Natural Resources

Bargaining the Environment for Development: The Ewekoro Experience

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Irrespective of the indicators used for measuring development, the probability of attaining higher rate of growth by industrialized nations is very high. This is because job opportunities are created and consequently have multiplier effect on economic development. It is therefore imperative that for development to take its cause in the third world countries, the transition to modern economy requires some degree of industrialization. In achieving this, these countries should concentrate on those industries that utilize more of their endowed resources as input. Where the resource use is not managed properly, the environment gets destroyed. Hence just as industrialization can spur economic development, it can also generate environmental problems.
Unfortunately and because of peculiar problems associated with land availability in Nigeria for instance, the same location harbours farm lands and industrial sites.
On this basis, the paper critically examines the impacts of industrial activities on agricultural productivity.
Using Ewekoro- a small and all rural community in the south- west Nigeria, the community accommodates a cement factory where farming is the major occupation of the residents. On this note, samples are drawn from the staff of the factory and the residents of Ewekoro in order to determine the degree of the community's development, extent of environmental change and their consequences on agricultural activities. Descriptive statistics and econometric technique shall be used to analyse the generated data.
Finally it is expected that if the factory does not have an adequate method of disposing its wastes, agricultural output will be affected.

Introduction

Going by the previous experiences of several economies, attainment of sustainable development is not without some degree of environmental degradation. Where there is no serious concern for the environment or serious measures for containing its problems, several problems like indiscriminate dumping of wastes, illegal mining and pollution are encouraged.

These are more prevalent in the least developed countries such that several times, untreated wastes are dumped into the environment. To worsen the situation industries are located haphazardly without due regard to physical planning policies.

As far as land ownership is concerned in the African settings land availability has remained inadequate to meet its demand. Hence, the same land that is used for farming is also used for industrial activities. This has continued to reduce agricultural productivity.

In the south-south Nigeria, agricultural activities have almost been paralysed due to oil spillages. For this reason, as long as the economy depends on oil as its major source of foreign exchange earnings, agricultural production keeps declining. The problem is not peculiar to south-south Nigeria alone, but also inevitable in the south east and south west Nigeria.

This is because for such an economy characterized by technological backwardness, low level of production and high population growth rate to attain economic growth and development, the environment is more likely to be over stretched due to exploitation of available resources.

As part of the government policy towards ensuring rural development, locating a cement factory for instance in agricultural based community poses problems to farmers. This is due to the excavation of limestone, gypsum, clay and waste released by the factory into the environment.

As a follow up to section one of section two this paper, examines some of the related studies that established strong connection between the environment and economic growth.

Section three further presents empirical issues revolving around industrial location and extent of environmental damage.

In section four, the generated data is discussed while section five concludes the paper with policy recommendations on how to ensure a safe environment along with sustainable development through agriculture and industrial growth.

Litrature Review

Related Studies on Environment-Economy Interaction

Several studies have emphasized the significance of environmental resources to growth and development in several respects. It is the belief that since our needs arise from the atmosphere and ends in it, there is bound to be some contradictions.

In view of the compelling situation Kuznet (1995) for instance, claims that increased pollution in least developed countries are due to increases in income whereas as income increases, pollution declines in rich countries.

On the other hand, most of the least developed countries rely heavily on land to meet their domestic and foreign needs.

Attempts at reducing over concentration on land and shifting to other sources of growth such as industrialization shall according to Ahmed (2005) generates far better social outputs. Thus “employment, vendor operations, infrastructure utilization and other service sector activities acquire impetus”.

Considering the reliance of least developed countries on agriculture, industrialization to them merely means specialising in the conversion of raw materials into industrial goods such as steel, paper and chemical. But by every standard and without adequate control, their

degree of environmental pollution compared to service economies is far outrageous. Not withstanding, for industrialization to fulfill the goal of economic development, it must be able to make the best use of available domestic resources.

It is thus important that for industrial development to take its cause, a sound agricultural foundation according to Fashola (2004) is a necessary condition for viable agro-allied industrial development of a tropical under developed country. This will however engenders natural resource depletion, ecosystem destruction and climatic changes.

These environmental problems that arise out of excessive or in appropriate resource use are more complex whenever regenerative capacity of the renewable natural resources Dasgupta and are threatened Maler (1990).

In similar vein, Oshuntokun (1999) for instance claims that the bush burning tends to remove foliage and also destroys the surface nutrients of the soil thus destroying biodiversity.

Furthermore, the emission of hazardous gases into the environment (Sighn, 1999) and the unsafe use of pesticides in agricultural systems (Aina, 1995) usually cause natural disaster such as desertification and flood.

It is therefore imperative that for the problem to be resolved, emphasis should be placed ion quantitative relationship between resource availability and agricultural growth. That is, the quantity of land, water and other natural resources needed to sustain growth.

Overtime however, emphasis has shifted to absorption capacity of the environment to cope with pollution generated by agriculture and industry. Thomas (1997) for example analyses the impact of fatal poisoning of wild birds by spent lead sheet in Europe and North America.

Copious amount of documented evidences of these problems and ways of addressing them are immense (US fish and wild life service: 1986, Gregson and Alloway 1984, Andriano: 1986, Thomas and Pokras: 1993, Pain: 1992 and Thomas:1995) to mention but few.

Furthermore, lead do not remain inert in soil, but corrode and release particulate compounds (Bunce and Thomas, 1995). Hence the problem of lead poisoning widens to include other organisms with no exemption to human beings.

Further destruction to soil emanates from massive application of chemical fertilizers, pesticides and other agro chemicals to agricultural farm lands thus constituting the single most important difficulty faced in large scale agricultural projects.

Attainment of growth through agriculture to ensuring industrialization can only be sustained with minimum negative impact on the environment.

Else, the environment becomes an unsafe place to live in thus necessitating the need to ensure a balanced ecosystem. Once this is achieved, economic growth devoid of serious environmental consequences is sustained (Subair, 2004).

Leading authors that share similar opinion on the attainment of economic growth without much damage to the environment at the same time are Kadekodi (2001), Kuik and Gilbert (2002), Oshuntokun (1999), Ruttam (2002) and Shane (1998).

Limits to Agricultural Production

The relative limited nature of environmental resources often demand that the same location be used for both agricultural and industrial purposes. Coincidentally industries source for their raw materials from land which is often used by the residents for agricultural production. Sometimes the residents are relocated and at times relocation is impossible. Hence at such times, agricultural activities take place within the industrial environment.

Be as it may some industries are located within a particular location on the basis of available mineral resources. Extracting the mineral resources tend to widen the economy base and reducing unemployment, providing raw materials for local industries and for exports,

opening up of remote areas and provision of infrastructures. These are the positive effects mining of according to Ogezi (1992).

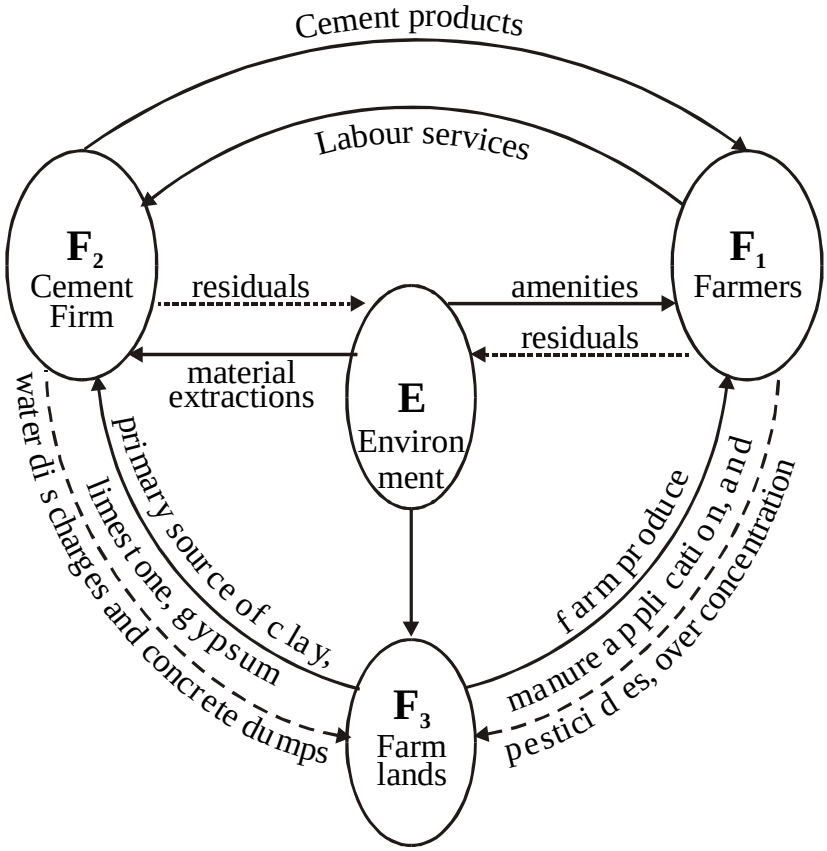
In addition to the benefits derived from mining, it also produces several backward, forward and final-demand linkages with other sectors of the economy.

For instance, in order to maximize economic returns, ores are mined more quickly especially in large, low-grade open –cast deposits. This causes major harmful impact on the environment in terms of significant solid, liquid and gaseous wastes which often pollutes the environment through the release of trace elements and other materials which engender land use, water use, ecological, air-use and socio-economic impacts.

Upholding this submission, Aina and Salau (1992) observe that excavations for laterite and sand, quarrying for clay, gravel and stones are common features in many different parts of Nigeria. Eventually this result into land degradation and ecosystem destabilization.

Igbozurike (1983) further notes the specific impacts as "land surface devastation (including erosion), land subsidence, disruption of drainage systems, deforestation, excessive water draw down and lowering and contamination of water table".

Buttressing the extent of spill over effects of industrial activities on agricultural productivity, Subair (2004) observes that locating cement factory in a farming community poses problems to agricultural farmlands. This has been attributed to excavation of limestone, gypsum and clay including the disposal of its waste like cement dust and slurry water into the environment. This is summarized in the diagram below:



Figured 1: Environment, Agricultural and Industrial Nexus

The effect of water discharges and concrete dumps by the factory (F_2) are the increase in phosphate (P_H) value of the stream water and inability to reforest or cultivate farm lands (F_3) (Okafor, 1986).

This ultimately encouraged the farmers (F_1) to exert more pressure on available lands through the application of manure so as to attain higher productivity.

Subsequently the soil texture and its nutrients are damaged.

In summary, the actions of human beings most especially in the areas of bush burning during pre-planting operations, massive deforestation to meet both fuel and construction needs of rural and urban households, soil excavation and soil surface exposure to agents of erosion at mining sites, water and air pollutions during oil exploration tend to limit agricultural productivity.

Data and Methodology

Data Collection Procedure

The study was carried out in Ewekoro with the use of Owode as a control location.

Ewekoro is one of the sites of West African Portland Cement Company (WAPCO) blessed with large deposits of limestone – the major raw material in the production of cement.

The Ewekoro plant of WAPCO is located in Ewekoro local government area of Ogun State in the south west Nigeria. The local government area is bounded in the North by Abeokuta, in the East by Obafemi – Owode, in the West by Yewa South and in the South by Ado-Odo Ota.

Majority of the inhabitants are farmers and the area is largely rural. Most of these farmers engaged in the planting of sugar cane, cassava, maize and vegetable. Cash crops such as cocoa, kolanut and oil palm are also cultivated. These farmers also engaged in the rearing of livestocks like small ruminants, poultry and pigs.

On the other hand, Obafemi-Owode local goverme,nt a non-WAPCO site is all rural community bounded in the East by Shagamu. Besides sharing boundary with Ewekoro in the West, it also shares boundary with Oluyole local government of Oyo State in the North and Ifako-Ijaiye local government of Lagos State in the South.

Since majority of the residents are farmers, most of them engaged in the cultivation of rice, maize, cassava, yam, oil palm and kolanut. Though they are equally rearing small ruminants, poultry and pigs.

The population in the study was based on management and staff of WAPCO and farmers in the study locations. In all iii respondents made up of ii staff of WAPCO and 100 farmers from the areas of study were carefully selected.

One management staff and ten other staff of WAPCO were selected through systematic sampling procedure using the staff list as the sampling frame.

Fifty farmers were also randomly selected from the list of farmers made available by the Village Extension Agents (VEAS) of the Ogun State Agricultural Development Progaramme (OGADEP) for each study area.

Structured and open-ended questions were used to generate the primary data. However, secondary data in respect of the company's profile and services to the communities were obtained mainly from the management staff. Data on appointable positions, employment history and work details were obtained from the other staff of WAPCO.

The WAPCO staff were able to complete the questionnaires with little assistance because of their relative educational background. On the other hand, the farmers were interviewed by the enumerators in each of the studied locations.

Analytical Techniques

Besides description statistical tools, multiple regression model was used to investigate the major determinants of agricultural output in an industrial location. The explicit function for the regression model was:

$Q = F (X_1, X_2, X_3, X_4)$

Where:

Q = Agricultural Output

X^1 = Land use

X_2 = Quantity of Seed

X_3 = Bags of Fertilizer

X_4 = Other Inputs.

Analysis and Interpretation Of Results (Farmers' profile)

Table 1: Distribution of Respondents by some Personal Characteristics in study locations.

Characteristics	Ewekoro N = 50	Owode N = 50
Sex (%)		
Male	96	86
Female	04	14
Average Size of Household		
Male	5.56	3.65
Female	3.98	3.85
Total	9.54	7.50
Years of Formal Schooling (%)		
None	46	42
< 7 years	30	28
7-9 years	04	10
10-12 years	04	10
12 years +	16	04
no response	00	06
Age (%)		
< 20 years	00	00
21-40 years	16	28
41-60 years	70	32
60 years +	14	40
no response	00	00

From table 1, the socio-economic characteristics of the farmers were complied in terms of average size of household, literacy level and age for the studied locations.

While Ewekoro was inhabited by 96 percent male and 4 percent female, Owode was inhabited by 86 percent male and 14 percent female from the total sample size of 50 respondents.

On the average, the household in Ewekoro was comprised of 5.56 male respondents while that of Owode was made up of 3.65 respondents.

With Ewekoro recording 3.98 female respondents per household, Owode recoded 3.85 female respondents. The aggregate average size of 9.54 respondents was recorded in Ewekoro with 7.50 respondents recorded for Owode.

In terms of education, 46 percent did not receive formal training in Ewekoro while that of Owode was 42 percent of the total sample size.

Through 30 percent and 28 percent received less than seven years training in Ewekoro and Owode respectively. At the same time, 8 percent in Ewekoro and 20 percent in Owode had formal schooling of between seven to twelve years training.

For twelve years and above, 16 percent was recorded in Ewekoro and 4 percent recorded in Owode.

Finally only Owode recorded 6 percent no response to school training during the study period.

Going by the age distribution, the percentage of active labour force was between the ages of 21 and 60, from which Ewekoro recorded 86 percent while Owode recorded 60 percent. Most active members of labour force engaged in farming activities as shown in the occupational characteristics of these farmers in the locations of study.

Table 2: Occupation Characteristics of Farmers

Characteristics	Ewekoro N = 50	Owode N = 50
Main Occupation (%)		
Farming	52	96
Others	48	04
No response	00	00
Average length of residence (yrs)	17.92	35.43
Average length of farming experience in the community (yrs)	13.4	24.70
Average length of farming experience (yrs)	15.56	29.07
Major growth crops (%)		
Maize	10	08
Cassava	72	68
Vegetable	04	00
Cocoyam	02	04
Kolanut	00	00
Yam	04	00
Plantain	00	04
Rice	00	08
Others	08	08
Types of livestock (%)		
None	08	16
Goat	48	10
Sheep	32	10
Poultry	12	64
Rabbit	00	00
Others	00	00

From table 2, out of the total sample size interviewed 52 percent and 96 percent engaged in farming activities in Ewekoro and Owode respectively.

About 48 percent of the Ewekoro farmers were also engaged in other occupations. In Owode however, other occupations were insignificant because it was predominantly occupied by farmers.

The average years of residence of those farmers interviewed in Ewekoro was 17.92 and 35.43 in Owode while their average length of farming experience were 15.56 years and 35.43 years respectively.

Most of the farmers had considerable length of farming experience within their communities to the periods of 13.4 years in Ewekoro and 24.7 years in Owode.

The proportion of farmers that engaged in maize production was 10 percent while 72 percent engaged in cassava production. About 4 percent of these farmers were involved in vegetable production, with 2 percent of them diversifying into the production of cocoyam and 4 percent in yam production. The remaining 8 percent of these farmers engaged in the production of other commodities not mentioned in this study.

In Owode too, only 8 percent of the farmers engaged in maize production with 68 percent engaged in cassava production while none engaged in vegetable production.

Further to this, 4 percent engaged in cocoyam, 4 percent in plantain, 8 percent in rice and 8 percent in other commodities.

On the hand, 92 percent of the Ewekoro farmers engaged in livestock production with 48 percents, 32 percent and 12 percent involved in goat, sheep and poultry production respectively. But in Owode only 10 percent were involved in goat production with 10 percent and 64 percents of them engaged in sheep and poultry production respectively. It is equally important to note that while 8 percent did not involve in livestock production in Ewekoro, 16 percent did not also involve in livestock production in Owode.

West African Portland Cement Company's (WAPCO) Profile

WAPCO is a public limited liability company registered in Nigeria with its corporate headquarters originally located at Ikeja in Lagos State but later relocated to Shagamu in Ogun State. This was due to reorganization carried out in 2002 in order for the company to realize its goals inspite of the harsh economic conditions in the country. The company's lines of production included elephant cement, paints, motor rewinding parts and electrical parts.

The company's engines were operated with the use of coal, electricity generating plants, petrol, diesel and hydroelectric power in that order. Though its major source of power generation was the coal used to generate power in the kilns.

The major raw materials used at WAPCO were limestone, scale, red alluvium, gypsum and water. In most cases, the raw materials were sourced locally with large quantities of 2500 tons of limestone, 200 tons of scale and 200 tons of red alluvium used daily.

Table 3: Farmers' Description of WAPCO Activities in Ewekoro

Awareness of the years of WAPCO existence	19.65 years
Major products of WAPCO	Cement, paints
Major raw materials used	Limestone, clay
Method of harvesting raw materials	Mined from the soil in the forest
Kinds of wastes generated	(%)
Cement dust	94
Slurry	04
Smoke and soot	01
Others	01
No response	00

From table 3, the major wastes generated by the plant were cement dust and slurry water. While the cement dust was disposed through the precipitator, the slurry water was channeled to nearby drains and streams.

Through the farmers claimed that since the existence of the company in their community for almost twenty years, they had been facing the problems of heavy smoke and soot emission.

Going by the nature of operational schedule of the company's plant, about 93 percent of the total sample size interviewed were male a shown in the table 4.

From the total work fore, the highest ranked occupation was technician since it constituted about 29 percent of the total work force sampled. In other words and by corroborating the nature of the plant's operational schedule, an average worker was a technician.

Table 4: Characteristics of WAPCO Staff Interviewed

Characteristics	N = 14	Mean /Mode
Sex	(%)	
Male	92.86	
Female	7.14	Male
Designation		
Manager	14.29	
Engineer	14.29	
Technician	28.57	Technician
Secretary	14.29	
Others: Est. farm supervisor		
Fire security	28.57	
Account supervisor		
Security		
Length of working experience		
< 5 years	21.43	
5-10 years	35.71	7.75 years
10 years +	14.21	
Length of work with WAPCO		
< 5 years	50.00	
5-10 years	35.71	4.50 years
10 years +	14029	

The average member of staff had about eight years working experience with an average length of service with WAPCO revolving around four years.

Impacts Measurement of WAPCO Activities on Agriculture

An inverse relationship emerged while measuring the impacts of WAPCO'S activities on the farmers' productivity.

Thus as the company's activities increase so the environmental hostility to agricultural activities increase.

Hence subair (2004) viewed WAPCO'S impact on agriculture as the "consequence of direct interaction with the physical environment" The interaction was as a result of mining of limestone, gypsum, scale and emission of cement dust as well as channelization of slurry water.

To about 40 percent of the Ewekoro farmers, damage to soil structure was the most dangerous consequence of WAPCO'S mining activities.

The farmers further upheld that the spill over effect of the damage to soil structure was reduction in the available land for farming.

Moreso, there had been increase in crop failure due to decrease in soil fertility.

Furthermore, the aggregate effects of the company's activities on agricultural productivity were based on the estimated benefits from maize / cassava production by the farmers in the location of study.

Our estimated benefits had been based on maize / cassava production since there were commonly cultivated in the two areas of study.

From table 5, average land cultivated for maize / cassava production in Ewekoro was 1.10 hectare compared to that 1.32 hectare of land cultivated by Owode farmers.

The discrepancy in the hectares of land cultivated was due to the fact that while some farmers in Ewekoro had the opportunity of doing part-time job with the Cement factory, the same opportunity did not avail to Owode farmers. This was corroborated by the lower.

Average variable cost (AVC) of #10,538.44 incurred by Owode farmers compared to that of #13,686.15 incurred by Ewekoro farmers.

Table 5: Estimated Benefits of Maize/Cassava Production in Ewekoro and Owode Farms.

Estimates	Ewekoro	Owode
Average Land Cultivated (ha)	1.10 ha	1.32 ha
Average variable cost of Production (N)	13,686.15	10,538.44
Average Revenue from Production (#)	47,7444.79	61,745.60
Average Gross Margin from Production (#)	34,058.64	51,207.16
Average Profit /hectare from Production (#)	30,962.40	38,793.30

Worst still, the Ewekoro farmers earned less revenue compared to that of Owode farmers. The average revenue of Ewekoro farmer was #47,744.79 while that of Owode farmer was #61,745.60.

Furthermore, the average gross profit per hectare (AGP/ha) per unit of land was higher in Owode than in Ewekoro. While a farmer made an AGP/ha of #38,793.30 in Owode, a farmer from Ewekoro made an AGP/ha of #30,962.40 from maize / Cassava production.

The study further established the causal relationship between agricultural output (Q) in an environmentally deteriorated location and various inputs compared to an environmentally friendly location. This was necessitated by the need to establish the way forward in managing the environment for sustainable agricultural development.

Based on the excavation activities of WAPCO in Ewekoro, it was expected that the hectare of land cultivated would show a negative and significant relationship with production. However, since Owode did not fall within the cement factor's location, the expectation should be the reverse.

Other inputs effects were though tested, but to a greater extent, land in this circumstance served as the fundamental factor of production. However, the effect of these other inputs on agricultural production were expected to be positive.

From table 6, the coefficients of determination (R^2) indicated that the inputs influenced agricultural production in the two locations but by different dimension.

In Owode the degree of dependency of agricultural production on its inputs was 42 percent while that of Ewekoro was 83 percent.

Table 6: Regression Coefficients and Level of Significance of Independent Variables Related to Agricultural Productivity in Owode and Ewekoro.

Locations	Dependent variable	Constant Values	Independent Values X_1	X_2	X_3	X_4	R^2	F-Values
Owode	Q	25792 (3.21)	-5049 (-1.27)	1.28 (0.43)	2.95 (1.29)	0.91 (2.32)	0.42	2.66
Ewekoro	Q	32276 (12.83)	21748 (6.88)	-1.07 **(-1.71)**	-2.22 (-4.30)	-0.61 (-1.88)	0.83	42.81

Note: t- statistics in brackets below the regression values.

It was surprising however to note that the relationship between hectare of land cultivated (X_1) and output realized was negative in Owode thus not conforming with a priori expectation.

This implied that diminishing returns had set in since most of the farmers concentrated on limited percel of available land. Contributing more to this problem was the rare opportunity of engaging in part-time job as obtained in Ewekoro.

Furthermore, inspite of the problems faced by Ewekoro farmers, some respite in form of support services from the pollutant (WAPCO) were still rendered to the farmers though not enough to cover their losses.

However, all other inputs (X_4), seedlings (X_2) and bags of fertilizers (X_3) positively influenced agricultural production in Owode but negatively influenced same in Ewekoro.

This further confirmed that the cement company's activities negatively impared the performance of other supporting inputs to land.

Hence irrespective of palliative measures proffered to free farm lands from environmental hazards without taken cognizance of the quality of other supporting inputs, agricultural productivity would continue declining.

Finally, the overall regression equation's F-values were found to be statistically significant at 5 percent level.

Conclusion and Implication For Policy

It is concluded in this paper that despite the fact that agriculture plays vital roles in industrial development, industrialization has continued to undermine agriculture.

This is through the environmental problems it has generated through excavation and consequent soil destruction.

For these problems to be solved there must be sound environmental policy towards ensuring compliance with stated environmental standard expected of any industry.

In this wise, WAPCO should be forced to treat its wastes (cement dust and slurry water before disposing them. Where it fails, heavy sanctions should be imposed on the company.

Notwithstanding, the farmers should be enlightened on how to apply chemical to different crop quantity and when to do so. In addition some measures like deep and frequent tillage should be introduced to the farmers in order to help them maintain or even improve the soil fertility.

Finally in order to maintain cordial relationship with farmers in its areas of operation, WAPCO should adopt a small bargaining solution by compensating those farmers whose farm lands have been destroyed with the environmental protection agents facilitating the arrangement.

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