© Kamla-Raj 2009
PRINT: ISSN 0970-9274 ONLINE: 2456-6608
J Hum Ecol, 27(1): 75-84 (2009)
DOI: 10.31901/24566608.2009/27.01.10

Environment- Productivity Relationship in the South West Nigeria's Agriculture

Kola Subair

School of Business, Media & Information Technology American Heritage University
255 North District Street, San Bernardino, CA 92401, U.S.A
Telephone: +19098849000; Fax: +19098853000
E-mail: kolasubair@hotmail.com; kolasubair@yahoo.com

KEYWORDS Farmlands. Industrialization. Development. Agriculture. Nigeria

ABSTRACT The growth rates in the industrialized nations have been impressive most especially in the area of job creations. This has had impact on economic development. It is very essential for the third world countries to industrialize if they must be freed from poverty and underdevelopment. But since most of these countries have primary resources, their focus should be on those industries that use more of these resources as inputs. Nigeria's weakness in regional planning, for instance, encourages locating farmlands and manufacturing industries in the same area. Such is the case of Ewekoro- a small and all rural community in the south- west, Nigeria. This community harbours a cement factory sitting side by side with a farming community. Respondents for the study were drawn from the staff of the factory and the Ewekoro farmers. The goal was to determine the extent of the community's development, the degree of environmental degradation and the impact of both on agricultural output in the area. To some extent the activities of the cement factory affect agricultural output through environmental degradation. The study shows how all this have occurred. It then points to how economic growth can be facilitated with lesser impact on the environment.

1. INTRODUCTION

Through the benefit of hindsight, several economies attained sustainable development with some degree of environmental degradation. This has been attributed to the factor of industrialization. Activities on the environment however these tend to hinge on effluents which according to (Cooper et al. 2006; Ekundayo 1997) may include acids, oils and cooling water. All these consequently create a cascading concern about the protection and safety of the environment. Where there is no serious concern for the environment or measures for containing its problems, several issues such as indiscriminate dumping of waste, illegal mining and pollution are often inescapable. These are more prevalent in the least developed countries such that several times, industries are located without due regard to physical planning. For instance, in Africa, the same land that is used for farming could also be used for industrial activities and this has continued to undermine agricultural activities.

In south-south Nigeria, agricultural activities have almost been paralyzed 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 will continue to decline. Since part of the government's policy towards ensuring development is to attract industries to the rural areas, locating a cement factory for instance in an agrarian community may pose some problems to the farmers in such a community. Some of these problems might be attributed to the excavation of limestone, gypsum, clay and waste released by the factory into their environment.

Studies have emphasized the significance of environmental resources to growth and development. In view of the compelling situation, Kuznets (1955) asserts that increased pollution in least developed countries is due to increases in income whereas as income increases, pollution reduces in rich countries. Further reinforcing this opinion are Reardon et al. (2001) stating that an increase in income particularly in the developing countries is usually responsible for the high demand for protein in order to ensure balanced diet. Hence, the demand for production of "low cost feed grains with an attendant risk of low-diversity cropping and intensive chemical use" (Robertson and Swinton 2005) is generated.

*Address all correspondence at:
Dr. Kola Subair
518 Kosciusko Street, #3L Brooklyn, NY 11221, U.S.A
Telephone: +13474397220; *Fax:* +13474136400
E-mail: kolasubair@hotmail.com,
kolasubair@yahoo.com

In contrast however, the various propaganda on calorie in-takes in wealthy nations which according to Reardon et al. (2001) has "created a rapidly growing market for foods that are produced to meet standards that focus on process attributes that consumers can not directly observe as opposed to traditional performance standards". All these processes such as minimal chemical use and forest conservation are beneficial to the environment, such that it reduces over concentration on land and shifting to other sources of growth like industrialization that shall according to Ahmed (2005) generates far better social outputs. Thus "employment, vendor operations, infrastructure utilization and other service sector activities" are accelerated.

Considering the reliance of developing countries on agriculture, industrialization to them means merely assembling of expensive imported components into finished goods while exporting their primary commodities at very ridiculous prices. By every standard the degree of environmental pollution compared to developed economies is far outrageous. It is thus important that for industrial development to take its course there is need for a sound agricultural foundation which according to Fashola (2004) is a *condition sine qua non* for a viable agro-allied industrial development of a tropical under developed country. The environmental problems that arise out of excessive or inappropriate resource use are more complex whenever regenerative capacity of the renewable natural resources are threatened (Maler 1997). Additionally, the general attitude of bush burning because of inadequate farm implements tends to remove foliage and also destroys the surface nutrients of the soil and its biodiversity (Oshuntokun 1999).

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 this problem to be solved, emphasis should be placed on the 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) analyses the impact of fatal poisoning of wild birds in Europe and North America. Several ways of resolving the problem have also been identified by (Andriano 1986; Gregson and Alloway 1984; Pain 1992; Thomas and Pokras 1993; Thomas 1995). Furthermore, lead, which affects the environment, does not remain inert in soil, but corrodes and releases 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 major difficulty faced in large scale agricultural projects.

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 negative environmental consequences is attained (Subair 2004). The attainment of growth through agriculture in ensuring industrial development can be sustained with minimal negative impact on the environment if necessary cautions are observed (Kadekodi 2001; Kuik and Gilbert 2002; Oshuntokun 1999; Ruttan 2002; USDA 1998). Meanwhile, extracting the mineral resources tend to strengthen the economy by providing employment, raw materials for local industries as well as for exports, opening up of remote areas and provision of infrastructures (Ogezi 1992).

On the other hand, natural resources' extraction 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 without minding its environmental effects. This has harmful impact on the environment in terms of significant solid, liquid and gaseous wastes which often pollute the environment through the release of trace elements and other materials which engender land use, water use, ecological, air-use and socio-economic consequences. Igbozurike (1983) notes the specific negative impact as "land surface devastation (including erosion), land subsidence, disruption of drainage systems, deforestation, excessive water draw down and lowering and contamination of water table". Aina and Salau (1992) observe that excavations for late rite and sand, quarrying for clay, gravel and stones are common features in many different parts of Nigeria. Eventually, these result in land degradation and ecosystem destabilization.

Intensive agricultural activities arising out of population growth and subsequent increase in demand for "basic protein requirements and economic growth (aid the) fueling of higher rates of per capita consumption" (NRC 2003), propels environmental degradation. In the long-run the purpose of achieving high level productivity in the sector is defeated. For example, the decline in agricultural sector's contribution to Nigeria's GDP as a result of oil discovery in the 1970s prompted several regimes to invest heavily in agricultural equipment. Rather than achieving the target of higher output, agricultural sector continued to perform below expectation, a situation that Dittoh and Aromolaran (1997) describe as "overcapitalization" in the agricultural sector. In the real sense of it, "overcapitalization" crowds out the much expected gains from agriculture otherwise known as a 'Dutch Disease'. Agricultural overcapitalization in Nigeria greatly influences the farmers' ways of life and thus impacting negatively on their productivity.

Subair (2004) observes that locating a cement factory in a farming community poses some problems to agricultural farmlands. This has been attributed to excavation of limestone, gypsum and clay including the disposal of the factory's waste like Cement dust and slurry water into the environment as depicted in figure 1. From figure 1, 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 will encourage farmers (F_1) to exert more pressures on available lands through the application of manure so as to attain higher yields. By so doing, the soil texture and its nutrients are damaged.

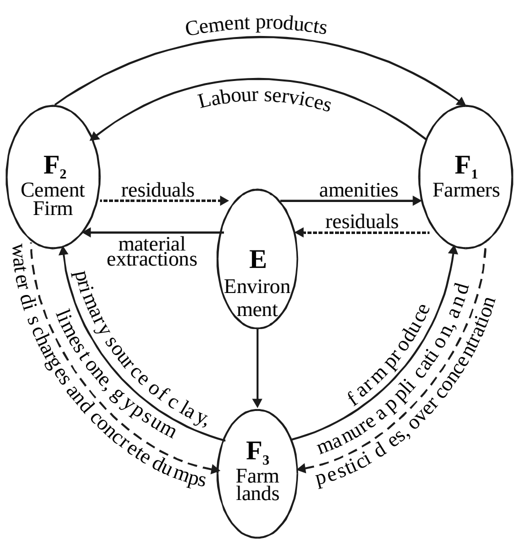

Fig. 1. Environment, agriculture and industrial nexus

Bush burning during pre-planting operations and 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.

2. METHODOLOGY

Data Collection Procedure

This study was conducted among the Ewekoro farmers (target) that were assumed to be threatened by the activities of West African Portland Cement (WAPCO) factory which releases liquid effluents and polluted air into the surrounding land, streams, rivers and lagoon. The study was also conducted among Owode farmers (control) where West African Cement Factory is not located. WAPCO is located in Ewekoro since the community has large deposits of limestone – the major raw material used 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 people are farmers and the area is largely rural. Most of these farmers engage in the planting of sugar cane, cassava, maize and vegetables. Cash crops such as cocoa, kola nut and oil palm are also cultivated. These farmers also engage in the rearing of live stocks such as small ruminants, poultry and pigs.

On the other hand, Obafemi-Owode local government is not within WAPCO presence, and it is hugely a 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. Majority of the inhabitants are farmers. They are engaged in the cultivation of rice, maize, cassava, yam, oil palm and kola nut. Though, they also breed small ruminants, poultry and pigs.

The management staff and employees of WAPCO and farmers in the studied locations were our respondents. In all, 111 respondents made up of 11 staff of WAPCO and 100 farmers from the studied locations 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 questionnaires 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 regular appointments, employment history and work details were obtained from the other staff of WAPCO.

The WAPCO employees 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

Descriptive statistics were computed from the administered questionnaires to describe the socio-economic characteristics of the farmers. On-farm study data were fitted to three functional forms, Linear, Semi-logarithm and Cobb-Douglas with the best functional form selected based on statistical and economic criteria. The basic Cobb-Douglas production function was chosen in order to specify the underlying relationship between the value of yield and its explanatory variables with the implicit form stated as:

$$Q = AX_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4}$$

and which is also transformed into a log-linear form below:

$$\text{Ln } Q = \text{Ln } A + {}_{b1}\text{Ln}X_1 + {}_{b2}\text{Ln}X_2 + {}_{b3}\text{Ln}X_3 + {}_{b4}\text{Ln}X_4 + \ldots + \mu$$

Where:

Q = Agricultural Output
X_1 = Land use
X_2 = Quantity of Seed
X_3 = Bags of Fertilizer
X_4 = Other Inputs.

For the purpose of this study, output is defined in terms of the total value of maize/cassava produced per hectare. It is hypothesized that output (Q) is related to all variables (ΣX_{is}) and µ is an error term with appropriate properties while 'A' and'b_{1-4}'are regression coefficients to be estimated. These coefficients also represent the elasticities of production with respect to each of the inputs based on Cobb-Douglas production function.

Furthermore, the gross margin analysis was used to determine the contribution of the enterprises to the farmers' income in the studied locations. This is thus stated as

Gross Margin = Gross Return – Variable Cost:

$$GM = \sum_{i=1}^{n=1} p_1 q_1 - \sum_{i=1}^{n=1} a_1 c_1$$

Where:
p = unit price of maize/cassava
q= output in terms of quantity
a_1= quantity of each variable input used
c_1 = unit cost of each variable input used

3. RESULTS AND DISCUSSIONS

Farmers' Profile

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

While Ewekoro is inhabited by 96 percent male and 4 percent female, Owode is inhabited by 86 percent male and 14 percent female from the total sample size of 50 respondents. On the average, the households in Ewekoro comprised 5.56 male respondents while that of Owode is made up of 3.65 respondents.

With Ewekoro recording 3.98 female respondents per household, Owode recorded 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% of Ewekoro farmers had no formal education with Owode having 42% of its farmers un-educated from the total sample size. Though, 30% and 28% received less than seven years training in Ewekoro and Owode, respectively. At the same time, 8% in Ewekoro and 20% in Owode had formal schooling of

Table 1: Distribution of respondents by some personal characteristics in study locations

Characteristics	*Ewekoro (n = 50) %*	*Owode (n = 50)* %*
Sex		
Male	96	86
Female	4	14
Average Size of Household		
Male	5.56	3.65
Female	3.98	3.85
Total	9.54	7.5
Years of Formal Schooling		
None	46	42
< 7 yrs	30	28
7-9 yrs	4	10
10-12 yrs	4	10
12 yrs+	16	4
No response	0	6
Age		
< 20 yrs	0	0
21-40 yrs	16	28
41-60 yrs	70	32
61 yrs+	14	40
No response	0	0

Source: Field survey, 10-13 April, 2006.
*Subair, K (2004), extracted from pp. 366 – 372.

between seven to twelve years training. For twelve years and above, 16% in Ewekoro and 4% in Owode received formal education. Finally, only Owode recorded 6% no response to school training during the study period.

On average the farmers' low educational attainment hampers their mobility and thus lowering their real cost. This underscores the need for appropriate technological and agronomic assistance to maximize farmers' output and consequently income.

On the basis of age distribution, the percentage of active labour force is between the ages of 21 and 60, from which Ewekoro recorded 86% while Owode recorded 60%. Most active members of labour force engage in farming activities as observed in Table 2.Of the total sample size interviewed, 52% and 96% took to farming activities in Ewekoro and Owode, respectively. About 48% of the Ewekoro farmers are also engaged in other occupations. In Owode however, percentage of other occupations is insignificant because it is predominantly occupied by farmers.

The average years of residence of those farmers interviewed in Ewekoro is 17.92 and 35.43 in Owode while their average length of farming experience are 15.56 years and 29.07 years respectively. Most of the farmers have considerable farming experience within their communities averaging 13.4 years in Ewekoro and 24.7 years in Owode.

Table 2: Occupational characteristics of farmers

Characteristics	*Ewekoro (n = 50) %*	*Owode (n = 50)* %*
Main Occupation		
Farming	52	96
Others	48	4
No response	0	0
Average length of residence (years)	17.92	35.43
Average length of farming experience in the community (years)	13.4	24.7
Average length of farming experience (years)	15.56	29.07
Major Growth Crops		
Maize	10	8
Cassava	72	68
Vegetable	4	0
Cocoyam	2	4
Kola nut	0	0
Yam	4	0
Plantain	0	4
Rice	0	8
Others	8	8
Types of Livestock		
None	8	16
Goat	48	10
Sheep	32	10
Poultry	12	64
Rabbit	0	0
Others	0	0

Source: Field survey, 10-13 April, 2006.
*Subair, K (2004), extracted from pp. 366 – 372.

As shown in Table 2, the proportion of farmers in Ewekoro that engage in maize production is 10% while 72% engage in cassava production. About 4% of these farmers are involved in vegetable production with 2% of them diversifying into the production of cocoyam and 4% in yam production. The remaining 8% of these farmers engage in the production of other commodities not mentioned in this study. In Owode too, only 8% of the farmers engage in maize production with 68% engaging in cassava production while none engaged in vegetable production. Further to this, 4% are engaged in cocoyam, 4% in plantain, 8% in rice and 8% in other commodities.

On the hand, 92% of the Ewekoro farmers engaged in livestock production with 48%, 32% and 12 % involved in goat, sheep and poultry production, respectively. However, in Owode, only 10% are involved in goat production with

10% and 64% of them engaging in sheep and poultry production, respectively. Finally, the ratio of farmers not involved in livestock production in Owode to that of Ewekoro farmers is 2:1.

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 despite the economic crisis in the country. The company's lines of production include elephant cement, paints, motor rewinding and electrical parts.

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

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

As indicated in Table 3, the major wastes generated by the plant are cement-dust and slurry water. While the cement dust is disposed through the precipitator, the slurry water is channeled to nearby drains and streams. However the farmers claimed that since the existence of the factory in their community for almost twenty years, they have been facing the problems of heavy smoke and soot emission.

Table 3: Farmers description of WAPCO activities in Ewekoro

Awareness of the years of WAPCO existence	19.65
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	4
Smoke and soot	1
Others	1
No response	0

Source: Field survey, 10-13 April, 2006.

Table 4: Characteristics of WAPCO staff interviewed in Ewekoro

Characteristics	*WAPCO staff (n = 14)* %	*Mean / Mode*
Sex		
Male	92.86	
Female	7.14	Male
Designation	%	
Manager	14.29	
Engineer	14.29	
Technician	28.57	
Secretary	14.29	
Others: company's farm supervisor, fire security, account supervisor, security	28.57	Technician
Length of Working Experience		
< 5 yrs	21.43	
5-10 yrs	35.71	7.75 yrs
10 yrs +	42.86	
Length of Work with WAPCO		
< 5 yrs	50	
5-10 yrs	35.71	4.50 yrs
10 yrs +	14.29	

Source: Field survey, 10-13 April, 2006.

On the basis of the operational schedule of the company's plant stated in Table 4, about 93% of the total sample size interviewed is male. From the total work force, the highest ranked occupation is technician since it constitutes about 29% of the total work force sampled. In other words an average worker is a technician. It was also revealed by Table 4 that the average member of staff has 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 exists in the impacts of WAPCO'S activities on the farmers' yield in the target location. Thus as the company's activities increases the environmental hostility to agricultural activities also increases.

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

According to 40% of the Ewekoro farmers, damage to soil structure is the most dangerous consequence of WAPCO'S mining activities. The farmers further claimed that the spill-over effect of the damage to soil structure is reduction in the available land for farming. More so, crop failure has continued unabated due to decrease in soil fertility.

Regression Analysis

The study further establishes the relationship between agricultural yield (dependent variable) and its inputs (independent variable) in a deteriorating environment compared to an environmental friendly location. This has been necessitated by the need to identify the best method of managing the environment for sustainable agricultural development.

Using the ordinary least squares method, the production function explains 42% and 83% of all variations in the values of the yields of maize/ cassava in Owode and Ewekoro, respectively. The inputs' coefficients were significant at 5% level as shown in Tables 5 and 6.

In Table 5, land was negatively related to output in Owode while all other inputs were positively related. The negative coefficient of land may be explained by farmers' concentration on limited parcel of land coupled with rare opportunities of available part-time job in Ewekoro. On the other hand, Table 6 shows that all other inputs except land were negatively related to output in the target location due to some support services rendered by WAPCO to the farmers. However, these support services were not enough to prevent the negative contribution of other supporting inputs to land.

Table 5: Estimated parameters of maize/cassava production by Owode farmers

Inputs	*Parameters*	*Significant values*
Land use (X_1)	-5049	-1.27
Seed (X_2)	1.28	0.43
Fertilizer (X_3)	2.95	1.29
Other inputs (X_4)	0.91	2.32
Intercept	25792	3.21
Statistics		
R^2	0.42	
F- statistics	2.66	
N- samples	50	

Source: Computed by the author.

Table 6: Estimated parameters of maize/cassava production by Ewekoro farmers

Inputs	*Parameters*	*Significant values*
Land use (X_1)	21748	6.88
Seed (X_2)	-1.07	-1.71
Fertilizer (X_3)	-2.22	-4.3
Other inputs (X_4)	-0.61	-1.88
Intercept	32276	12.83
Statistics		
R^2	0.83	
F- statistics	42.81	
N- samples	50	

Source: Computed by the author.

Returns to Scale

The production function estimation gives information on returns to scale of inputs used in maize/cassava production. It could increase, decrease or remain constant, depending on the ratios of inputs to output. In the typical Cobb-Douglas formulation, Returns To Scale (RTS) is given by the sum of the input coefficients:

$$RTS= a_1 + a_2 + \ldots\ldots. + a_n$$

The returns to scale and marginal yields of inputs for the target and control locations are thus provided in Table 7. Apart from land which is fixed in nature and with extreme coefficients (-5049, 21748), the sums of the elasticities for production in Owode and Ewekoro are 5.14 and -3.90 respectively. The production function thus exhibits increasing returns to scale for Owode and decreasing returns to scale for Ewekoro. The sampled maize/cassava farmers were therefore operating at economically irrational production region.

Table 7: Resource elasticities for maize/cassava production in Owode and Ewekoro

Inputs	*Elasticity (Owode)*	*Elasticity (Ewekoro)*
Land use (X_1)	-5049*	21748*
Seed (X_2)	1.28	-1.07
Fertilizer (X_3)	2.95	-2.22
Other inputs (X_4)	0.91	-0.61
Total	-5043.86*	21744.1*

Source: Computed by the author.

Gross Margin and Profit Analyses

The aggregate effects of the company's activities on agricultural output were based on the estimated benefits from maize/cassava production by the farmers in the studied locations.

The gross margin for average farmers in

Owode shows considerable reduction in cost as the farm size increases while that of Ewekoro increases along with its farm size. This is corroborated by the lower total variable cost (TVC) of =N=10,538.44 naira incurred by Owode farmers compared to that of =N=13,686.15 Naira incurred by Ewekoro farmers. This may be attributed to availability of cheap labour in Owode since they do not have alternative job other than farming.

Gross margin per hectare similarly increased with the farm size thus implying that economies of scale exist. The gross margin for an average farmer in Owode was higher than that of Ewekoro as shown in Table 8.

Worse still, the Ewekoro farmers earn less revenue compared to Owode farmers. The revenue earned by an average farmer in Ewekoro is =N=47,744.79 Naira while that of Owode farmer is =N=61,745.60 Naira per harvest period. Considering the Benefit-Cost ratio (B/C), the situation in Ewekoro suggests that while the B/C for an average farmer is 2.8:1, that of Owode is 2.7:1 which signifies that farming will be more lucrative in Ewekoro if concentrated upon.

But Table 9 shows that the gross profit per hectare of land for an average farmer is higher in Owode than in Ewekoro. While an average farmer in Owode earns =N=38,793.30 Naira, an average farmer in Ewekoro earns =N=30,962.40 Naira from maize/cassava production thus indicating a 1.3:1 profit ratio. If Owode farmers receive similar support like their counterparts in Ewekoro, it might be possible for them to attain more than proportionate increase in output.

4. CONCLUSION AND RECOMMENDATIONS

Conclusion

In conclusion, despite the vital role played by agriculture in industrial development, the latter has continued to undermine the former. This is through the environmental problems the WAPCO cement factory had generated through excavation of limestone, waste disposal and consequent soil destruction.

Recommendations

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

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

The farmers should be enlightened on how best to apply chemicals to different crop quantities 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.

This should be supported by management practices through constant contacts with the extension agents who will give them appropriate guidance and demonstration. By so doing the

Table 8: Gross margin by farm locations

Locations	*Total hectares*	*Total revenue (=N=)*	*Total variable cost (=N=)*	*Gross margin (=N=)/ hectare*
Ewekoro	1.10 ha	47, 744.79	13, 686.15	34,058.64
Owode*	1.32 ha	61, 745.60	10,538.44	51,207.16

Source: Field survey, 2006.
*Subair, K (2004), extracted from pp. 366-372.

Table 9: Profit margin by farm locations

Locations	*Gross margin (=N=)/hectare*	*Total fixed Cost (common cost) =N=*	*Profit (=N=)/ hectare*
Ewekoro	34,058.64	3,096.24	30,962.40
Owode*	51,207.16	12,413.86	38,793.30

Source: Field survey, 2006.
*Subair, K (2004), extracted from pp. 366-372.

social and ecological factors would have been considered such that maximum output will be attained in the long run.

Since agricultural activities are curtailed in most of the environmentally unfriendly areas, policy measures by government should be designed towards efficiency and maximization of resource use. Overall, concessions should be given to farmers in such areas so as to ensure a consistent and efficient input delivery system of fertilizer, seeds, and pesticides. Furthermore apart from cash compensation, government must also compel WAPCO to support the farmers by making available some farm equipment in order to ensure efficient resource utilization.

Finally, in order to maintain cordial relationship with farmers in Ewekoro, WAPCO should adopt a small bargaining solution by compensating those farmers whose farms have been destroyed with the environmental protection agents facilitating such arrangement.

ACKNOWLEDGEMENTS

The author wishes to express his heartfelt gratitude for the useful comments on this paper and steadfast encouragement of Professor Abubakar Momoh of Lagos State University, Ojo, Nigeria.

REFERENCES

Ahmed N 2005. Making the Industrial Development Environment Friendly. Official homepage of Dawn network. From <http://www.dawn.com> (Retrieved April 20, 2006).

Aina EAO 1995. Environment and Development: Moving Agriculture to the 21st Century and Beyond. *Convocation Lecture Series No.1*, Abeokuta: Unaab.

Aina TA, Salau AT 1992. *Land Tenure, Land Use and Environmental Degradation: The Challenge of Sustainable Development in Nigeria*. Ibadan: NEST

Andriano DC 1986. *Trace Elements in the Terrestrial Environment*. New York: Springer-Verlag

Bunce NG, Thomas VG 1995. The solubility of metallic lead in natural waters and its contribution to pollution. *Crucible*, 27: 22-44.

Cooper FK, Davey NT, Dunwell NM 2006. Environment and development. In: FK Cooper, NT Davey, NM Dunwell (Eds.): *International Development Abstracts.* Norwich: Elsevier, pp. 170-186.

Dittoh S, Aromolaran AB 1997. Overcapitalization: The bane of "modern" agriculture in Nigeria. *Journal of Economics and Allied Studies*, 1: 27-38.

Ekundayo JA 1997. Environmental consequences of the pollution of the Lagos lagoons. *Bulletin of The Science Association of Nigeria***,** 3: 298-302.

Fashola MA 2001. A schema for Nigeria's optimal industrial development. In: MOA Adejugbe (Ed.). *Industrialization, Urbanization and Development in Nigeria (1950-1999).* Lagos: Concept Publications Limited, pp. 301-302.

Gregson SK, Alloway BJ 1984. Gell permeation chromatograph studies on the speciation of lead in solutions of heavily polluted soil. *Journal of Soil Science*, 35: 55-61.

Igbozurike UM 1983. Energy Development and Energy Crises with Special Reference to Nigeria. Department of Geography *Lecture Series No. 11*, Nsukka: Unn.

Kadekodi GK 2001. Environment and development. In: RA Bhattacharya (Ed.): *Environmental Economics-An India Perspective*. New York: Oxford University Press, pp. 162-175.

Kuik OJ, Gilbert AJ 2002. Indicators of sustainable development. In: CJM Jeroen van den Bergh (Ed.): *Handbook of Environmental and Resource Economics.* Massachusetts: Edward Elgar Press, pp. 722-727.

Kuznets S 1955. Economic growth and income inequality. *American Economic Review*, 49: 3-11.

Maler KG 1997. Environment, poverty and economic growth. In: P Boris, JE Stiglitz (Eds.): *Annual World Bank Conference on Development Economics*. Washington, D.C: The World Bank, pp. 252-256.

NRC 2003. *Frontiers in Agricultural Research: Food, Health, Environment and Communities*. Washington, D. C: National Academy Press.

Ogezi AE 1992. Impact of mining on the Nigerian environment. In: EOA Aina, NO Adedipe (Eds.): *Towards Industrial Pollution Abatement in Nigeria.* Lagos: FEPA, pp. 37-48.

Okafor FC 1988. Rural development and the environmental degradation versus protection. In: PO Sada, FO Odemerho (Eds.): *Environmental Issues and Management in Nigerian Development. Ibadan:* Evans Brothers Press, pp. 150-152.

Oshuntokun A 1999. *Environmental Problems of Nigeria with Special Emphasis on Northern Nigeria*. Ibadan: Davidson Press/ Friedrich Ebert Foundation.

Pain OJ 1992. Lead Poisoning in Waterfowl. Slimbridge: International Waterfowl and Wetlands Research Bureau.

Reardon T, Codron JM, Busch L, Bingen J 2001. Global change in agri-food grades and standards: Agribusiness strategic responses in developing countries. *International Food Agribusiness Management Review*, 2: 423-426.

Robertson GP, Swinton SM 2005. Reconciling agricultural productivity and environmental integrity: A grand challenge for agriculture. *Front Ecol Environ*, 3: 38-44.

Ruttan VW 2002. Productivity growth in world agriculture: Sources and Constraints. *Journal of Economic Perspectives*, 16: 161-174.

Subair K 2004. The environment and economic development. In: Toyin Falola, J Steven- Salm (Eds.): *Nigerian Cities*. New Jersey: Africa World Press Incorporation, pp. 363-375.

Thomas VG, Pokras MA 1993. International analysis of non-toxic shot adoption for water fowling. In: ID Thompson (Ed.): *Forests and Wildlife: Towards the 21st Century*. Canada: Union of Game Biologist, pp. 124-129.

Thomas VG 1995. Why the U.S. and Canada aren't adopting non-toxic short and fishing sinkers. *International Journal of Environmental Affairs*, 7: 364-378.

Thomas VG 1997. The environmental and ethical implications of lead short contamination of rural lands in North America. *Journal of Agricultural and Environmental Ethics*, 10: 41-54.

USDA1998. *Agricultural Economic Report: US Agricultural Growth and Productivity- An Economy wide Perspective*. Washington D. C: Economic Research Service, Usda.