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CONTINGENT VALUATION OF WATERSHED PROTECTION IN NIGERIA: A CASE STUDY

by
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ABSTRACT

The search for appropriate methods for valuing natural resources and monetising externalities is a pressing problem facing many governments, particularly those of the developing countries. While the Nigerian government allocates 2% of its annual gross income for ecological damage restitution (The Ecological Fund), experiences arising from incessant disputes in the oil producing areas, fishing sites, increasing incidence of soil erosion and flooding and other environmental problems, all point to the need to supplement the Ecological Fund with money from other sources.

Most environmental degradation resulting from anthropogenic processes in water resource projects can be ascribed to the "common property" perception of water and associated natural resources. Moreover, in deciding which environmental regulations, and water resource projects and programmes are desirable or otherwise, it is imperative to weigh the negative socio-economic impacts, againts the very real beneficial effects. Such a process will entail better monetary quantification of the cost-benefit analysis of the projects and programmes, particularly during environmental impact assessment process.

This paper focusses on the use of the willingness-to-pay (WTP) approach for determining the amount of money that people in selected large-scale irrigation and dam project areas in the Sudano-Sahelian zone of Nigeria are willing to forego for the sake of environmental protection in the watershed. After a general description of the problems and approaches to valuing and monetising environmental resources and their protection, the details of the study findings and policy implications are discussed.

INTRODUCTION

In Nigeria and most other developing countries, there is a burgeoning demand for analyses that quantify the benefits to society of improvements in environmental

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quality or the social costs of environmentals degradation. The efficient use of natural resources as well as man-made capital and human resources, is a vital pre-requisite for sustainable development. Without proper natural resource pricing and under conditions of seeming ubiquitous and abundance of resources, ill-defined property rights, economic and political uncertainties as well as monopolistic conditions and government subsidy of certain resources, there is a tendency to exacerbate local resources consumption and cause environmental degradation and depletion of valuable natural resources (Harris, 1984; Aina and Sawalu, 1990; Sawalu, 1992; Olokesusi, 1987, 1982).

According to Munasinghe and Lutz (1991), the identification of sustainable development options requires:

1) good understanding of the physical, biological and social impacts of environmental degradation;
2) precise estimates of the economic value of damage to the environment, to improve the design of policies and projects, and to arrive at environmentally sound investment decisions;
3) development of policy tools and strengthening of human resources and institutions to implement viable strategics and manage natural resources on a sustainable basis.

This paper focuses on the second aspect mentioned above - economic valuation of environmental resources. Pearce (1989) observes that economies tend to behave as if environmental services were free goods, gifts of nature. Economies and the environment are closely inter-related and inter-dependent. Inefficient allocation and degradation of natural resources continue particularly for forest and water resources since their prices do not reflect properly the social costs. The situation is prevalent in Nigeria.

The 1983 maximum compensation rate for annual trees in the oil exploration areas range from ₦63.00 for bitter leaf per hectare to ₦2, 850.00 per hectare of yams. Also, one ogbono tree is rates at ₦18.75 while a hard wood stand is rates at ₦50.00 (see Gberuse, 1988). Simple logic and reasoning easily shows that in the light of prevailing cost of goods and services, these rates are not tenable. Payment for water quality deterioration and aquatic life damages is also very low. The implementation of these rates by the oil companies with government approval confirms that the policy makers are either unaware of the need for proper pricing or have acted due to poorly determined resource pricing and hence inappropriate compensation rates or both. The long drawn battles between the oil companies on the one hand and the indigenes of the oil producing communities for appropriate compensation is a typical result of this poorly understood, but critical issue.

Water and watersheds ought to be managed as valuable natural resources to meet multiple uses rather than just inputs to specific sectoral activities. In this connection, given limited financial resources, escalating irrigation construction costs and rising environmental consciousness, better water resources planning and management can help the country sustain economic development without underpricing or destroying the goose that lays the golden egg.

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* A popular tree whose fruits are used for making soup.

The newly promulgated Environmental Impact Assessment Decree No. 86 of 1992 imply extra-financial burden on public sector project proponents. The same goes for the maintenance of the various national parks and water resources. Given the inadequacy of financial resources in the country and the emerging pressures on environmental resources, it becomes critically important to use these limited resources in sustainable ways, such that the maximum benefits are derived. Empirically determined and sound economic analysis of projects and policies constitute important means of making the allocation process more efficient. Moreover, funds could be generated for these purposes in form of levies and taxes that are derived from WTP studies.

The valuation of environmental resources is also critical for other reasons. One is the issue of intergenerational equity and role of discount tares in economic calculations.

The need to develop a more appropriate valuation system becomes imperative if we are to reduce the level of guestimate in the costs of environmental improvement, violence and rate of natural resources wastage. This study is meant to fill the gap created by the absence of a more appropriate valuation system in the country for environmental damages and restitution.

LITERATURE REVIEW

Empirically, environmental impacts are often difficult to measure in physical terms. Seconds, is the problem of valuation in monetary terms, of the physical damage and/or assets. Three broad approaches have however been taken in the estimation of environmental benefits and each is briefly examined.

An early attempt made in this respect is the notion that differential property and environmental values in areas proximate to potential hazards or externalities might reflect social costs is based on the hedonic price theory. Lancaster's theoritical description of consumption decisions has provided a basis for the hedonic price theory which Rosen (1974) improved upon. The theory holds that the market price which consumers are willing to pay for any specific good, reflects utility maximizing behaviour with respect to the good's various quality attributes. These attributes may include both private and public commodities. Consequently, differential market price depend upon consumers' preferences for the goods' attributes, and the demand/supply relationships that result from those attributes.

Thus, hedonic models developed by Ridker and Henning (1967) and Nelson (1979 and 1980) analysed the impact of air quality and noise level respectively on property values. Both studies found that consumers are willing-to-pay more in areas with low risk. Similarly, Baker (1988) used a reduced form of equilibrium prices (hedonic) to assess the impact of hazardous waste disposal facilities on residential property values. The conclusion is that residential property values is affected by the presence of hazardous waste disposal facilities.

A few studies have used the amount of money people are willing-to-pay to value environmental quality. Pearce and Markandya (1988) in a study of a sample of Berlin residents used this method, and extrapolated it to Berlin as a whole and then to Germany as a whole. It was found that if air quality were to be improved in Berlin and Germany, it would be worth US $1.6 billion and US $48 billion, respectively.

Moreover, the values given by people were higher the more informed people were, about the state of air pollution and its effects on health, materials and vegetation. Another technique under the willingness-to-pay approach is the replacement cost (Gouping, 1988).

The third example involved the examination of the linkage between air pollution and human health. By looking at the many factors that contribute to health status (age, diet, cigarette smoking, income) in the context of very large sets of data, economists and others have tried to establish the statistical link between health and pollution and the willingness-to-pay for improved environmental quanlity. (See Gregor, 1977; Anderson, 1967; Winkelstein, et al, 1967)

Similar to this direct valuation method is that by Anderson (1989) who studied the benefits of afforestation in northern Nigeria. The study concludes that shelter belts have significant positive effects on crop yields, generally in the range of 10-30 percent above the "without" shelter belt scenario.

Harris (1984) used contingent valuation to obtain from the public the amount which the public in the Naikato basin in New Zealand were willing-to-pay for improved water quality for recreation, aesthetics and conservation purposes. From the iterative bidding process, about $3.7 million per year could be collected from the 3.4 million people living within the basin.

Briones (1986) evaluated a waterhed management plan in the context of a multi-purpose dam in the Philippines, using the production function analytical technique. Watershed management was found to possess positive net benefits, that is the costs of introducing a management scheme were less than the expected costs of sediment damage.

In Haiti, a contingent valuation study of water supply was conducted. The mean bid (average WTP) for public standpipes was about US $1.0 (Gs 5.7) per month which was about 1.7% of household income. On the other hand, the average WTP for private connections was US $1.25 (Gs 7.1) per month - about 2.1% of household income.

Environmental valuation studies are not yet common in Nigeria. Arimah (1990) used the hedonic price approach to determine the attributes of housing values in Ibadan. He found that apart from school quality and recreational facilities, other factors influencing housing value are available infrastructure. In a similar vein, Olokesusi (1993) deduced that the rent paid for residential accomodation in parts of Ibadan, is negatively impacted by proximity to the Ring Road solid waste disposal facility.

The literature on WTP (contingent valuation) to avoid further environmental degradation in the country is quite scarce. While Salawu (1992), Chokor and Obadan (1992) and Enabor (1992) recognised the importance of proper resource pricing and mentioned WTP or contingent valuation for this purpose, no further details on its operationalisation were made. In a study of Nsukka District in Anambra State, it was found that people were more than willing-to-pay for improved water services, than what was charged (Whittington, et al, 1990). The same conclusions was reached for Onithsa (see also Whittington, 1991).

Olokesusi (1992) used the WTP method to capture the amount of money people were people were ready to forego or spend, in order that the environment in the large-scale irrigation project areas of Chad Basin, Bakolori and Kano River can be protected from degradation. The study found a direct correspondence between WTP

and income on the one hand, and WTP and satisfaction with irrigation project on the other. However, that particular study was unable to relate WTP to gender and level of education, because of the peculiar nature of the study area vis-a-vis these socio-demographic characteristics.

This paper therefore addressess five related questions:

i) Are irrigation project farmers willing to contribute financially to environmental improvements in their communities?
ii) How does the WTP of these farmers vary spatially?
iii) How does the WTP of these farmers vary according to age and income?
iv) Does farmers' satisfaction with irrigation experience have a significant impact on WTP?
v) What policy measures can be deduced from the preceeding four questions?

SCOPE AND METHODOLOGY OF STUDY

The three major irrigation and dam projects, used as case study are:

i) the Kano River Project (KPR) in Kano State;
ii) the Bakolori Irrigation Project (BIP) in Sokoto State; and
iii) the South Chad Irrigation Project (SCIP) Phase I in Borno State.

These three projects were selected because of their large-scale and the long history of irrigation farming in the area. In view of problems obvious in the Sudano-Sahelian zone of Africa, WTP for environmental protection by the inhabitants becomes a subject of interest.

Survey questionnaires were administered in 6 communities in the BIP area, and 12 and 9 in the KRP and SCIP areas respectively. In all, 597 farmers were sampled thus, 278 in the BIP, 207 in the KRP and 112 in the SCIP during July to September in 1990. Information sought by the questionnaires include respondent's age income, occupation, perception of community and environmental problems, amount willing-to-pay for environmental protection and level of satisfaction with the irrigation projects, among others. The existing watershed condition was described to the respondents and the situation if protection were in place. They were then asked iteratively the amount WTP until a maximum was reached. Stratified sampling technique was used to select respondents who are mainly household heads; and where household heads could not be found, male adults aged 18 and above were interviewed. However, project managers and village heads were interviewed on difficulties to achieve project objectives, activities and general problems in the project areas, and efforts made so far. Secondary data were collected from project documents, government reports, journals and newspapers. The data collected were processed and analysed with a view to determine the weighted mean of the amount that the project farmers are WTP based on age groups and annual incomes among other factors.

DISCUSSION OF RESULTS

Results of the analysis show that 63.3% of the sample claim that they are willing-to-pay for environmental protection in their localities, as againts 21.1% (Table 1). This high percentage suggests that, apart from emphasizing the importance of

environmental protection in national development, is also a measure of the level of environmental awareness and support for the government in its efforts towards improving the state of the local environment. According to Table 1, respondents in the Kano River Project area are more willing-to-pay. Again, Table 2 points out that Kano River Project ranks over Bakolori and South Chad Irrigation Projects in the frequency distribution of the amount respondents are willing-to-pay per annum for environmental protection. This can be ascribed to satisfaction with irrigation experience by the farmers concerned.

Comperative weighted mean of the amount willing-to-pay can be used for policy purposes in cost-recovery for environmental protection and conservation. It is imperative to point out in this case study that, age-cohort shall generate a slightly higher revenue for the governmnet than will do annual income (Tables 3 and 4 respectively). Levies based on annual income and/or flat rates will be less costly and cumbersome to implement.

Table 1: Respondents Willingness-to-Pay for Environmental Protection Project Basis

Responses	Project area responses (% and frequency of responses)						Total for All Projects	
	Kano River		Bakolori		South Chad		Freq.	%
	Freq.	%	Freq.	%	Freq.	%		
Yes	166	80.2	127	45.7	85	75.8	378	63.3
No	9	4.3	43	15.6	20	17.8	72	12.1
Non-Response	32	15.5	108	38.7	7	6.4	147	24.6
TOTAL	207	100	278	100	112	100	597	100

Source : Author's Field Survey (1990)

Table 2: The Monetary Value which Respondents are Willing-to-Pay Yearly for Environmental Protection

Amount willing to Pay (Naira)*	Responses on Project Basis					
	South Chad		Kano River		Bakolori	
	Freq.	%	Freq.	%	Freq.	%
Nothing	20	17.9	9	4.3	43	15.6
Under N 100.00	29	25.9	80	38.6	28	10.0
N 100.00 - N 200.00	24	21.4	36	17.4	22	7.9
N 201.00 - N 400.00	8	7.1	9	4.3	39	14.0
N 401.00 - N 600.00	6	5.4	10	4.8	23	8.2
N 601.00 - N 800.00	4	3.6	-	0.0	8	2.8
N 801.00 - N 1,000.00	6	5.4	1	0.5	-	0.0
N.1,001 00 - N 2,000	-	0.0	11	5.4	1	0.4
TOTAL	112	100.0	207	100.0	278	100.0

*U.S. $1 = N22.00 at the official exchange rate in July, 1994.
Source : Author's Field Survey (1990)

Table 3: Weighted mean that Project Farmers are Willing-to-Pay according to Project and Cohort

Age Cohort (N)	Weighted Mean Amount (N)					
	Kano River Project		Bakolori Project		South Chad Project	
	Mean	Weight	Mean	Weight	Mean	Weight
19 - 30	339.11	59	389.61	28	450.17	18
31 - 40	449.15	49	382.75	54	423.57	30
41 - 50	248.83	39	388.24	29	247.50	19
51 - 60	641.92	12	361.20	23	471.64	7
Above 60	614.50	7	380.30	10	345.15	10
Weighted Mean	383.88	166	381.58	144	364.11	84

Source : Computed from Field Data (1990)

Table 4: Weighted mean that Project Farmers are Willing-to-Pay according to Project and Annual Income

Annual Income (N)	Mean Amount Willing-To-Pay In Naira(N)					
	Kano River Project		Bakolori Project		South Chad Project	
	Mean	Weight	Mean	Weight	Mean	Weight
0 - 499	210.20	5	92.86	7	225.25	4
500 - 999	196.31	13	336.59	11	308.58	6
1000 - 1499	490.24	25	254.93	21	166.73	15
1500 - 1999	421.89	23	389.94	24	374.20	25
2000 - 2499	390.34	46	474.43	27	453.50	15
2500 - 2999	294.05	33	448.16	22	283.56	9
Above 2999	500.17	21	281.56	16	636.59	11
Weighted Mean	383.89	166	361.24	128	364.30	85

Source : Computed from Field Data (1990)

CONCLUSIONS AND POLICY IMPLICATION

Dam and irrigation projects, unarguably have associated cost and benefits. A major cost is the degradation of the environment which the farmers are aware of and wants some restitution. To this end, they made known the monetary contributions which they are willing to make.

The results from the study, shows that 63.3% of the respondents are WTP between N1 - N400 per annum for environmental protection, irrespective of their age, and income. The weighted WTP and categorised on the basis of age, income vary in the three projects. Due to the very low literacy level in the area, amount WTP based on the literacy level is not determined. However, there are some relationship between amount which the respondents are WTP and factors such as the issue of compensation, level of environmental awareness and irrigation experience. This

probably accounts for the higher WTP situation in the more relatively successful and better planned Kano River Project.

Much as the WTP approach provides some data about how people value non-tradeable goods, its usefulness in this example can not be extended to other watershed and for future years due to possible divergences in bio-physical and socio-economic characteristics of the area and inhabitants respectively. Moreover human perception vary across space and time.

Nevertheless, the fact is that project beneficiaries are willing-to-pay for environmental protection as a result of high level of environmental consciousness and too, if the irrigation experience, issues of compensation and level of environmental awareness are highly satisfactory. This opportunity of willingness-to-pay should be harnessed to buttress the government's Ecological Fund. And based on the improved environmental awareness, Nigerian rural and farming population should henceforth be involved in future Environmental Impact Assessment studies, including ex-post evaluation studies. Meanwhile, strategy for cost-recovery in environmental protection activities, particularly in water resources development, should be determined by certain factors.

Firstly, cost-recovery should be seen as a desirable goal in future water resources development projects. Secondly, cost-benefit of project can be analysed based on willingness-to-pay for environmental protection. Project operations and monitoring therefore, would require planners investing an amount not less than what project beneficiaries are willing to pay for mitigation. Project managers would then need to compensate such investments by way of levies, charges, etc., right from the commissioning stage, albeit in a phased manner. A general policy statement in this regard is therefore called for. However, the "Willingness-to-Pay" approach may not be suitable for estimating possible income for cost-recovery in industrial pollution control attempts due to geo-political, scientific and socio-economic considerations. Financial resources mobilised by implementing a surcharge/levy on the citizenry can be used as counterpart funds for water resources development and environmental management in such watersheds.

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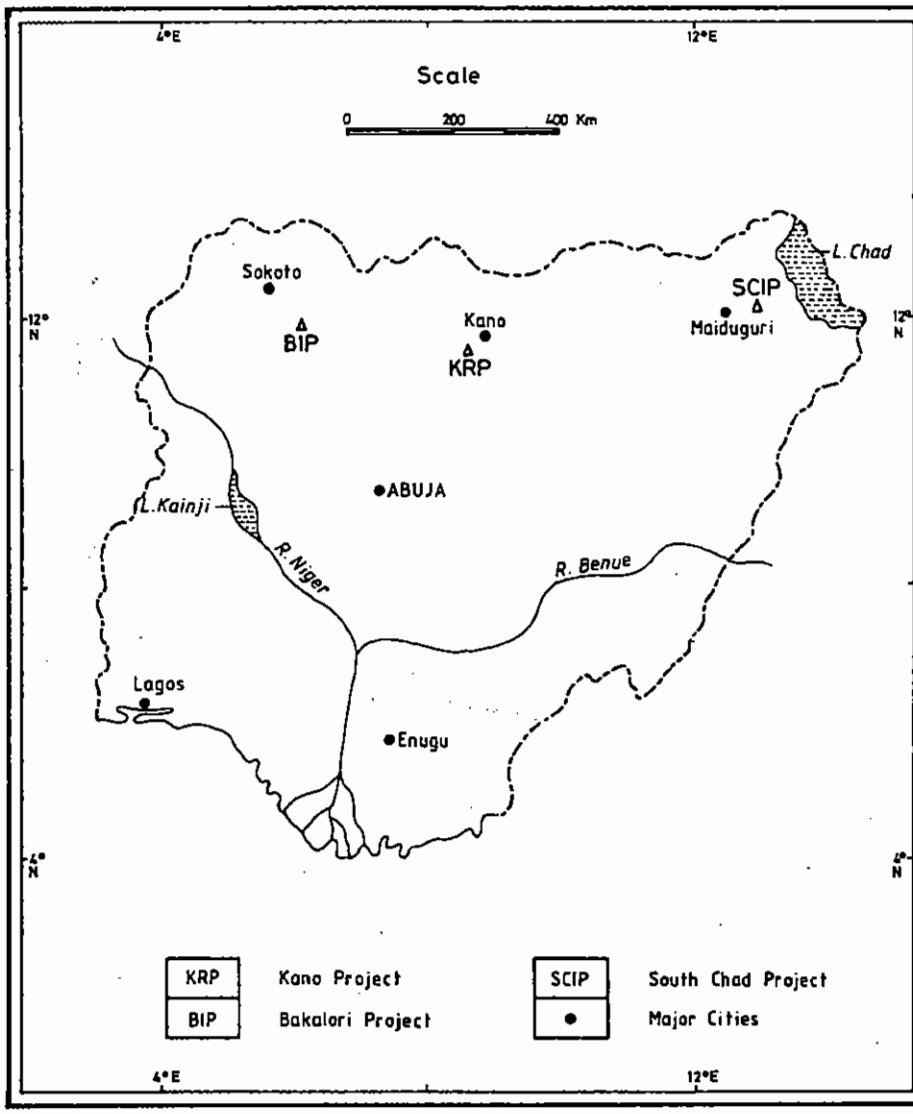

Figure 1. Map of Nigeria Showing Study Area