AGRICULTURAL EXTENSION DELIVERY TOWARDS PROMOTING FADAMA IRRIGATED FARMING SYSTEM IN NORTHERN NIGERIA: IMPLICATIONS FOR SUSTAINABLE FADAMA ECOSYSTEM

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ABSTRACT

Agricultural Extension is an integrated science of social change in which farmers and their households are made conscious of their problems, feel the need to solve them and motivated to take actions, using available resources in order to enhance their livelihood. However, to what extent has this social change concept "functional" in terms of ensuring sustainable development? Sustainable development has always been one of the major public concerns over natural resources and the environment. In ecological terms, sustainability refers to the ability of the ecosystem to maintain productivity over time in the face of large disturbances (Cornway, 1987). The crucial issue addressed in this study is whether the promotion of irrigated farming system in Nigeria, through Fadama Development Initiative (FDI), is consistent with sustainable ecological development. This paper argues that Agricultural Extension service delivery in Nigeria has propagated overdependence on agro-chemicals, including fertilizers, heavy and frequent tillage operations and uneconomic use of water, which is unfriendly to the environment. It therefore proposes a workable model involving an educational programme, through the extension service, to train farmers on organic manuring and reworking of farm residues into the soil, practice of minimum tillage to reduce the development of iron-pan and enhance water percolation (reduce soil erosion), and efficient water utilization.

Keywords: Agricultural Extension, irrigation, Fadama Ecology, Sustainability, Northern Nigeria

1. INTRODUCTION

The task of feeding the population of semi-arid regions in northern Nigeria, where one cropping is carried out during wet season due to lack of adequate rainfall necessitates further exploitation of the environment for food by man. Hence, the introduction of irrigation schemes, which facilitates the production of two or more croppings each year. However, irrigated agriculture the world over is currently facing important challenges. On one hand, it has to provide a major share of the required increase in food and fibre production to meet the objective of poverty alleviation and development. According to reports, an estimated 80% of the additional food supplies required to feed the world in the next 80 years will depend on irrigation (Tolba, 1994). On the other hand, the problem of food production through irrigation is being exacerbated by a degradation of not only the existing irrigation systems but also the general ecosystem to the extent that the sustainability of irrigation development is continuously under threat.

This study therefore examined the agricultural extension service delivery system towards promoting sustainable *fadama* irrigated farming system in northern Nigeria. *Fadama,* according to Kolawole and Scoones (1994), is a seasonally flooded or floodable plain among major rivers or depressions on the adjacent low terraces. It is a *Hausa* word for a land which is seasonally waterlogged or flooded and retains moisture within the rooting zones of crops for at least some parts of the dry season (Akinola, 1997). The question is, "to what extent is the *fadama* irrigated farming system being promoted by the extension service functional?" In other words, to what extent is the farming system being promoted has enhanced farmers' livelihood? Are the farm lands and the system's service areas subjected or exposed, through the use of agro-chemicals and plough technology, to main environmental hazards like water-logging, erosion, weed/insect pest infestation and salinity? Answers to these questions, it is hoped, will help in suggesting

appropriate policies and institutional modifications that can ensure compatibility between irrigated dam project and ecosystem and consequently a sustainable agricultural development.

2. HYPOTHESES

1. The promotion of irrigated dam projects by the Agricultural Extension service in Nigeria has not significantly improved the livelihood of farmers in the study areas.
2. The promotion of irrigated dam projects by the Agricultural Extension service in Nigeria has no significant relationship or effect on the ecosystem.

3. CONCEPTUAL FRAMEWORK

3.1 The "Environment" Concept

Timberlake (1991) described the environment as including the natural (Cosmic) elements of a country that form the basis of its progress or development viz: land or soil, water, air, genetic resources, wildlife, climate and other renewable and non-renewable resources. In Nigeria, the Federal Environmental Protection Agency (FEPA) considered the environment as including water, air, land, plant, animals and human beings living therein and the inter relationship existing amongst them (Adeluyi, (1990). These conceptual frameworks reveal that man and his developmental strategies are very much dependent on the environment.

While the ways we manipulate the environment seem imperative for the survival of man, they are pursued in an unsustainable way to the extent that the environment is continuously jeopardized. Deterioration of the environment through the practice of irrigated agriculture has been attributed to the introduction and promotion of advanced technology without regard to local conditions as well as poor systems management (Olofin, 1993).

3.2 The Sustainability Paradigm

In ecological terms, sustainability refers to the ability of the ecosystem to maintain productivity over time in the face of large disturbances (Cornway, 1987). The Brundtland Commission described sustainable development as implying meeting the needs of the present generation without compromising the ability of future generations to meet their own, stressing that "if needs are to be met sustainably, the earth's natural resource base must be conserved and enhanced" (WCED, 1987).

While there is no consistent blue-print in building the paradigm of sustainable development, irrigated agriculture is essentially a development intervention strategy designed and been promoted to arrest the socio-economic stagnation and offsetting the production crisis inherent in rural areas. Before the advent of irrigated dam projects, *shaduf* system of irrigation was popular in the storm channel zones while in the alluvial channel complexes of the *fadama* areas, flooding was extensive and long lasting such that irrigation was by residual moisture utilization technique. Inputs were limited to household labour, seeds from local markets or last season's harvest and the dropping of grazing animals and occasional addition of household refuse (*tarki*) supplement the natural silt to replenish the land nutrients.

However, the construction of irrigated dam projects, and presently the *Fadama* Development Initiative (FDI) has resulted in some changes necessitating the modernization of *fadama* areas by the World Bank assisted State ADPs. According to Olofin (1993), such changes involve the use of tube wells, wash bores and perennial channel flow as source of water, and water pumps to replace the *shaduf* as lifting device. Important inputs in this new dispensation include chemical fertilizers, herbicides, pesticides and dressed seeds.

These changes, it has been found, have resulted into a number of socio-economic and ecological impacts, which give rise to the adoption of the functionalist paradigm as a theoretical approach of development in this study.

3.3 The Structural – Functionalist Paradigm

Simply put, functionalism as a development perspective argues that the structure is functional when the social structure produces commensurate functions or consequences for the social system (Davis, 1959). In other words, a social phenomenon is functional when it has positive influence on the social system and dysfunctional (eliminating it) when it has negative influence on the social system. The question, therefore, is "to what extent is the irrigated farming system been promoted by the agricultural extension service in Nigeria functional or dysfunctional?

4. RESEARCH METHODOLOGY

Kano River Project (Kadawa Sector), in the semi arid Nigeria, was selected for this study in 2007 irrigated farming season. The Kano River Project (KRP) in Kano State is one of the largest pioneer irrigation projects in the country initiated in 1970 under the Hadejia – Jama'are River Basin Development Authority (Ahmed, 1994).

From the six zones that make up the KRP, 16 farmers, who engage in dry season farming, were purposive-randomly selected from each of 4 zones, and 18 farmers from each of the remaining 2 zones, making a sample size of 100 farmers. Semi-structured questionnaire was used to collect data, which were analysed using frequency analysis for deductive and inductive conclusions and Chi-square (X^2) to test the hypotheses for significance.

5. RESULTS AND DISCUSSION

5.1 Irrigated Farming System and Farmer's Livelihood

Areas of farmers' livelihood investigated include levels of human possession, accessibility to social amenities and healthcare delivery. Table 1 shows that farmers' livelihood was enhanced as a result of participation in the *Fadama* irrigation project. Majority (76%) of the farmers invested more of their proceeds on marrying more wives, 72% on means of mobility, especially bicycles and 70% on renovating their houses and building of new ones. The high percentage of farmers investing on marrying more wives is noteworthy, as this implies having more children, thereby increasing the household size, a status symbol in the study areas. These livelihood items procured by the farmers, post-project, agreed with the benefits identified by Odejide (1994).

Table 1: Livelihood items procured by farmers, post-project

ITEMS ACQUIRED	%
More wives	76
More land	30
More/better houses	70
Bicycles purchased	72
Production items	40
Motor cycles	4
Household items	32
None	4
Motor **v**ehicle	4

5.1.1 Farmer's Accessibility to Social Amenities

As shown in Table 2, there were percentage decreases in farmers' responses as to their perception on the availability and accessibility to schools (22%), health centres (10%) and market places (44%) in the project area. The only areas of significant improvement were in the provision of access roads, transportation, boreholes and clinics which were already in place even before the advent of the project. Generally, there was a percentage decrease of 14 at the project area in the availability of and accessibility of farmers to social amenities with an insignificant X^2 -value of 7.28. The hypothesis is therefore accepted.

Table 2: Availability of and accessibility of farmers to social amenities in Kano River Project.

SOCIAL AMENITY	RESPONSES (% OF FARMERS)		
	Before Project	After Project	%Difference
Markets	60	16	-44
Schools	46	24	-22
Health Centres	36	26	-10
Transports	24	34	10
Medicine Stores	24	28	4
Boreholes	22	30	8
Roads	14	40	26
Maternity	12	26	14
% Decrease	-	-	(14)
X^2 = 7.28			

5.1.2 Farmers' Health Status in Irrigated Environment

Since a baseline study could not be carried out as to the health status of farmers before the inception of the project, the extent of farmers' predisposition to diseases attack was examined. The results shown in Table 3 revealed that farmers in these irrigation systems, including their households, were more predisposed to disease attack after the project than before it. There was increased prevalence of diseases due to increased density of vectors (Table 4) consequential to the irrigation project. Hence, the insignificant X^2 value of 3.31, and 4.80 observed for these two parameters at 0.05 level of significance (Tables 3 and 4). On this basis, the hypothesis is substantiated and therefore accepted.

Table 3: Disease prevalence before and after participating in the project.

ILLNESS/DISEASES	RESPONSES (% OF FARMERS)	
	BEFORE PROJECT	AFTER PROJECT
Malaria	32	76
Diarrhea	34	64
Filarisis	22	49
Itching	22	46
Abnormal skin condition	46	68
Terminal haematuria	24	44
Response mean	70	58
% difference	29	
X^2	3.31	

Table 4: Perceived vector density before and after the project by farmers.

VECTOR	PERCEPTION OF DENSITY (% OF FARMERS)	
	BEFORE PROJECT	AFTER PROJECT
Malaria	24	74
Flies	36	56
Snails	10	24
Total	70	154
Mean	23	51
% difference	29	
X^2	4.80	

5.2 Effects of Irrigated Dam Projects on the Environment

As shown in Table 5, the ecological hazard perceived by most of the farmers (66%) was the infestation of both farm lands and canals by weeds, followed by insects (61%), flooding (58%), erosion (57%) and to a lesser extent salinity (37%). Unfortunately, however, the farmers could not ascertain the causes of these problems talk less of preventing or controlling them, as they generally claimed "it is a natural occurrence". However, the statistical analysis showed a significant X^2 value of 19.90 at 5% probability level, implying that irrigated farming system, as practiced by the farmers, was an important factor causing environmental hazards. The hypothesis tested in this study is therefore rejected.

Table 5: Farmers' perception of the projects' impact on the environment in the study areas

ENVIRONMENTAL PARAMETER PERCEIVED	%YES	%NO	TOTAL
Flooding	58	42	100
Salinity	37	63	100
Erosion	57	43	100
Weeds	66	34	100
Insects	61	39	100
Chi square (X^2)	19.90		-

Critical Chi square (X^2) = 9.49, d.f. = 4

New weeds and new insects, which were hitherto not common in the areas, were the major environmental hazards perceived by the farmers both on their farm plots as well as along the irrigation canals. Examples of the most prevalent weeds were locally named as "kirikiri" (Cynodon dactylon L.) and "Geron Tsuntsu" (Digitaria ciliaris L.) while those of the insects included the cowpea pod borers and Selepa docilis of egg plant (Solanum melongena L.) just to mention some few.

With irrigation projects inter-sparse among uncultivated dry areas in semi-arid Nigeria, spread and survival of insects is made easier, as according to Adeoye (1986), such irrigated areas usually serve as "bridges" for insects which would otherwise be unable to travel long distances without food or shelter. The favourable micro-climate of such irrigated "islands" encouraged faster development of fauna and flora species which would have perished under harsh dry environments.

Water-logging, another environmental hazard perceived by the farmers, is a situation whereby soil water in excess of field capacity restricts aeration and inhibit normal crop development. It occurs from surface pounding of irrigation water due to restricted drainage or due to shallow water table resulting from the presence of iron pan in the subsoil. Erosion, also perceived by the farmers, occurs due to poor levelling during land preparation. As soon as irrigation water is applied, the already tilled soil, with little or no vegetative cover, is transported down slope by run-off, leading to erosion.

Salinity is perceived by farmers when there is a "whitish appearance" on the surface of their farm plots. This they attributed to excessive fertilization which they did not consider to constitute any problem since "the more the better" is their usual claim. However, salinity has been described as a situation whereby excessive concentration of soluble salts prevails within the root zone in the soil. This situation is said to be detrimental to optimum growth and development of crops and so farmers need to be adequately informed about its effects on crops.

6. CONCLUSION AND RECOMMENDATION

It is clear, from this survey, that the irrigated farming system being promoted by the extension service in Nigeria is generally dysfunctional and unsustainable. This agrees with Olofin (1993) who argued that, "neither the large nor the small-scale irrigation system is working well" in Nigeria. However, we cannot abandon irrigation since it has to provide its fair share of the national agricultural development programme. Moreover, a lot of resources have been sunk into

these projects. To get the best out of these systems and ensure their long-term sustainability, therefore, it is recommended that:

(i) Farmers should be health conscious and health educated in areas of:
  (a) wearing of boots while working in irrigated fields;
  (b) maintenance of drainage and sanitary latrine systems;
  (c) proper disposal of household wastes to eliminate breeding sites for disease vectors like mosquitoes and flies; and
  (d) other preventive mechanisms against water-borne diseases characteristic of riverine ecosystem.

(ii) Policy makers and extension service providers need to identify appropriate training strategy to be adopted in sensitizing and motivating farmers in irrigation systems on the economics of resource use, particularly as regards water and agro-chemical management so that farmers, who hitherto perceived that " the more the better" of these resources on their farms will be more conscious of the necessity to conserve them as well as the damaging effects of their excessive use on the environment.

(iii) Researchers should evolve a workable model that will incorporate the farmer's age-long indigenous irrigated farming systems into the current *Fadama* Development Initiative through the extension services to train farmers on organic manuring and reworking of farm residues into the soil and the practice of minimum tillage to reduce the development of iron-pan thereby enhancing water percolation and reduces soil erosion.

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