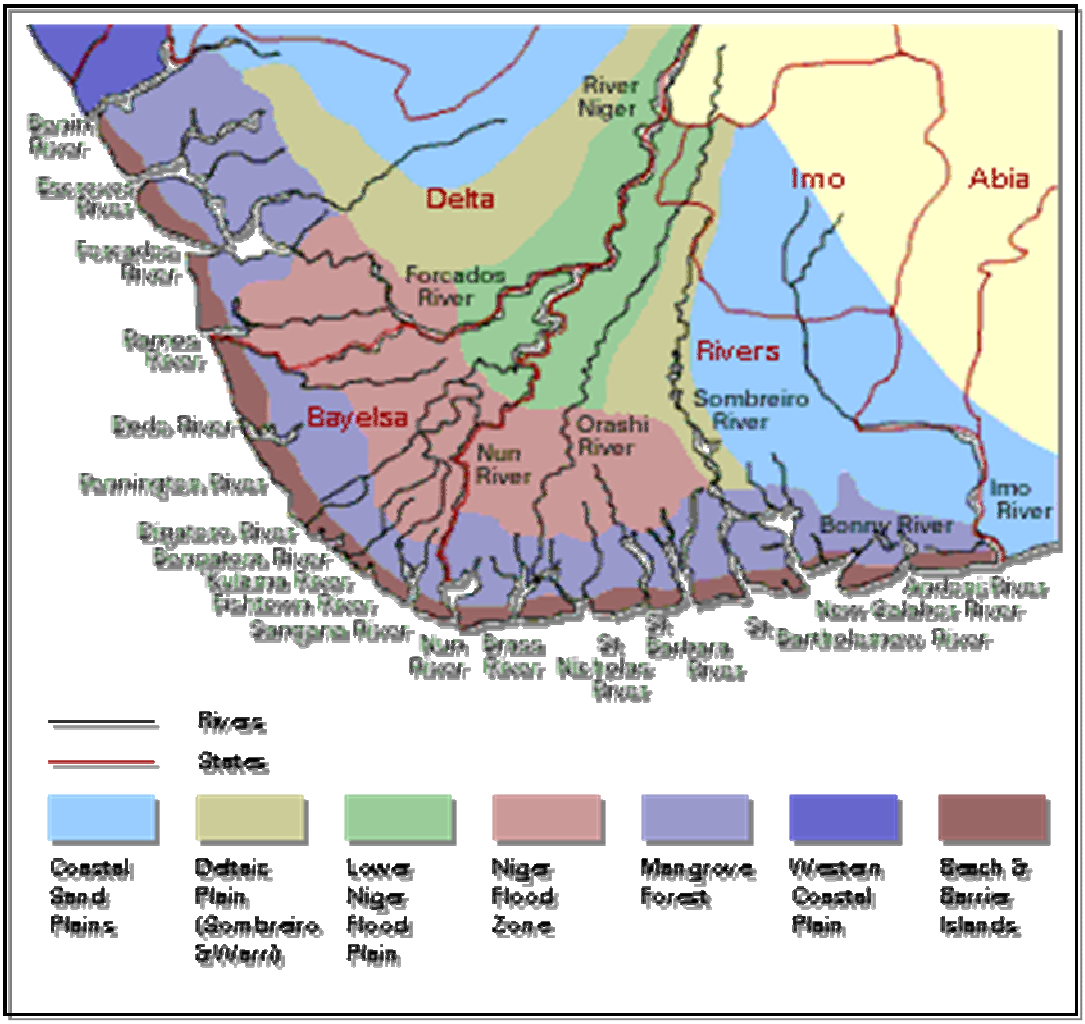


**Fig. 1. Map of Niger Delta, Nigeria**

*Source: http://www.waado.org/nigerdelta/Maps/NigerDelta_Rivers.html*

The Niger Delta environment can be grouped into four ecological zones: costal barrier islands, mangrove swamp forests, freshwater swamps, and lowland rainforests. This well-endowed ecosystem contains one of the highest concentrations of biodiversity on the planet, in addition to supporting abundant flora and fauna, arable terrain that can sustain a wide variety of crops, lumber or agricultural trees, and more species of fresh fish than any ecosystem in West Africa [3] and Wikipedia [1]. With all these features it is important to examine the factors considered by Estate Surveyors and Valuer in choosing the method(s) adopted in the valuation wetland resources for compensation.

## 3. SIGNIFICANCE OF WETLAND

For millions of people “swamps” long suited only for draining have become “wetlands” worth *conserving* [4].

Wetlands, historically considered as worthless wasteland, are now considered among the most important natural resources throughout the world [5]. As the society have begun to appreciate the importance of wetlands, increased emphasis has been placed on maintaining existing wetlands and, where possible, restoring those wetlands that have been lost or seriously degraded. The task of maintaining and restoring wetlands is not only a technological challenge but will also be costly to society in terms of scarce resources that will need to be employed. In the same vein, [6], in a research on Africa, conducted for International Water Management Institute (IMWI) stated that throughout history, wetlands have played an important role in human development. Their perceived value, which has always been largely dependent on social perceptions of the use and benefits to be gained from them, has varied from place to place and, as the quote above illustrates, has changed over time. Wetland values arise through the interaction of the ecological functions they perform with human society. They stated further that until recently, in many parts of the world, wetlands were considered, with few exceptions, as unproductive wastelands associated with disease, difficulty of access and danger. [7] identified the provision of habitat for mosquitoes that transmit illnesses as a function of many wetlands that has a huge negative impact on human wellbeing and, historically, was one reason for draining many of them.

McCartney et al. [6] opined that in recent years, greater insight into the ecological processes that occur in wetlands has brought about a radical change in perception. Wetlands are now widely viewed as valuable ecosystems that play an important role in maintaining environmental quality, sustaining livelihoods and supporting biodiversity. For example, many seasonally saturated wetlands make a vital contribution to the livelihoods of millions of people living in the arid and semi-arid areas of Africa [8]. [9] estimated the global economic value of wetlands (i.e., the value attributed to direct physical benefits, but neglecting wetland-related costs) to be US$70 billion a year. People also gain nonphysical benefits from wetland functions. These are associated with spiritual enrichment, cognitive development and aesthetic experience. Hence, wetlands bring a wide variety of tangible and intangible benefits to large numbers of people. The way in which they do so is complex and multifunctional and is directly related to the ecological functions and, hence, the condition of the wetland. However, wetlands are also associated with many costs. In the past, it has often been the cases that while the costs were recognized the less quantifiable benefits to human welfare have tended to accrue without communities and decision-makers fully appreciating them. As a result, the benefits have often gone unrecognized in development and resource planning, and management.

[10] opined that wetlands - including (inter alia) rivers, lakes, marshes, estuaries, lagoons, mangroves, seagrass beds, and peatlands – are among the most precious natural resources on earth. These highly varied ecosystems are natural areas where water accumulates for at least part of the year. Driven by the hydrological cycle, water is continuously being recycled through the land, sea and atmosphere in a process that ensures the maintenance of ecological functions. Wetlands support high levels of biological diversity: they are, after tropical rainforests, amongst the richest ecosystems on this planet, providing essential life support for much of humanity, as well as for other species. He noted also that wetlands are not only sites of exceptional biodiversity; they are also areas of enormous social and economic value, in both traditional and contemporary societies. Wetlands are an integral part of the hydrological cycle, playing a key role in the provision and maintenance of water quality and quantity as the basis of all life on earth. They are often interconnected with other wetlands, and they frequently constitute rich and diverse transition zones between aquatic ecosystems and terrestrial ecosystems such as forests and grasslands.

[11] conducted a study on the Significance of Wetlands in Urbanized Locations in South Alabama using two creeks – Milkhouse Creek had approximately 136.3 acres of wetland and Second Creek had approximately 77.3 acres. The purpose of the study was to determine the differences between urban stream water quality when wetlands are present or when they have been modified or destroyed. The result shows that the watersheds' acreage was found to be 6,033 acres for Milkhouse Creek, and 5,113 acres for Second Creek, approximately and that the turbidity levels with Milkhouse Creek were consistently lower than those of Second Creek, with the exception of the first sample results, which were not recorded as accurately as the other four. The study concluded that with respect to the amount of wetland acreage available to each creek, it is understandable that Milkhouse Creek would have slightly better values across the board, since it had slightly more wetland acreage available for the improvement of the urban runoff. Although Second Creek did not necessarily have "poor" water quality, the results from it demonstrate the effect a difference of (at least) 58 acres of wetlands can have on water quality results within urban locations.

## 4. THE NEED FOR VALUATION OF WETLANDS

Wetlands are valuable ecosystems which provide water, food, raw materials, services such as flood attenuation and water purification, as well as intangible values such as cultural and religious value. In some areas, they can be particularly important for peoples' livelihoods. Despite this, and legislation to protect them, they are increasingly threatened, with more than half of the world's wetlands being lost already. They are degraded beyond the socially optimal extent due to market failure since markets do not reflect true values or costs) and government failure (perverse incentives, lack of well-defined property rights leading to open access and ignorance of decision makers as to the value of wetlands.

[12] were of the view that a major reason for excessive depletion and conversion of wetland resources is often the failure to account adequately for their non-market environmental values (market failure) in development decisions. They posit that by providing a means for measuring and comparing the various benefits of wetlands, economic valuation can be a powerful tool to aid and improve wise use and management of global wetland resources. They stated further that valuation attempts to assign quantitative values to the goods and services provided by environmental (wetland) resources, whether or not market prices are available to assist in the assessment of the value.

Valuation is important because services provided by aquatic ecosystems have attributes of public goods. Public goods are non-rival and non-excludable in consumption, thus preventing markets from efficiently operating to allocate the services e.g. wetland filtration of groundwater. As long as the quantity of groundwater is not limited, everyone who has a well in the area can enjoy the benefits of unlimited potable groundwater. However, in the absence of any market for the provision of water through wetland filtration, there would be no observed price to reveal how much each household or individual may be willing to pay for the benefits of such a service. Although everyone is free to use the aquifer, yet no one is responsible for protecting it from contamination. This is not an action that could be undertaken by a company and provided for a fee (price) because no individual has ownership of the wetland filtration process or the aquifer. However, non-market values can be estimated to assess whether the benefits of collective action—perhaps through a state environmental agency or the Federal Environmental Protection Agency (FEPA), exceed the cost of the proposed actions to protect the wetland, and consequently the wetland filtration process and the quality of the water in the aquifer for drinking purposes.

Some aquatic ecosystem services indirectly contribute to other services that are provided through a market but the value of this ecological service itself is not traded or exchanged in a market. For example, an estuarine marshland may provide an important "input" into a commercial coastal fishery by serving as the breeding ground and nursery habitat for fry (juvenile fish). Although disruption or conversion of marshland may affect the biological productivity of the marsh and thus, its commercial fishery, a market does not exist for the commercial fishery to pay to maintain the habitat service of the marshland [13]. Aquatic ecosystem services that do not have market prices are excluded from explicit consideration in cost-benefit analyses and other economic assessments, and are therefore likely not to get full consideration in policy decisions. 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 wetlands [13]. This facilitates optimal decision-making which maximises societal well-being.

If monetary values of ecosystem services are not estimated, many of the major benefits of aquatic ecosystems will be excluded in benefit-cost computations. The likely outcome of such an omission would be too little protection for aquatic ecosystems and as a consequence, the services that people directly and indirectly enjoy would be undersupplied. Valuation, therefore, can help to ensure that ecosystem services that are not traded in markets and do not have market prices receive explicit treatment in economic assessments [14]. The goal is not to create values for aquatic ecosystems; rather, the purpose of valuation is to formally estimate the "non-market" values that people already hold with respect to aquatic ecosystems. Such information on non-market values will in turn assist in assessing whether or not to protect certain types of aquatic ecosystems enhance the provision of selected ecosystem services and/or restore damaged ecosystems.

Finally, economic values are often used in litigation involving damage to aquatic ecosystems from pollution or other human actions. According to 12] wetland valuation is used to build local and political support for its conservation and sustainable use, help diagnose the causes of environmental degradation and biodiversity loss, allow more balanced planning and decision-making, and/or develop incentive and financing mechanisms for achieving conservation goals.

## 5. FACTORS RESPONSIBLE FOR THE CHOICE OF WETLAND VALUATION METHOD

Generally, the choice of method(s) adopted in the valuation of wetland resources is (are) predicated on some factors that must be taken into consideration, in the process of valuation. The choice of method(s) must be decided before setting out for field work and it stems from the basis and purpose of wetland valuation. [12] and [15] variously identify the determination of the overall objective or problem to be solved by the valuation as the most important factor to take into consideration when choosing a particular method. The two group of authors conclude that where the damage to wetland is from a specific external environmental impact such as oil spills on a coastal wetland, the type of assessment required is impact analysis, but where the problem has to do with making a choice between two or more alternative wetland use options (e.g., whether to divert water from the wetlands for other uses, or to convert/develop part of the wetlands at the expense of other uses), the type of assessment required is partial valuation, and when the total economic contribution, or net benefits, to society, of the wetland system (e.g., for national income accounting or to determine its worth as a protected area) is concerned, then total valuation is required.

Also, [12] were of the opinion that resource control and data collection options will influence the choice of valuation method to be adopted for any wetland valuation and importance of the wetland resources, to be valued, must equally be taken into consideration in choosing a valuation method. [16] identifies the complexity and limitations of the method as critical in making a choice of wetland valuation method. They opine that the problem with using willingness to pay to measure the value of wetlands is that it requires a carefully designed survey, so it is not as straightforward as market price. They went further to state that not all available methods can be used in measuring values of the component parts of wetland resources.

[17], working on ecosystem valuation, listed statistical complexity, information required, availability and accessibility of data required, people's perception, limitation of the method and availability of substitutes as factors to consider in making a choice of wetland valuation method. Explaining further, the authors stated that contingent ranking requires more sophisticated statistical techniques to estimate willingness to pay. Information bias (contingent valuation) may arise whenever respondents are forced to value attributes with which they have little or no experience. In such cases, the amount and type of information presented to respondents may affect their answers. The replacement cost method requires information on the degree of substitution between the market good and the natural resource. Few environmental resources have such direct or indirect substitutes. The method is relatively complex to implement and interpret, requiring a high degree of statistical expertise. Large amounts of data must be gathered and manipulated. The time and expense to carry out an application depends on the availability and accessibility to data. Market data may only be available for a limited number of goods and services provided by an ecological resource and may not reflect the value of all productive uses of a resource. The travel cost method assumes that people perceive and respond to changes in travel costs the same way that they would respond to changes in admission price. The availability of substitute sites will affect values. The travel cost method is limited in its scope of application because it requires user participation. It cannot be used to assign values to on-site environmental features and functions that users of the site do not find valuable. The productivity method is limited to valuing those resources that can be used as inputs in production of marketed goods. The various factors to be considered in the selection of wetland valuation method(s) are as shown in Fig. 2.

The various factors to take into consideration in making a choice of wetland valuation method include statistical complexity, availability and accessibility to data required, people's perception, limitation of the method, quality of site and availability of substitute sites. The complexity and limitations of the methods are critical in making a choice of wetland valuation method. Not all available methods can be used in measuring values of the component parts of wetland resources. Some of the methods such as contingent ranking, replacement cost and hedonic pricing require more sophisticated statistical techniques to estimate willingness to pay. Availability of substitute sites will affect values. Where there are sites that can be substituted for the one in question the tendency is to have a lower value for such site while on the other hand high value will be attached where there is no substitute site. The time and expense required to carry out a valuation depends on the availability and accessibility to data. Market data may only be available for a limited number of goods and services provided by wetland resource and may not reflect the value of all productive uses of a resource. Individual's perception/view/opinion about a thing, at times, determines the value attached to such a thing. For example, the travel cost method assumes that people perceive and respond to changes in travel costs the same way that they would respond to changes in admission price.

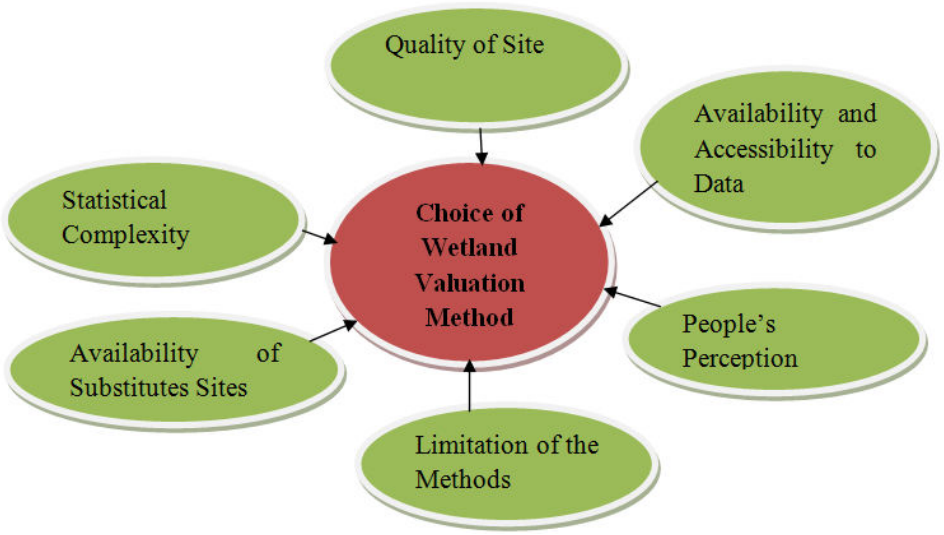


**Fig. 2. Factors influencing the choice of wetland valuation method**
*Source: [18]*

## 6. MATERIALS AND METHODS

In the conduct of this study, the primary data used was collected by administering questionnaire, and conducting personal and telephone interviews. Secondary data were sourced from published materials conference papers produced by other researchers. Both descriptive and exploratory approaches were used for the literature review, while an explanatory approach was used in analysing the data collected. Personal/telephone interviews were conducted on the officials of NIESV and Heads of Department of Universities offering Estate Management courses. This was done with a view to ascertaining whether environmental valuation is included in the curriculum for professional examinations and that of the selected Universities. Questionnaire was administered on the 120 Estate Surveying and Valuation firms in Bayelsa, Delta and Rivers States (as contained in the lists made available by the NIESV's Branch Secretaries in the three States). However, only 72 (60%) out of the eighty (80) questionnaires retrieved were found useful and were thus analysed and used for the study (Table 1).

**Table 1. Questionnaire distribution and retrieval**

| State | Questionnaires distributed | Questionnaires retrieved | questionnaires used |
|---|---|---|---|
| Bayelsa | 3 | 3 (100%) | 3 (100.0%) |
| Delta | 19 | 16 (84.2%) | 13 (68.4%) |
| Rivers | 98 | 61 (62.24%) | 56 (57.1%) |
| Total | 120 | 80 (66.67%) | 72 (%60.0) |

The primary data collected were collated, analysed and presented using tools such as frequency distributions and percentages, relative importance index (RII) and principal component analysis (PCA). While PCA was used to reduce the factors to the most important ones, RII was calculated thus:

$$RII = \frac{\sum a_i n_i}{\sum x_j}$$

Where: i= response category index
$x_j$= the sum of j factors 1,2,3 …….N
$a_i$= constant expressing the weight given to the ith response.
$n_j$= the variable expressing the frequency of the ith

## 7. RESULTS AND DISCUSSION

The data collected were collated, analysed and discussed in Tables 2 – 9.

**Table 2. Respondents' academic qualifications**

| Academic qualification | Frequency | Percentage |
|---|---|---|
| OND | 1 | 1.4 |
| HND | 11 | 15.3 |
| B. Sc. | 49 | 68.0 |
| M. Sc. | 10 | 13.9 |
| PhD | 1 | 1.4 |
| **Total** | **72** | **100.0** |

Table 2 reveals that 68.0% of the respondents held B. Sc Degree, 15.3% held Higher National Diploma (HND), 1.4% held Ordinary National Diploma (OND) all in Estate Management, while only 13.9% and 1.4% held higher degrees, that is, M.Sc. and PhD respectively. In the past, there used to be fewer numbers of respondents with higher degrees which might not be unconnected with high demand for Estate Surveyors and Valuers in both State and Federal Ministries, Local Government Council Offices, banks, insurance companies and in other areas of businesses, coupled with good remunerations. However, situation has changed now as Estate Surveyors and Valuers now find solace in engaging in academic pursuits with job security and good remuneration. An indepth interview conducted among the respondents with higher qualifications indicated that pursuing higher degrees is a recent development, especially among those who have the focus of going into academic in later years. Not minding the paradigm shift, it can be inferred that respondents in the study area, have the required academic qualifications for registering and practicing as Estate Surveyors and Valuers.

**Table 3. Respondents' involvement in wetland valuation exercises**

| Wetland valuation exercise | Frequency | Percentage |
|---|---|---|
| No | 17 | 23.6 |
| Yes | 55 | 76.4 |
| Total | 72 | 100.0 |

Results as contained in Table 3 show that majority of the respondent Estate Surveyors and Valuers (76.4%) have at one time or the other participated in wetland valuation. This situation is not unexpected since a chunk of the Niger Delta land is made of wetlands and a high proportion of these have either been acquired by multinational oil companies or their activities have resulted in the pollution of wetland ecosystems and valuation is usually required to determine the compensation payable to the affected people or community as the

case may be. The high rate (76.4%) of involvement in wetland valuation by Estate Surveyors and Valuers in the study area could be due to incessant oil spillages and physical development resulting from continuous expansion of companies involved in oil exploration.

Following from Table 3, subsequent analysis was carried out using the respondents that had been involved in wetland valuation with the belief that they are the ones that would be able to answer subsequent questions.

**Table 4. Environmental valuation as part of school curriculum in higher institution**

| Curriculum | Frequency | Percentage |
|---|---|---|
| Yes | 3 | 5.5 |
| No | 52 | 94.5 |
| **Total** | **55** | **100.0** |

The result as contained in Table 4 shows that only (5.5%) of the respondents took any course in environmental valuation during their undergraduate school days. Indepth interviews with respondents who claimed that environmental valuation was part of school curriculum in their higher institutions revealed that they trained in institutions outside Nigeria. Personal interviews held with the Heads of Department of Estate Management in institutions offering Estate Management courses revealed that environmental valuation has been included, as a topic, in the valuation curriculum either or both at M. Sc. and final year undergraduate classes in some Universities. On the other hand, environmental valuation is being taught as a course, at undergraduate level in only one University. However, it is yet to be so included in the valuation curriculum of other institutions. The interview further revealed that the teaching of environmental valuation is a development that started about five years ago. Also the personal interview conducted on the research department of NIESV revealed that environmental valuation is yet to be included in the Institution's curriculum for professional examinations. The import of all the above therefore is that Estate Management graduates are yet to be fully armed with adequate training in environmental valuation and by implication, wetland valuation and this may affect their perception and the choice of method used in wetland valuation. It is therefore not surprising that factors considered in selecting appropriate wetland valuation methods are limited to those indicated in Table 5 below:

**Table 5. Factors influencing choice of wetland valuation method for compensation**

| | Responses | |
|---|---|---|
| **Factors** | **No** | **Yes** |
| Availability and accessibility to data | 12 (21.8%) | 43 (78.2%) |
| Availability of substitute Sites | 31 (56.4%) | 24 (43.6%) |
| People's perception | 32 (58.2%) | 23 (41.8%) |
| Limitations of methods | 20 (36.4%) | 35 (63.6%) |
| Statistical complexity | 50 (90.9%) | 5(9.1%) |
| Quality of site | 40 (72.7%) | 15 (27.3%) |

Table 5 shows that 78.2% of the respondents were of the opinion that availability and accessibility to data is a major factor influencing the method adopted in wetland valuation. Limitation of the methods (63.6%) equally influenced the choice of wetland valuation method used by the respondents. Other factors include availability of substitute sites (43.6%), people's perception (41.8%), quality of site (27.3%) and statistical complexity (9.1%) Availability and accessibility to data is very important in the application of the various wetland

valuation techniques. Limitations of the methods are important taking into consideration the fact that not all the identified methods can be adopted in the valuation of wetland resources, especially the non-use components. Though the three factors chosen can and do influence the choice of method(s) for wetland valuation, it can be inferred that respondent Estate Surveyors and Valuers, in the study area, are yet to fully appreciate how important other factors could be in choosing wetland valuation method.

Further examination was conducted on the factors influencing the choice of wetland valuation method for compensation with a view to establishing respondents' rating of the identified factors. This was done using RII which was calculated thus:

$$RII = \frac{\sum a_i n_i}{\sum x_j}$$

Where: i= response category index
$x_j$= the sum of j factors 1,2,3 …….N
$a_i$= constant expressing the weight given to the ith response.
$n_j$= the variable expressing the frequency of the ith
The analysis is as shown in Table 6.

**Table 6. Ranking of factors influencing the choice of wetland valuation method for compensation**

| Factors | 5 | 4 | 3 | 2 | 1 | Total | RII | Ranking |
|---|---|---|---|---|---|---|---|---|
| Availability and | 38 | 3 | 3 | 7 | 4 | 55 | | |
| Accessibility to data | $a_in_i$ = 190 | $a_in_i$ = 12 | $a_in_i$ = 9 | $a_in_i$ = 14 | $a_in_i$ = 4 | 229 | 4.16 | 1st |
| Availability of | 12 | 21 | 9 | 8 | 5 | 55 | | |
| substitute Sites | $a_in_i$ = 60 | $a_in_i$ = 84 | $a_in_i$ = 27 | $a_in_i$ = 16 | $a_in_i$ = 5 | 192 | 3.49 | 2nd |
| People's Perception | 5 | 21 | 11 | 5 | 13 | 55 | | |
| | $a_in_i$ = 25 | $a_in_i$ = 84 | $a_in_i$ = 33 | $a_in_i$ = 10 | $a_in_i$ = 13 | 165 | 3.00 | 4th |
| Limitations of | 15 | 14 | 13 | 8 | 5 | 55 | | |
| Methods | $a_in_i$ = 75 | $a_in_i$ = 56 | $a_in_i$ = 39 | $a_in_i$ = 16 | $a_in_i$ = 5 | 191 | 3.47 | 3rd |
| Statistical | 2 | 9 | 14 | 15 | 15 | 55 | | |
| Complexity | $a_in_i$ = 10 | $a_in_i$ = 36 | $a_in_i$ = 42 | $a_in_i$ = 30 | $a_in_i$ = 15 | 133 | 2.41 | 6th |
| Importance of | 0 | 21 | 10 | 12 | 12 | 55 | | |
| Wetland | $a_in_i$ = 0 | $a_in_i$ = 84 | $a_in_i$ = 30 | $a_in_i$ = 24 | $a_in_i$ = 12 | 150 | 2.72 | 5th |
| Quality of Site | 2 | 5 | 6 | 6 | 36 | 55 | | |
| | $a_in_i$ = 10 | $a_in_i$ = 20 | $a_in_i$ = 18 | $a_in_i$ = 12 | $a_in_i$ = 36 | 96 | 1.74 | 7th |

Table 6 reveals that availability and accessibility to data (RII = 4.16) was ranked first among the factors influencing the choice of wetland valuation method. Availability of substitute sites (RII = 3.49) was ranked second while limitations of methods (RII = 3.47) was ranked third. The ranking of availability and accessibility to data (RII = 4.16) as number one could emanate from the general understanding that valuation thrives on the availability and

accessibility to reliable data. On the other hand, the fact that each of the valuation methods has its specific area of application could account for ranking limitation of the methods (RII = 3.49) in the second position.

## 7.1 Principal Components Analysis (Factor Analysis)

To determine the most critical factors influencing the choice of wetland valuation methods, Factor Analysis was conducted on the identified factors. The analysis was conducted, using Principal Component Analysis, with a view to reducing the factors to the most important ones. In other words, PCA is used to reduce the dimensionality of the data set and to identify new meaningful underlying variables so as to explain the components (factors) that account for variance. The results of these are contained in Tables 7 – 9.

**Table 7. Communalities**

| | Initial | Extraction |
|---|---|---|
| Availability and Accessibility to Data | 1.000 | .407 |
| Availability of Substitute Sites | 1.000 | .599 |
| People's Perception | 1.000 | .632 |
| Limitations of Methods | 1.000 | .804 |
| Statistical Complexity | 1.000 | .899 |
| Quality of Site | 1.000 | .734 |

Table 7 indicates the variance in each variable that is accounted for i.e. it extracts only that proportion that is due to the common factors and shared by several items. Initial communalities are estimates of the variance in each variable accounted for by all component or factors. Extraction communalities are estimates of the variance in each variable accounted for by the components. The communalities in Table 7 are all high indicating that the extracted components represent the variables well.

Table 8 shows the variance explained by the initial solution (initial eigenvalues), extracted components and rotated components. Under the initial eigenvalues, the total column gives the amount of variance in the original variables accounted for by each component; the percent of variance column gives the ratio of the variance accounted for by each component of the total variance in all of the variables. In Table 7, eigenvalues greater than 1 were extracted and these show that the first three principal components (availability and accessibility to data, availability of substitutes, and people's perception) form the extracted solution accounting for 66.7% of the total variability in the original six components (variables) so that the complexity of the data set can considerably be reduced using the extracted components.

Table 9 shows the rotated component matrix of the three components that accounted for 66.7% of the total variability in the original six variables. The first component (availability and accessibility to data) is most highly correlated with quality of site (0.779) and availability of substitute (0.747) however it is less correlated with people’s perception. The second component (availability of substitute sites) is most highly correlated with people’s perception (0.771) and the third component (people’s perception) is most highly correlated with statistical complexity (0.943). Table 9 reveals that the correlations between the three components are not very strong.

**Table 8. Total variance explained**

| Component | initial eigen values | | | Extraction sums of squared loadings | | | Rotation sums of squared loadings |
|---|---|---|---|---|---|---|---|
| | Total | % of variance | Cumulative % | Total | % of variance | Cumulative % | Total |
| 1 | 1.946 | 27.806 | 27.806 | 1.946 | 27.806 | 27.806 | 1.945 |
| 2 | 1.652 | 23.596 | 51.402 | 1.652 | 23.596 | 51.402 | 1.651 |
| 3 | 1.073 | 15.329 | 66.731 | 1.073 | 15.329 | 66.731 | 1.075 |
| 4 | .879 | 12.552 | 79.283 | | | | |
| 5 | .644 | 9.194 | 88.477 | | | | |
| 6 | .351 | 5.011 | 100.000 | | | | |

**Table 9. Component correlation matrix**

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| Availability and accessibility of data | -.289 | .560 | -.102 |
| Availability of substitute sites | .747 | -.108 | -.170 |
| People's perception | -.003 | .771 | .197 |
| Limitations of methods | -.356 | -.809 | .149 |
| Statistical complexity | -.051 | .078 | .943 |
| Quality of site | .779 | -.212 | .286 |

## 8. CONCLUSION AND RECOMMENDATIONS

The study revealed that only four factors have major influences on the choice of wetland valuation method adopted in the study area. These are; availability and accessibility to data (RII = 4.16), availability of substitute sites (RII = 3.49), limitations of valuation methods (RII = 3.47) and people's perception (RII = 3.00).

The study showed that only 5.5% of the respondents took any course in environmental valuation during their undergraduate school days. Also environmental valuation has not been included in NIESV Professional valuation curriculum. Indepth interview conducted on Heads of Department of the universities offering Estate Management courses in the Southern part of the country showed that the teachings on environmental valuation, generally, is a recent development and is yet to cut across all Universities offering Estate Management courses. The interviews further revealed that while graduates from some institutions already have an understanding of environmental valuation, those from other institutions are yet to have any understanding of environmental valuation and this may affect their perception of wetland resources and eventually the choice of method(s) for their valuation.

NIESV should include environmental valuation in the curriculum for professional examinations (training). In addition, NIESV should organise mandatory training/workshop/seminar on wetland valuation and similar topical issues as they may arise from time to time to keep members up-to-date with the appropriate techniques available. Also, ESVARBON should mandate Institutions offering Estate Management courses to include environmental valuation as a Course, rather than treating it as just a topic under

valuation as a course, as is currently done in majority of the universities. This is to ensure a detailed coverage of the various aspects of environmental valuation.

NIESV and ESVARBON should begin to think about specialisation in the field of valuation. Environmental valuation is an aspect of valuation that requires skills that go beyond the ones used for general valuation. Hence for a Valuer to adequately handle such assignment he must have acquired the required expertise for it. In other words, the Valuer must understand the components of the environment (attributes, functions and services), the appropriate methods for their valuation and the various multidisciplinary skills required for such valuation. The two bodies should make regular attendance and participation at professional trainings a condition for annual renewal of membership and seal.

## COMPETING INTERESTS

Author has declared that no competing interests exist.

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