CONTRIBUTIONS OF RURAL WATER SUPPLY AND SANITATIONS TO AGRICULTURE: A CASE STUDY OF GWAGWALADA, NASARAWA AND NINGI RUSAFIYA PROJECT AREAS OF THE FEDERAL CAPITAL TERRITORY, PLATEAU AND BAUCHI STATES RESPECTIVELY OF NIGERIA.

BY

BILKISU ODEKINA OMAR.

A THESIS SUBMITTED
TO THE POSTGRADUATE SCHOOL,
AHMADU BELLO UNIVERSITY ZARIA,
IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE
DEGREE OF MASTER OF SCIENCE IN
AGRICULTURAL ECONOMICS.

DEPARTMENT OF AGRICULTURAL ECONOMICS
AND RURAL SOCIOLOGY,
FACULTY OF AGRICULTURE,
AHMADU BELLO UNIVERSITY ZARIA.

SEPTEMBER, 1996

DECLARATION

I hereby declare that this thesis is written by me and that it is the product of my research work. It has not been presented elsewhere in any previous study for other qualification.

..... 11/9/96

BILKISU ODEKINA OMAR DATE

The above declaration is confirmed

..... 23/9/96

DR. M. I. KOLAWALE DATE

CHAIRMAN, SUPERVISORY COMMITTEE.

CERTIFICATION

This thesis titled: CONTRIBUTIONS OF RURAL WATER SUPPLY AND SANITATIONS TO AGRICULTURE: a case study of Gwagwalada, Nasarawa and Ningi RUSAFIYA project areas of the Federal Capital Territory, Plateau and Bauchi States respectively by Bilkisu O.Omar meets the regulation governing the award of the degree of master of science (Agricultural Economics) of Ahmadu Bello University Zaria and is approved for its contribution to scientific knowledge as literary presentation.

....

DR. M. I. KOLAWALE — DATE
CHAIRMAN, SUPERVISORY COMMITTEE

....

PROF. J. O. OLUKOSI — DATE
MEMBER, SUPERVISORY COMMITTEE

....

HEAD OF DEPT. OF AGRIC. ECONOMICS — DATE
AND RURAL SOCIOLOGY.

DEDICATION

THIS WORK IS DEDICATED TO THE MEMORY OF MY LATE BROTHER, MALLAM YAKUBU OMAR ODEKINA. YOU DID NOT LIVE TO SEE YOUR PET SISTER GROW UP. MAY YOUR GENTLE SOUL REST IN PERFECT PEACE.

BILKISU. O. OMAR.

ACKNOWLEDGEMENT

I wish to express my sincere appreciation and thanks to the Chairman of my supervisory committee Dr. M. I. Kolawale for his invaluable criticism and patience during the development of the research write up. I also do appreciate the contributions of Prof. J. O. Olukosi towards improving the standard of the write up.

My profound gratitude goes to the National Water Resources Institute for providing vehicle and finance during the course of data collection and analysis.

I also wish to express my thanks to Dr. Comfort Olayiwale for providing necessary literature for the project.

Friends and relations gave me moral and financial support throughout the study period : to them I say thank you all.

My regards go to Mr A. C. Egbe for his patience during the production of this thesis.

Finally my profound gratitude and praise be to Almighty Allah for His care and guidance throughout my struggling period.

ABSTRACT

Most forms of rural development have positive bearing on agricultural growth in third world countries. This is because agricultural activities are mostly undertaken in rural areas. In this respect, improving water supply and sanitation in the rural areas is a direct attempt at improving agricultural production in the intended areas. Thus, improved rural water supply and sanitation is expected to lead to an increased agricultural production and standard of living of the rural dwellers. It was against this background that it was necessary to study one such development project established to improve the water supply and sanitation of the rural people of Gwagwalada, Nasarawa and Ningi RUSAFIYA project areas of the Federal Capital Territory, Plateau and Bauchi States respectively. Since no similar study in this areas of development existed, this study serves as an eye opener for future researches.

The major aim of this study was to determine the role played by water supply and sanitation project of RUSAFIYA in increasing agricultural production in the study areas.

Primary and secondary data were used. The primary data were information gathered from the farmers in the study areas while the secondary data consisted of information obtained from the village clinics. The tools used in analyzing the data collected were the descriptive

statistics, correlation analysis, regression analysis and tabular presentations.

The overall result of the correlation analysis showed that there existed a positive relationship between output and. the independent variable inputs such as fertilizer use and land holding among the respondents in all the three locations. The regression analysis results showed a high R^2 value for both male and female respondents in all the three locations in 1993.

The study provided understanding of the low agricultural production in rural areas. The availability of inputs such as seeds, fertilizer, agricultural machineries not withstanding,studies into health of farmers, availability of important amenities such as potable water, decent waste disposal facilities cannot be over emphasized.

The general conclusion from the respondents was that RUSAFIYA project did improve their agricultural production and their general living standard since they spend less time to obtain " Clean water" and could go to toilet just around their compounds.

TABLE OF CONTENTS PAGE

DECLARATION I

CERTIFICATION II

DEDICATION III

ACKNOWLEDGEMENT IV

ABSTRACT V-VI

TABLE OF CONTENTS VII-X

LIST OF TABLES..... XI-XII

CHAPTER ONE: INTRODUCTION..... 1

1.1 HISTORICAL DEVELOPMENT OF RURAL WATER SUPPLY AND SANITATION PROJECT IN NIGERIA..... 1

1.1.1 DIRECTORATE FOR FOOD, ROAD AND RURAL, INFRASTRUCTURE (DFRRI) 2

1.1.2 EXTERNAL SUPPORT AGENCIES 3

1.1.3 UNDP/ WORLD BANK PROJECT (RUSAFIYA) 4

1.2 PROBLEM STATEMENT 7

1.3 OBJECTIVES 10

1.4 HYPOTHESES 10

1.5 ORGANIZATION OF THE THESIS 11

CHAPTER TWO: LITERATURE REVIEW 12

2.1 OVERVIEW OF RURAL DEVELOPMENT 12

2.1.1 MEANING OF RURAL DEVELOPMENT 12

2.2 WATER, SANITATION AND RURAL HEALTH 15
2.3 WATER SUPPLY AND RURAL HEALTH 16
2.4 RURAL HEALTH AND AGRICULTURE 18
2.5 IMPACT OF WATER SUPPLY ON AGRICULTURE 20
2.6 PARTICIPATION OF THE RURAL COMMUNITY IN DEVELOPMENT 23
2.6.1 MODE OF PARTICIPATION 25
CHAPTER THREE: BACKGROUND INFORMATION 27
3.1 IMPLEMENTATION STRATEGY OF RUSAFIYA PROJECT 27
3.2 FUNDING OF RUSAFIYA PROJECT 30
3.3 FARMING SYSTEM 32
3.3.1 GWAGWALADA AREA 32
3.3.2 NASARAWA AREA 32
3.3.3 NINGI AREA 33
3.4 SOCIO-ECONOMIC ACTIVITIES 33
3.4.1 GWAGWALADA AREA 33
3.4.2 NASARAWA AREA 34
3.4.3 NINGI AREA 34
CHAPTER FOUR: METHODOLOGY 35
4.1 THE STUDY AREA 35
4.1.1 THE LOCATION 35
4.2 SAMPLE SIZE/SAMPLING PROCEDURE 35
4.3 DATA COLLECTION 37
4.3.1 PRIMARY DATA 37
4.3.2 SECONDARY DATA 38

4.4 ANALYTICAL FRAMEWORK 39
4.4.1 DESCRIPTIVE STATISTICS 39
4.4.2 CORRELATION ANALYSIS 40
4.4.3 REGRESSION ANALYSIS 40
4.5 LIMITATION OF DATA COLLECTION 42
CHAPTER FIVE: PRESENTATION OF RESULTS
AND DISCUSSIONS 43
5.1 SOCIO-ECONOMIC ACTIVITIES 43
5.2.1 DISTANCE TO WATER SOURCES 43
5.2.2 NUMBER OF MEMBERS OF
HOUSEHOLD ENGAGED IN FARMING 45
5.2.3 TIME TAKEN TO FETCH WATER 46
5.2.4 MEDICAL TREATMENT RECEIVED
BY THE RESPONDENTS 48
5.2.5 FERTILIZER USAGE 49
5.2.6 LAND HOLDING OF RESPONDENTS 51
5.2.7 FARM PRODUCE OF RESPONDENTS 52
5.3 METHODS USED BY RUSAFIYA IN
INTRODUCING THE PROJECT TO THE STUDY
AREAS 53
5.4 ASSESSMENT OF RUSAFIYA PROJECT BY
RESPONDENTS 55
5.5 CORRELATION ANALYSIS 57
5.6 REGRESSION ANALYSIS 61
CHAPTER SIX: SUMMARY, CONCLUSION
AND RECOMMENDATIONS 66

6.1 SUMMARY 66

6.1.1 SUMMARY OF FINDINGS 67

6.2 CONCLUSIONS 73

6.3 RECOMMENDATIONS 74

6.4 LIMITATIONS OF THE STUDY AND SUGGESTION FOR FURTHER RESEARCH 76

REFERENCES 77

LIST OF TABLES

TABLE	PAGE
2.1 Classification of infectious diseases related to water supplies	16
2.2 Impact of water investment	23
3.1 Project duration as at 30th June 1991	29
3.2 Project duration and completion time	29
3.3 Funding of RUSAFIYA project	31
3.4 Disbursement and balance as at June 1991	31
5.1 Distance to water sources (KM)	44
5.2 Household members engaged in farming	45
5.3 Average time taken to fetch water (hrs)	47
5.4 Average medical treatment received by respondents	48
5.5 Average bags of fertilizer used	50
5.6 Land under cultivation ·	51
5.7 Sorghum yield in bags among male respondents	52
5.8 Rice yield in bags among female respondents	53
5.9 Results of correlation analysis between sorghum output and independent variables among male respondents in RUSAFIYA project areas in 1989	58

5.10 Results of correlation analysis between sorghum output and independent variables among male respondents in RUSAFIYA project areas in 1993 59
5.11 Results of correlation analysis between rice output and independent variables among female respondents in RUSAFIYA project areas in 1989 60
5.12 Results of correlation analysis between rice output and independent variables among female respondents in RUSAFIYA project areas in 1993 60
5.13 Regression results of sorghum output and independent variables among male respondents in RUSAFIYA project areas in 1989 61
5.14 Regression results of sorghum output and independent variables among male respondents in RUSAFIYA project areas in 1993 62
5.15 Regression results of rice output and independent variables among female respondents in RUSAFIYA project areas in 1989 63

5.16 Regression results of rice output and independent variables among female respondents in RUSAFIYA project areas in 1993 63

CHAPTER ONE

INTRODUCTION

1.1 HISTORICAL DEVELOPMENT OF WATER SUPPLY AND SANITATION PROJECTS IN NIGERIA.

The history of water supply to rural dwellers in Nigeria probably dated back to the colonial era when scattered hand dug wells and borehole schemes were implemented.However, the strategy of planned water supply scheme to rural population occurred in the early 1970s with the introduction and use of hand pumps.

Nigeria had witnessed various strategies of rural water supply and sanitations in recent years. Some of the strategies were integrated along with other components of rural development by the government while others were by individual indigenous and external support agencies. Most of the strategies for water provision had its focus on the urban areas. Such recent strategies included: The National Borehole Programme, Drought Relief Water supply Programme, National Water Rehabilitation Project, Multistate water Supply Programme, The World Bank Water Supply Project.

Some programmes designed for rural development had water supply as a component. Some of those programmes are brought into this study for comparison.

1.1.1 DIRECTORATE FOR FOOD, ROAD AND RURAL INFRASTRUCTURE (DFRRI)

DFRRI was launched in 1986 by the Babangida Administration with the following development objectives:

1. To improve the quality of life and standard of living of the majority of the people in the rural areas by:

a. Raising the quality of rural housing as well as the general living and working environment in the rural areas:

b. Substantially improve the quality, value and nutritional balance of their food intake.

2. To make rural areas more productive and less vulnerable to natural hazards, poverty and exploitation and give them potable drinking water and a mutually beneficial linkages with other parts of the national economy.

At the initial stage, the directorate seems to have started on what may be considered "a serious take off". A total of 11,310 water points were provided by DFRRI as at end of 1991 since inception in 1987. DFRRI is infact fast losing face because experience has shown that boreholes installed by DFRRI broke down few moths after installation. This was attributed to the poor construction by the contractors.

In a paper prepared by the Federal Ministry of Agriculture, Water Resources and Rural Development (1992) it was observed that although DFRRI

programme could have improved water services coverage in rural areas, the sustainability elements of the programme in terms of community participation, operation and maintenance and availability of spare parts were not encouraging. From comparative studies of the various strategies to improve rural water and sanitation coverage undertaken by Federal Ministry of Agriculture, Water Resources and Rural Development (1992), DFRRI has a very low efficiency, very low sustainability but high coverage and that all its projects were executed through contracts rather than through the use of direct labour.

The mode of DFRRI programme does not allow the involvement of the rural people in all the stages of project development. This resulted in the rural people feeling unconcerned about the abandoned water points. As far as they were concerned, it was DFRRI pump and.not theirs.

1.1.2 EXTERNAL SUPPORT AGENCIES:

Some external support agencies had been directly involved in rural water supply and sanitation projects while others are at present assisting the country with rural water supply and sanitation using low-cost technologies. Among the external support agencies assisting the country are United Nations Children Fund, United Nations Development Programme/World Bank etc. These agencies employed their own implementation strategies and also involved individuals, groups, local governments, State governments to varying degrees. The strategy used has been guided by strengthening sustainability elements to community participation, direct

labour execution of the project and maintenance ability.

The sustainability elements approach of the external support agencies included the development of simpler low-cost technology which can be operated and maintained at village level. The emphasis laid on low-cost technology by the programme continues to exert influence in policy making through practical demonstration such as digging of wells, installation of the pumps and repair activities. Also the external support agencies believed that unless the user communities themselves are actively involved in the planning, financial support, operation and maintenance of the system they cannot be sustained and will break down within a fairly short period of time.

Their activities have increased water and sanitation coverage in rural areas where the projects were located.

The background of the UNDP/World Bank Water Supply and Sanitation Project was presented briefly since it was the project that was used as a case study.

1.1.3 UNDP/WORLD BANK PROJECT (RUSAFIYA)

RUSAFIYA is a United Nation Development Programme (UNDP)/World Bank Programme in Nigeria initiated in 1987 with its headquarters in Jos. It was conceived as a pilot demonstration project to execute a rural water supply and sanitation scheme which can be sustained by rural dwellers.

RUSAFIYA was initiated with the following objectives:

a. Supply of water and sanitation units at local government level for technical

an logistic support.

b. Organize project communities for installing, operating and maintaining water and sanitation services.

c. Provision of storage and distribution system for hand pump spare parts.

Generally the project aim was to provide rural water and sanitation services that are socio-culturally accepted, technically feasible and financially affordable to the participating communities. Thus, assessment was based on the techniques used. The participatory techniques in situation analysis, group dynamics and role play were the dominant methods used in training the Water and Sanitation Committee (WASCOM) members in all the project areas. These techniques were used to clarify the WASCOM members' roles to determine a suitable arrangement and maintenance of the hand pumps and Ventilated Improved Pit (VIP) latrines and to train the rural people in awareness of health problems associated with inadequate water supply and sanitation.

The implementation strategies of RUSAFIYA were based on community participation and the concept of "learning by doing".

The project was funded from an initial grant of about four million U.S. dollars from UNDP being the main sponsors of the project. Inputs from the Dutch government and an additional funding from Norwegian Agency for International Development serve as other sources of financial input to carry out the project. The Federal Ministry of Health which serves as the supervising ministry

contributes ₦50,000.00 (fifty thousand naira) per participating state. The selected States contributed ₦6,610,740.00 (Six million, Six hundred and ten thousand, Seven hundred and forty Naira) while the local governments where the project were located provided the manpower needed for the extension work and other manual labour.

RUSAFIYA project have been sited in local government areas in four states in Nigeria and a local government in the Federal Capital Territory. The states and local government areas involved in the project are: Bauchi (Ningi), Benue (Oju), Borno (Gwoza), Plateau (Nasarawa) and Federal Capital Territory (Gwagwalada).

The project team in Jos provided services in training, supervision of construction, management support and advice to all the States and local government areas involved in the project.

Each participating state had a state co-ordinator whose function was to link the implementation agency with his State government on one hand and his State government and the Local government on the other.

The Local government areas have a unit and twelve extension agents drawn from the council's health/primary health care (PHC) community development department, works and rural development departments.

The extension agents in each Local government consisted of six men and six women who have been thoroughly trained on their input to the participating community and the thrust of the project. In each benefiting community, a water

and sanitation committee (WASCOM) was established which consisted of both men and women for effective participation. The extension agents educate the rural populace and WASCOM members on the value of ownership and maintenance of facilities constructed in their communities especially the water pumps and ventilated improved pit latrine (VIP) through active self involvement.

The UNDP - Word Bank water and sanitation programme has been active in varying degrees in about 40 countries. The programme evolved from a project beginning in 1978 and assumed its present form largely in response to the priorities and goals of the International Team of (1991). The countries involved are classified into various regions. The regions are: East Africa, West Africa, South Asia, East Asia and Pacific, Latin America and Caribbean Region, Europe, Middle East and North Africa and North Africa Region.

1.2 PROBLEM STATEMENT:

Water supply is a daily necessity and key factor in human health and well being. Yet by 1970, 88% of the rural population in developing countries was estimated to be without reasonable access to a safe and adequate water supply (WHO, 1972) quoted in Anee (1977). The problem of rural water supply in developing countries is so enormous that the present strategies appear inadequate to resolve it.

According to a World Health Organisation survey conducted in 1970 only 14% of the rural world population had reasonable access to "safe water". This has

contributed to low agricultural production apart from other factors such as shortage of fertilizer, capital, labour and other agricultural inputs. Majority of rural inhabitants obtain their potable water from streams, wells, rivers and rain waters. These water sources often cause infectious diseases which drastically reduce the energy and therefore the number of working days of rural inhabitants. Low agricultural production goes a long way to affect the standard of living of the rural farmers and the nation at large.

It was estimated that about 55 million rural dwellers in Nigeria lack safe water supply and that the figure could rise to Bi million by the year 2000 unless a major breakthrough is achieved in the execution of clean water supply project in the country (WB, 1987).

Nigeria and many other developing countries are faced with the problem of low agricultural production not only due to lack of modern agricultural inputs but also due to lack of other important amenities such as potable water and sewage disposal facilities.

The low agricultural production among the rural dwellers of the study areas is attributed partly to epidemic of guinea worm infection, skin rashes, and other water related diseases and improper sanitation.

All the areas where RUSAFIYA project are sited had predominantly reported guineaworm epidemic over the years before the RUSAFIYA project. Critical view of these areas indicated that there were few abandoned water points

and no sewage disposal facility of whatever kind before the inception of RUSAFIYA project.

Agricultural development policies have focused attention mainly on increasing agricultural production without paying adequate attention to the health of producers. It was apparently thought that pumping money into agricultural sector could bring about development of rural communities. The failure to plan and fund comprehensive programme of integrated rural development where rural dwellers might benefit from good roads, potable water, proper sanitation, electricity, health clinics, access to agricultural inputs e.t.c has made the billions of naira voted and spent on programme that were supposed to improve the standard of living of the rural dwellers ineffective.

Between 1960 and 1980, for .instance, over N3 billion was allocated for agriculture and rural development in Nigeria. Between 1981 and 1985, the total expenditure on similar project rose to N13.6 billions (Analyst, 1987).

Inspite of the billions of Naira voted and spent, there has not been much improvement in the life of the rural dwellers in Nigeria three decades after independence.

The study of the rural water supply and sanitation has been chosen not only because it is a suitable pedestal to the understanding of the problems of agricultural production and rural development but because of the important role it plays in the overall improvement of rural dweller's standard of living.

It is against this background that a study of two non-conventional factors of agricultural production and rural development was chosen. A critical assessment of the contribution of water and improved sanitation to agriculture using the RUSAFIYA project as a case study was the focus.

1.3 OBJECTIVES

The broad objectives of the study was to determine the role played by the water and sanitation project of RUSAFIYA in increasing agricultural production in the study areas.

The specific objectives are:

(1) to study the methods used by RUSAFIYA in introducing rural water and sanitation as a package to the study areas.

(2) to determine the impact of the water and sanitation project to agricultural production in the study areas and;

(3) to assess the effectiveness of the RUSAFIYA project in mobilizing the rural communities for participation in rural development project

1.4 HYPOTHESIS:

(1) That improved rural water supply and sanitation will not lead to reduced medical treatment received from the clinics and therefore improved health.

(2) That improved health will not lead to more hours spent on farm activities.

(3) That improved rural water supply and sanitation will not lead to an increase in agricultural production and standard of living of the rural dwellers.

1.5 ORGANISATION OF THE THESIS

The thesis write up is made up of six chapters. Chapter one is the general introduction, the problem statement, objectives and hypotheses. Chapter two focused mainly on literature relevant to the study while chapter three is the background information. Chapter four is the methodology. Chapter five is presentation and discussion of results while chapter six comprise the summary, conclusions and recommendations for future study.

CHAPTER TWO

LITERATURE REVIEW

2.1 OVERVIEW OF RURAL DEVELOPMENT.

It would be difficult to formulate any meaningful and workable strategy for rural development, unless the policy makers of the third world Countries are made to realise the clear concept of rural development, its problems and components.

Past governments have improved the standard of living of the rural people through various programmes to increase agricultural production. According to the government, since about 75% of Nigerian population live in the rural areas, where their major occupation is agriculture, any effort made at improving rural agricultural production means rural development.

2.1.1 MEANING OF RURAL DEVELOPMENT.

The word "Development" means different things to different people. Where the difference arises is actually on the aspect of development where emphasis is laid.

The concept "development" according to Moemeka (1983) is described as an informative concept of the existing conditions that are no longer conducive to human dignity and socio-economic advancement and therefore must be changed for the better. The phrase "rural development" according to Norman (1974) is defined in many ways and can include all aspects of rural life. He stressed that rural

development is defined as the process whereby a series of quantitative and qualitative changes brought about within a given rural populations which results in improved living condition through an increased production activity" (UNESCO, 1970).

Buttern (1967) defined rural development as "almost any form of local betterment which is in some way achieved through the willing co-operation of the people living together in a defined area". Taking the Nigerian situation into consideration, Hotline (1987) defined rural development as "a strategy defined to provide rural communities with full employment, mass education, adequate food supply, roads, water supply, decent housing, health, electricity, social stability, social security and industries for communal benefits". Umalele (1976) claimed that rural development should be seen as "improving the living standard of mass of low income population residing in rural areas and making the process of their development self sustaining" . In a similar view Orewa (1974) defined rural development as a "programme which has the objectives and strategy which are aimed at transforming the citizens in rural areas from victims of poverty and ignorance into contented human beings able to earn an income capable of sustaining reasonable standard of living for himself and his family".

Abalu (1981) viewed rural development as the eradication of poverty which is a common characteristic in most rural areas of Nigeria. From the perspectives of DFRRI, development has to do with a fundamental transformation of the

nation's mode of production so as to bring into being, qualitative changes in the living conditions of rural people.

Mijindadi (1978) does not see agricultural development as being the same with rural development. According to Mijindadi, in agricultural development, the emphasis is in the combination of appropriate production factors such as seeds, fertilizers, pesticides, farm equipment as well as other supportive activities to produce food. In contrast, he stressed that rural development "focuses on people and their vocational, economically, physically and socially acceptable levels of living as the dependent variable". While agricultural development does not embrace all the components of rural development, rural development on the other hand includes agricultural development. The rural population may need food but more basic than food, they need good health, schools, amenities like clean water, good communication system e.t.c.

According to Alubo (1987) rural development is a continuous process of adapting to the environment resolving challenges in material life and having meaningful participation in both. He further emphasised that rural development entails problem identification by those who actually confront these problems and not by the World bank and its surrogates.

The definition of rural development given by Diejeomah (1973) seems to have taken care of all the components. According to him,rural development is defined as a process of not only increasing the level of per-capita income in the

rural area, but also the standard of living of the rural population. The standard of living on the other hand depends on critical factors such as health, nutrition, housing,water supply,electricity, roads and recreation.

2.2 WATER, SANITATION AND RURAL HEALTH

According to David (1977), the relationship between water and health has been recognized from the time of Hypocrites, if not earlier. The association of marshy places with fevers and many unsophisticated communities in the tropics have similar views and are very discriminating in their voice and use of water.

Snow (1855) was the first to show a precise relationship of diseases to water in his well-known studies of cholera and he was closely followed by Budd who demonstrated the spread of typhoid through water supplies. In the later part of the nineteenth century, another type of relation to water was shown by Manson (1977) for filariasis and Rods for malaria (Dand, 1977). Guinea worm and schistosomiasis or bilharziasis were shown to depend on fresh water invertebrate for their spread.

The relation of personal hygienic to health had been recognized for many years though only recently have a series of epidemiological studies shown how the details of "access" to water determine the incidence of several infectious diseases. Furthermore, the supply of water do greatly influence facilities for disposing of human excreta and this in turn affects the spread of many important diseases.

Table 2.1: Classification of infectious diseases related to water supplies:

	CATEGORY	EXAMPLES
1	Water -borne infections. (a) classical (b) Non classical	Typhoid, cholera. Infective hepatitis
2.	Water - Washed infections (a) Skin and eyes (b) Diarrhea diseases	Scabies, Trachoma. Bacillary dysentery
3.	Water - based infections: (a) Penetrating skin (b) Ingested	Schistosomiasis Guinea worm
4.	Infection with water related insect vectors: (a) Biting near water (b) Breeding in water	Sleeping sickness yellow fever.
5.	Infections primarily of defective sanitation	Hookworm.

SOURCE: David J.B.(1977) in Health aspect of water supplies in Tropic Countries.

2.3 WATER SUPPLY AND RURAL HEALTH.

The rural dwellers usually have some sources of water available to them, even if these sources are unsafe and have to be fetched from a considerable distance from the house.

The availability of good and adequate water in rural areas for the communities is a basic development strategy. Water related diseases such as typhoid, guinea worm and epidemics that result from scarcity of good potable water and sanitation system is most predominant in the less developed countries in general and in the rural parts of Nigeria to be specific.

In more advanced countries where all urban areas have some form of functioning water supply and sanitation system, it is agreed that improved health and economic benefits would be generated if water were improved in rural "bad water" areas rather than urban ones. Robert et al (1976) in their study stated that although urban areas may need additional investment to reach World Health Organisation water supply standards, the contention is that there would be small change in health and economic activity from urban water supply improvement relative to the change to be expected from setting up a series of new water supply systems in rural areas lacking any potable water system at all.

A survey of diarrhea diseases was carried out by World Health Organisation in Mauritius in 1960 on a cross-section basis, the rural families were physically examined and rectal swab cultures were taken. The conclusion drawn from the study showed that:

a) Greater diarrhea infection rates were found among those who had less readily available water supply.

b) There was less diarrhea among those using municipal water.

Also, in a summary report on diarrhea diseases studies carried out, in seven developing countries over a five year period "1960 - 1965"(by WHO), among the general conclusions of the studies were that:

i. The availability of water definitely influenced the incidence of diarrhea. However, in all areas with basic sanitation where piped water supply was available, diarrhea rates were reduced.

ii. With the availability of water, the rate of reported diarrhea was found to have decreased. Difference between the reported cases of diarrhea in water supplied and non-water supplied areas were statistically significant in United Arab Republic and Iran.

iii. Provision of a piped-water supply to a community with basic sanitation led to a drastically significant reduction of diarrhea.

Poor water sources and sanitation are linked to many diseases such as diarrhea, guinea worm, cholera, infectious hepatitis and schistosomiasis. These together with malaria are the major causes of high mortality rate. Guinea worm disease has been shown to have a negative impact on agricultural production because of loss of many man-days caused by disability of the victim (FMAWRRD, 1992).

2.4 RURAL HEALTH AND AGRICULTURE:

Improving rural water supply and sanitation is an essential step in the development of rural industries, agriculture and other agro-based business such as

local weaving, cloth dyeing, vegetable and fruit production and other food processing. Benefits from these activities can be measured directly and its impact on the rural people can also be determined.

The causes of infectious diseases can be linked with sources of potable water. These disease drastically reduce the amount of working days of rural dwellers. The prevalence of these infections disease (cholera, skin rashes, typhoid etc) can be attributed to the sources of potable water, personal hygiene, environmental sanitation, indecent housing and location, nutritional and literacy level (Idachaba et al, 1980).

Infections are responsible for significant amount of lost man-days which translate into loss of substantial amount of agricultural contribution to the nation. Guinea worm infection becomes a cause of death when accompanied by cholera, typhoid and tetanus bacteria. These diseases have an adverse effect on health, education, social and economic activities of rural population in Nigeria. Since about 80% of the rural dwellers rely on agriculture for their subsistence and income, it is this sector that is mostly affected by the incidence of these epidemic diseases. This is particularly so because the peak of guinea worm, cholera and other infectious diseases overlaps with the critical period of labour demand for planting and harvesting . Agricultural activities will be neglected due to ill-health among the farmers.

World Bank (1976) identified two ways by which improved village water supply could increase rural production: First by reduction in the time and effort spent in fetching water and second; by increasing output through improved health. A reduction in endemic and parasitic diseases results in better utilization of food and avoids a waste of scarce resources such as labour.

2.5 IMPACT OF RURAL WATER SUPPLY ON AGRICULTURE :

Water had been in critical supply in most third world countries even though it plays a major role in development (Mageed, 1988). Water continues to be critical in every major effort to advance the course of civilization. There can be no diseases control and agricultural production improvement if the water supply system and sources is bad along with inadequate supply of agricultural inputs. No agro-industrialization that does not ultimately depend on a reliable supply of water. Improved rural water supply and sanitation projects are normally justified on the basis of their positive impact on the agricultural production and health and on the general development of rural areas.

A water supply project is both a consumption good and an investment good. It is an investment good in that it is part of local infrastructure and can indirectly generate additional future economic activity by attracting and assisting local commerce and industry and the improved health of local human resources can increase agricultural production.

A water system designed in a way to promote excess capacity during some

parts of the day could allow limited irrigation of small garden plots near the taps as additional benefits to the rural people living near such water points. This policy tends to produce the benefits in areas with acceptable soil but dry climate or in areas with at least one dry season where the lack of water is an inhibiting factor to garden. Garden can also be irrigated with waste water. An example of a successful water application is found in Lahore, Pakistan where a significant amount of food for human and animal consumption was produced by the waste water irrigation method (Robert et al 1976).

In Kenya, it was found that one of the major benefits of the Zaina potable water supply scheme for human consumption was the increase over four years period in the number of cattle, pigs, goats, sheep and poultry. This occurred in the areas where there was access to water trough than occurred in a similar nearby area that do not received a potable water supply system (Fenwick, 1966). Many rural water supplies will significantly reduce the walking distance and will lead to savings of time and energy. People attach value to time saving and that it has a real social benefit. When time and energy saving are achieved, the supply will have a genuine amenity value and more relief from drudgery has a real social benefit. If the time saved resulted in extra time being devoted to agriculture or other domestic chores, the social benefit of the project would be important and cannot be over emphasized.

Time saved in collecting water can be devoted to agricultural labour. Labour released for agriculture has an economic value if its marginal productivity is positive. The crucial determinant is its contributions during agricultural labour utilization peaks. However, in many rural communities, the marginal productivity of labour is high at times of land preparation, weeding, harvesting e.t.c. In dry areas where people depend on livestock (Cattle), water supply may provide a real benefit in keeping cattle alive if water was more limited in supply than grazing. In Kenya it was found that significant livestock benefits rose with an on farm connections, so that people did not have to walk their cattle and mix them with other people's animals (Fenwick,1966).

One important benefit from a safe and reliable community water supply arises when permanent settlement is made possible in fertile areas or grazing areas which are under populated owing to lack of dry season water (Ian and David, 1977).

Table 2.5 illustrates schematically major sources of possible benefits which a water project may create,(Ian and David , 1977). In some rural areas, the number of possible benefits is expected by availability of water in dry periods than by fodder and fertilizer or labour availability for livestock and crop respectively. Improved water supply is likely to increase livestock and crop production if other inputs such as feeds, medication and management for livestock and fertilizer, seeds, pesticides, labours, good land e.t.c for crop are adequate in supply.

TABLE 2.2: Impact of water investment.

POSSIBLE EFFECTS FROM WATER INVESTMENT.	SOURCES OF HIGHER INCOME	SOURCES OF IMPROVED HEALTH	SUMMARY OF BENEFITS
Public subsidy	Income distribution	n.a	More cash income
New crop activity	Higher value product.	Improved Nutrition	More cash income
Significant Labour release	More crops are cultivated	Improved Nutrition.	More or diversified subsistence improved health
Dairy Development	High value product High prices	Improved Nutrition	employment
Improved practice	Lower cost	n.a	More cash income
Less hired labour	Lower cost	n.a	More cash income
Water not carried		n.a	More cash income.

n.a : Not Applicable

SOURCE : Ian and David (1977); The Economics of community water supply and water waste and health in hot climate.

2.6 PARTICIPATION OF THE RURAL COMMUNITY IN DEVELOPMENT

Rural development from top to bottom strategy is part and parcel of the centralised planning system associated with conventional growth model. This planning model has little or no room at all for participation by the beneficiaries of

the development programme in the rural areas.

It was generally argued by Nkom(1982) that rural development programmes conceived and implemented by outside agencies tends to be ill-adapted to community circumstance and needs.This he said was because of limited reach or coverage, capacity for their sustained maintenance which could lead to under utilization of local resources and talents and generally creates a dependency situation whereby people abandon their old ways of doing things and become increasingly dependent on outside efforts which are themselves subject to drastic changes, administrative lapses or sudden stops. In other words, such programme are more costly, have higher chances of failure and tends to undermine rather than strengthen the capacity for local self action (Korten, 1981). According to Korten, emphasis should be laid on local participation in rural development.

Cohen and Uphoff (1977) identified four forms of participation:

1. Participation in decision making,
2. In implementation,
3. In sharing of benefits and;
4. In the evaluation of projects and programmes.

Participation in implementation involves human resource contributions to the execution of project and programme and the level of their readiness to adapt, accommodate and make contributions that can result to the success of the project or programme.

The level at which people participate in implementation of any development project depends on the extent to which they were involved in the decision making as well as their anticipation of benefits which they stand to gain from the project (Nkom, 1982).

2.6.1 MODE OF PARTICIPATION:

The rural people are as willing as any other group to participate in development activities especially those activities that will improve the quality of their living. The modalities for involving the rural people are equally important to the success of the project or programme.

The first mode of involving the rural communities, according to Abasiekong (1987), is by assigning them policy making role.He stressed that rural development planners should involve the rural poor in decision making. In this respect the representatives of the rural people should be regarded as essential members of planning and execution team of rural development projects. This modality is necessary because it will be assumed that the information brought by the rural people or their representatives regarding their needs problems and attitudes is near reality since the rural poor know what they need.

A second mode of involvement of the rural people in rural development can take place in the form of integrated rural project development. In this case participation of the communities is seen as a means of securing reliable information and feed back from the people by planners and policy makers. This

approach takes the opinion of the rural people into consideration by those that are supposed to be serving them.

The third mode of involvement is by increasing the power of the rural poor. This, according to Kramer (1969), is organizing and mobilizing the low income persons which in return serves as an effective pressure group that could influence the bureaucracies responsible for the rural poor under development. Hatch (1976) from his studies found that unless present rural practices, beliefs and attitudes are sympathetically understood by outsiders, especially policy makers, interventions are likely to be misguided.

The frequently mentioned reason for the failure of rural development projects in Nigeria is the lack of participation of the rural people in planning and implementation of projects. Abasiekong (1987) pointed out that for any successful development programmes, the rural people must form the subject and object of such development programmes.

Omar (1993) pointed out that the highest potential of sustainability is achieved when the community is involved in all the phases of the project. If any water project is to operate satisfactorily, the community involved have to be made to recognize the need for improving the water supply, they are also supposed to be educated on how to be responsible for maintenance and eventual replication of similar water system in their immediate neighborhood through "learning by doing".

CHAPTER THREE

BACKGROUND INFORMATION

3.1 IMPLEMENTATION STRATEGY OF RUSAFIYA

RUSAFIYA undertook an implementation strategy based on communal participation . The process which RUSAFIYA management used involved beginning with the most available resources and approach and institutional arrangement using the method of " learning by doing". As a learning by doing project, the RUSAFIYA management arrangement was modified totally as a result of increase in understanding and scope of the project. Water and sanitation divisions were established in all the project Local Government Areas with their heads appointed by the Local Government Councils as managers of the project implementation in all the involved local government areas .

The States participated in the activities of the project and serve as key factor in fostering good and speedy project performance in the pilot local government areas as well as towards replicating the same water and sanitation scheme in other local government areas of the State after the termination of the support grant from UNDP and the Netherlands Government.

The water and sanitation division was responsible for effective co-ordination of the project within the local government council's secretariat and in the benefiting communities . Before the take off of the project, a rapid reconnaissance survey (RRS) was carried out to identify communities and their felt need. A report

of the RRS was discussed with each local government area on the laid down criteria agreed upon by the local government council. This was then followed by an orientation training of the extension workers to acquaint them with what was expected of them and the extent of the thrust of the project.

Similarly, the extension workers used participatory approach to carry out community mobilization and education on principles of community management to convince the entire community and to ensure that people regard the water points as theirs. Also the extension workers had to make the community take upon themselves the duty of maintaining the parts and cleanliness of the surroundings of the water points and their VIP latrines. These were achieved by using the funds contributed by the beneficiaries. The beneficiaries were made to form associations for proper coordination of duties and effective collection of the fees from the villagers who also benefit from the water project. Women were encouraged to hold positions in the water and sanitation committee (WASCOM) formed, such as hand pump mechanics and village hygienic educators.

The project which started in September 1987 was given an even duration in each of the local government area i.e. from September to December 31st 1991. As at June 1991 two local government areas were in their 36th Months. According to the project team report from Jos, the delay in starting the project was due to delays in signing the memoranda of understanding in some States and late payments of the government counterpart funds in order to complete some of the

borehole contracts.

Table 3.1 Project Duration as at 30th June, 1991

LOCAL GOVERNMENT AREA	DURATION (MONTHS)
NASARAWA	45
GWAGWALADA	32
NINGI	37
GWOZA	28

Sources: A summary situation report on RUSAFIYA (JUNE,1992).

The project was supposed to have ended finally on 30th June 1992 in all but one local government area (Oju - Benue). But the project was not completed till March 1993 in all the selected study areas. The estimated time over run is discussed in table 3.2.

Table 3.2: Project Duration and completion time

LOCATION	TIME STARTED	TIME COMPLETED YEAR	MONTHS	ESTIMATED COMPLETION TIME YEAR	MONTHS	TIME OVER RUN (MONTHS)
GWAGWALADA	SEPT.1987	MAR.1993	66	DEC.1991	51	15
NASARAWA	OCT. 1988	MAR.1993	53	DEC.1991	38	15
NINGI	MAY 1988	MAR. 1993	58	DEC.1991	43	15

SOURCE: FIELD SURVEY, 1994.

Though all the locations were given even duration i.e. from september 1987 - December 1991, Nasarawa and Ningi project areas did not take off until October

1988 and May 1988 respectively.

The time overrun of about fifteen months (15) in all the three selected local governments was attributed to delay in the payment of government counterpart fund, complexity of project design and miscellaneous management issues. The "miscellaneous management issues" were termed confidential and should not be discussed further, according to the RUSAFIYA personnel.

The time overrun could have increased the costs of project as a result of inflation and increase in cost of inputs over time, since the various costs incurred were not made available it was difficult to determine the cost overrun of the project.

3.2 FUNDING OF RUSAFIYA PROJECT.

RUSAFIYA project was funded from an initial grant of about four million U.S. Dollars from United Nation Development Programme (UNDP) who was the main sponsor of the project with some inputs from Dutch government. Additional funding was secured from NORAD to carry out the Oju small pipe scheme. The Federal Ministry of Health as the supervising ministry was supposed to have contributed ₦50,000.00 (fifty thousand naira) per annum. Making a total contribution of ₦250,000.00 (two hundred and fifty thousand naira) per annum. The selected States were also supposed to have contributed their share to the project body. The amount to be contributed by the various participating States depended on the intensity of the project in the area involved. The amount to be

contributed by all the bodies involved are shown in Table 3.3:

Table 3.3: Funding of RUSAFIYA Project.

SOURCE	AMOUNT
UNDP	$ 3,130,727
THE NETHERLANDS GOVERNMENT	$ 797,244
FEDERAL GOVERNMENT OF NIGERIA	₦7,756,754.00
STATE GOVERNMENTS	₦6,610,740.00
TOTAL	$ 3,927,971 AND ₦14,367,49700

SOURCE: Field survey, 1994.

The amount contributed and balance outstanding made by the Federal Ministry of Health and the participating States are shown in Table 3.4 . The contribution was as at June 1991. The disbursement pattern of the UNDP and the Netherlands Government were not made available.

Table 3.4: Disbursement and balance as at June 1991 .

STATES	AMOUNT TO BE CONTRIBUTED (₦)	AMOUNT CONTRIBUTED (₦)	BALANCE OUTSTANDING (₦)
FMH	1,000,000.00	890,000.00	110,000.00
BAUCHI	2,102,573.00	1,692,211.00	410,362.00
BENUE	2,371,570.00	597,730.00	1,773,840.00
BORNO	1,709,700.00	653,560.00	1,056,140.00
PLATEA	1,607,867.00	938,390.00	69,577.00
U	2,236,885.00	1,838,949.00	97,935.21
FCT	10,428,059.00	6,610,740.79	3,817,854.
TOTAL			

Source : A Summary situation report on RUSAFIYA (WATSAN project NIR/87.001), 1992.

The failure of the States involved to meet their financial obligation has been the primary source of delays in all the project areas. The fund paid was normally

used in purchasing the equipment for the hand dug wells, the boreholes, hand pump materials as well as the VIP latrine materials. Materials needed for demonstration purpose were to be financed from the fund. Allowance and other general expenses of RUSAFIYA personnel and the project were partly financed from the fund.

3.3 FARMING SYSTEM

3.3.1 GWAGWALADA AREA:

The area is characterized by light rainfed, upland family farms situated around villages and hamlets. The area is not intensively cultivated as most parts have less than 35 percent of the land within cropping cycle

The main crops are sorghum, yams and maize. Sorghum and yams are grown throughout the area. The main farming system recognized in this area is yam-sorghum system. Several varieties of cowpeas are grown together with cassava and long season bulrush millet.(dauro) " Acha" Digitaria exilis is important in this area. Rice is grown normally by women in this area.

3.3.2 NASARAWA AREA:

Nasarawa is an area which has been cultivated intensively. The intensity of cultivation is concentrated in Nasarawa town while the hilly area along the boarder is largely uncultivated.Sorghum is grown throughout the area. The cultivation of yams are termed as being very important. The main farming system in this area is the yam-sorghum system. Rice is grown where-ever water is available.

3.3.3 NINGI AREA

The farming activities are characterized by rainfed, upland farming with use of some draught animals. The main crops grown are sorghum and bulrush millet, usually interplanted with cowpeas. The major farming system is the millet-sorghum system. In this area, groundnut are the most frequently grown cash crop, the other crop grown in minor scale included cassava. Rice is grown in wetland or swamp conditions. Sugar cane is also grown. All the crops are grown on ridges.

3.4 SOCIO-ECONOMIC ACTIVITIES

3.4.1 GWAGWALADA AREA:

Surplus food crops, particularly yams and sorghum are sold in local markets or to traders. Maize, rice and groundnut are also sold. Cultivation is almost entirely by hand with little use of organic fertilizer or manure. There are no draught animals and little mechanical cultivation. Maize, millet and cassava are grown on ridges. Yams are grown on large circular mounds. Cattle are rarely owned by the farmers. The value of cattle manure is not generally appreciated, thus cattle are considered a hazard rather than a benefit because of trampling. The major cash crops are yams, sorghum, beneseed and rice. The mean annual rainfall is about 1524mm and the length of rainy period of 190 days(Kowal and Knabe,1972).

3.4.2 NASARAWA AREA

Yams are the most important food crop though, sorghum, maize and cowpeas are inter-planted with yams. Yams and calabashes are the major cash crops but groundnut and cowpeas are also grown and sold. Cultivation is by hand as there are no draught animals or mechanized cultivation in the area. Farmers do not commonly own cattle but there are a number of settled fulani herdsmen. The value of farm yard manure is appreciated by maize, calabash and sorghum farmers, thus they are commonly grown on land where the fulani cattle have been kept. Nasarawa has a mean annual rainfall of about 1299mm with length of rainy period of 190 days (Kowal and Knabe, 1972).

3.4.3 NINGI AREA:

The most important occupation of Ningi people is farming. The main cash crop is groundnut. Draught animals are used for tedious jobs such as harrowing and ridging. Food crops such as sorghum, bulrush millet and cowpeas are normally inter-planted. Palm species "dabino" (date palm) also form one important cash crop though it has a long maturity period.

Cattle are commonly owned by farmers due to their importance as draught animals and also as sources of wealth. Donkeys are mainly used for transporting farm inputs to the farm and harvested crops from the farm. Calabashes are also grown and sold, although in small quantity. The mean annual rainfall is 1,016mm with rainy period of 130 days (Kowal and Knabe, 1972).

CHAPTER FOUR.

METHODOLOGY

4.1 THE STUDY AREA.

The study covers RUSAFIYA rural water and sanitation's project in three different locations in Nigeria. These locations are Gwagwalada in Federal Capital Territory, Nasarawa in Plateau State and Ningi in Bauchi State.

4.1.1 THE LOCATION

The study areas are located on longitude $7^{0}00'E$, - $7^{0}10'E$, $7^{0}35'E$ - $7^{0}42'E$, and $8^{0}5'N$ - $9^{0}35'N$ and latitude $8^{0}45'N$ - $9^{0}12'N$,$8^{0}30'N$ - $8^{0}35'N$ and$11^{05}S'$- $11^{0}30'S$ for Gwagwalada, Nasarawa and Ningi project locations respectively. The maximum temperature during the rainy season ranges between 29.7°C - 35.6°C, 29.7°C - 35.6°C and 28.4°C - 34.9°C while the minimum temperature ranges between 21.8°C - 24.8°C, 22.3°C - 25.2°C and 19.6°C - 22.8°C for Gwagwalada, Nasarawa and Ningi project areas respectively.

The predominant soil(parent material) of the study areas are derived from precambrian granite gneiss and migmatite of the basement complex. The surface horizons of many of the soils are sandy, which may be due to eolian sands.

4.2 SAMPLES SIZE/SAMPLING PROCEDURE:

The local government areas and States benefiting from RUSAFIYA water supply and sanitation's project are; Gwagwalada - Federal Capital Territory, Gwoza - Borno State, Nasarawa in Plateau State, Ningi - Bauchi State and Oju -

Benue State. Three of these project areas are Gwagwalada, Nasarawa and Ningi in the Federal Capital Territory, Plateau and Bauchi States respectively. The projects were located in the mentioned areas above due to persistence Guinea Worm and Cholera epidemic.

The selection of the three areas listed above was purposive based on proximity to the project headquarters (Jos) and easy accessibility of the locations for convenient administration of the questionnaire.

All the clusters of Villages in each selected local Government area were covered in the administration of the questionnaire. The cluster as used in this study means a collection of Villages/ population that benefitted from RUSAFIYA project.

Number of Villages depending on their population make up a cluster. The number of clusters in the selected local Government areas, varies depending on the number of villages and human population of each Local Government Area. Since the villages were close, in all selected local government areas, all data collected in the Villages were coded and treated under the broad umbrella of the local Government Areas concerned. The selection of respondents was through the use of stratified random sampling. Stratification was used for grouping the population into:

1. female and male.
2. persons who had suffered from water related infections such as

guinea-worm, cholera, skin rashes etc. before the inception of the water and sanitation project and;

3. those that are recognized for their agricultural production activities.

Simple random sampling method was then used to select the respondents. Forty respondents that were made up of 24 men and 16 women were randomly selected in each of the three local Government Areas. Those that were selected satisfied the stratification stated . A total of one hundred and twenty (120) respondents were selected and interviewed.

4.3 DATA COLLECTION

4.3.1. PRIMARY DATA:

The primary data were collected directly from the beneficiaries by means of structured questionnaire. A structured questionnaire is a set of questions systematically asked and printed by the researcher and respondents are free to express their opinion on the same questions on the space provided on the questionnaire. This method was used for the purpose of future reference and analysis .

The information that were collected included: traditional farming system, incidence of water related diseases before and after the inception of RUSAFIYA project, sources of potable water before RUSAFIYA project, number of times treatment was received before and after the inception of the project. Information on distance from the farmers houses to the sources of water before the

RUSAFIYA project and the distance to the RUSAFIYA water points were obtained through the use of comparative estimation of distances between two villages in Kilometers.

The time taken to obtain the water from the sources before RUSAFIYA project and the time taken to fetch water from the RUSAFIYA water points were obtained by comparative estimation of times compared to Radio Nigeria Kaduna 1 (Hausa station) programmes which is widely listened to by the respondents.

Household agricultural output before and after the inception of RUSAFIYA project was obtained. Information on output that was obtained were number of bags of sorghum harvested in 1989 and 1993 by the male respondents, and number of bags of rice harvested in 1989 and 1993 by the female respondents. Consideration was given entirely to these crops as a good indicator of increase or decrease in farmers output since these were the major crops commonly grown by the two categories of respondents in the project areas.

Information on perception of the respondents of RUSAFIYA project and problems faced as a result of the project was obtained.

4.3.2 SECONDARY DATA:

The secondary data used for this study were obtained from the records of water related diseases reported in the clinics in the study areas before and after the inception of RUSAFIYA project. Another set of secondary data was obtained

from the project headquarters in Jos on the costs of implementation of RUSAFIYA projects in the selected areas. Also the organizational structure of those that were involved in RUSAFIYA and information on the activities of the extension agents in the study areas were also collected. The information from the project headquarters was used to determine the methods used in introducing the water and sanitation project to the rural people of the study areas.

4.4 ANALYTICAL FRAMEWORK

In view of the largely qualitative nature of the data that were collected most of the analysis were descriptive in nature.

The primary data collected were tabulated and analysed using such techniques as Analysis of variance, multiple regression analysis and descriptive statistics. Cross tabulations were also made from the computer print out to indicate the relevant averages and their relationship. Relationship between awareness, participation, ownership of VIP latrines,medical treatment received in the village clinics, number of household members engaged in farm activities, bags of fertilizer used, distance to the sources of potable water, time taken to fetch the water and farm output were highlighted to examine statistical significance between the above variables and the output.

The analytical tools that were used are enumerated as follows:

4.4.1 DESCRIPTIVE STATISTICS.

The descriptive statistics used were measure of central tendency such as

relationship between some variables that explain the presence of debt among commercial farm operators. Long (1968) used two sets of regressions equations in the study of "why peasant farmers borrow" Qualitative variables were employed by the two studies cited above. Variables such as race of operator, experience on the farm, accessibility to market area e.t.c.are qualitative in nature.

In this study some quantifiable data were obtained from the respondents and were used for the analysis.

The following model was used for the regression analysis.

$Y = f(F, T, H, L)$.....(2)

Where

Y = Average output

F = Bags of fertilizer

T = Treatment received

L = Land(average) cultivated

H = Household members engaged in farm activities.

There are alternative functional forms of the model stated above. The appropriate form to be fitted to the data depends on two criteria, first;

functional forms simple enough which can explain the problem accurately, and second;

the form which has the best predictive power (Teh ,1973).

Ogunfowora et al (1975) stated that the linear and power functions are

mean, averages and percentages. The methods formed the basis for objective and subjective conclusions on the effect of RUSAFIYA project on the communities involved.

4.4.2 CORRELATION ANALYSIS

This tool was used to analyze data on the relationship between improved water and sanitation provision and the agricultural production.

The correlation coefficient(r) is a measure of the degree of closeness between two variables. It is calculated using the following formula.

$$r = \sqrt{\frac{(x-\bar{x})^2(y-\bar{y})^2}{\sum (x-\bar{x})^2(y-\bar{y})^2}} \text{----------(1)}$$

Where r = correlation coefficient

$X_1 \ldots X_4$ = independent variables

X = Mean of variables $X_1 \ldots X_4$

Y = Household output

$\bar{Y}$ = mean of variable Y.

The variables found to have influenced the average output of the respondents were singled out and used for regression analysis.

4.4.3 REGRESSION ANALYSIS

This tool has been used with success by Melichar in 1965 to analyze the

particularly useful where interest revolves around the quantitative estimation of relationship between variables. They pointed out that quadratic and other functional forms fitted to variables generally lead to a loss of degrees of freedom and often results to too many regression coefficients which are not often significant (in a probability sense).

4.5 LIMITATION OF DATA COLLECTION

During the course of this study, a number of problems related to data collection were encountered.

Firstly, due to the level of education of the respondents, lack of record keeping was a problem. Records such as the number of bags of fertilizer used, hectares under cultivation, number of household members engaged in farm activities for the farm operation, number of time that farmers received treatment in the village clinic/dispensary and the output obtained at the end of 1989 and 1993 were either under estimated or exaggerated.

The size of the farm output (yield) in the three locations should therefore be interpreted with caution since there were no standards to be compared to and also since most of the information depended on the farmers ability to recall events.

Secondly the secondary data that were collected from the RUSAFIYA officials were not indept since information on items such as costs involved were classified as official and confidential.

CHAPTER FIVE

5.1 PRESENTATION OF RESULT AND DISCUSSIONS.

Results are presented in five sections: presentation of the socio-economic activities before and after the inception of RUSAFIYA project, among the two categories of respondents in all the selected project areas, the role played by the RUSAFIYA personnel in introducing the project to the rural areas, the perception of the respondents of RUSAFIYA project and other development projects generally and finally the mathematical analysis comprising of the correlation and regression models.

5.2 SOCIO-ECONOMIC ACTIVITIES:

Description of the socio-economic activities of the two categories of respondents before (1989), and after (1993) the inception of RUSAFIYA project in the selected project areas are as follows:

5.2.1 DISTANCE TO WATER SOURCES:

To emphasize the distance trekked to obtain potable water for household use, the distance covered to fetch water from the existing sources before the inception of RUSAFIYA project and now with the RUSAFIYA water and sanitation points are resented below in the three selected locations i.e Gwagwalada, Nasarawa and Ningi areas among the males and female respondents.

Table 5.1 Distance to water sources (km)

	1989		1993			
LOCATION	MALES	FEMALES	MALES	FEMALES	%DECREASE MALES	% DECREASE FEMALES
GWAGWALADA	1.56	1.25	0.61	0.36	60.9	71.2
NASARAWA	1.46	1.80	0.61	0.45	58.2	75.0
NINGI	1.75	1.22	0.47	0.45	73.1	63.1
CUMULATIVE AVERAGE	1.59	1.42	0.56	0.42	64.8	70.4

Source: Field survey, 1994.

From Table 5.1 about 60.9% reduction in distance was recorded among the male respondents of Gwagwalada project area while about 71.2% was recorded for the female respondents in the same location. Similarly for Nasarawa location, a reduction of about 58.2%for male and 75.0% for female respondents was recorded. In Ningi location the percentage reduction in distance were 73.1% and 63.1% for male and female respondents respectively. Considering the cumulative average, about 64.8%reduction for males and 70.4% for females in the three locations jointly were observed.

This finding may be of importance to the various agricultural development authorities and research Institutes. It is implied that provision of potable water and decent sanitation near the user's household could lead to less trekking to water sources which in effect could lead to less fatigue and drudgery on the farmer's energy. The released time thus could be put into agricultural activities or other domestic chores.

5.2 NUMBER OF MEMBERS OF HOUSEHOLD ENGAGED IN FARMING:

Family labour was the mostly available labour that the farmers in the project areas utilized. Therefore an attempt was made to relate the number of members of household engaged in farming to the output obtained at the end of the farming season. The household involvement in average and percentage changes are presented in Table 5.2

Table 5.2: Household members engaged in farming.

	1989		1993			
LOCATION	MALES	FEMALES	MALES	FEMALES	%DECREASE MALES	% DECREASE FEMALES
GWAGWALADA	7.3	7.7	7.4	11.9	1.37	54.5
NASARAWA	7.1	6.8	7.3	9.1	2.82	33.8
NINGI	14.1	8.2	12.0	11.9	-14.89	40.2
CUMULATIVE AVERAGE	9.5	7.5	8.9	10.9	-2.19	45.3

Source: Field survey, 1994.

Table 5.2 shows that though there was a general increase in the number of household engaged in farming after the inception of RUSAFIYA project, specific cases of decrease in household members was recorded among the male respondents in Ningi project area i.e. 14.1 in 1989 to 12.0 in 1993 which gives a decrease of 14.89%. This therefore affected the cumulative average and resulted to a decrease of about 2.19%.

The highest increase was observed among the female respondents of Gwagwalada project area. The recorded increase was about 54.5% while the lowest increase in the female category was among the female respondents of

Nasarawa project area i.e. 33.8%.

The high difference between the percentage cumulative average of the male respondents and that of the female respondents cannot be explained but it could be assumed that the female respondents are likely to be more reliable because during the course of data collection, it was discovered that the recall ability of the female respondents was better than that of the male respondents. Also since the female respondents are more directly involved with all members of the family, there was high possibility that the women are in position to know the number of members of the family that were involved in farming activities in a particular farming season.

5.2.3 TIME TAKEN TO FETCH WATER.

Value is attached to time saving because of the benefit derived from it. Time saved in collecting water could be devoted to agricultural labour or other domestic chores. Labour released for agriculture has an economic value if its marginal productivity is positive. The time taken to obtain water from existing sources before RUSAFIYA project and after are presented in Table 5.3

Table 5.3: Average time taken to fetch water (Hrs.)

	1989		1993			
LOCATION	MALES	FEMALES	MALES	FEMALES	%DECREASE MALES	% DECREASE FEMALES
GWAGWALADA	2.33	2.13	1.04	1.19	58.2	40.6
NASARAWA	2.32	3.34	1.22	1.00	46.05	71.96
NINGI	3.33	2.45	1.32	1.04	56.8	61.2
CUMULATIVE AVERAGE	3.06	3.03	1.19	1.08	57.5	62.8

Source: Field survey, 1994.

From Table 5.3, the percentage reduction in time used in trekking to the existing sources of water (1989) and now with the RUSAFIYA water points relatively near the household compounds are 58.2% and 40.6% for male and female respondents of Gwagwalada respectively. In Nasarawa project area, the percentage reductions are 46.1% and 71.9% for male and female respondents respectively, for Ningi project location, the percentage reduction in time taken for males and females respectively are 56.8% and 61.2%. The cumulative average reduction in time for both males and females are 57.5% and 62.8% respectively.

Time saved mentioned earlier could be utilized for agricultural labour and other domestic activities. Labour used for agricultural purpose has an economic benefit. The implication from the finding presented in Table 5.3 is that all the locations had considerable reduction in time after the inception of RUSAFIYA project. The time saved ought to have a positive effect on agricultural production or other domestic activities.

This finding could be of importance to planners and policy makers

concerning integrated rural development programme because the ultimate aim of such programme is to improve the standard of living of the rural dwellers. Improved agricultural production cannot be achieved by the use of sophisticated implement only without the full utilization of the farmers time in coordinating the available agricultural inputs such as land, fertilizer application, use of pesticide and other inputs generally.

5.4 MEDICAL TREATMENT RECEIVED BY THE RESPONDENTS

The health of the farmers is very important to agriculture and agricultural production relatively depends on the health of the farmers especially rural farmers who form the bulk of agricultural producers in Nigeria. Table 5.4 shows the medical treatment received from village clinics by the two categories of respondents in the project areas.

Table 5.4: Medical Treatment Received

	1989		1993			
LOCATION	Males	Females	Males	Females	% decrease males	% decrease females
Gwagwalada	3.04	3.56	1.04	1.31	65.79	63.20
Nasarawa	3.17	3.13	1.21	1.50	61.83	52.08
Ningi	3.50	3.50	1.19	1.56	63.41	55.43
Cumulative Average	3.24	3.40	1.18	1.46	63.58	57.06

SOURCE: Field survey, 1994

Table 5.4 indicates the various number of times the respondents received treatment in the village clinics or dispensaries. The Table showed that there was reduction in visit to the clinic from 3.04 to 1.04 i.e. about 65.79% reduction

among the male respondents in Gwagwalada project locations. The smallest reduction in the number of times medical treatment was received in the village project location. A reduction from 3.13 to 1.50 times i.e. about 52.08% reduction which was less than the cumulative average of 57.06% was observed among the female respondents of Nasarawa.

The respondents agreed that, diseases such as guineaworm infection, skin rashes, cholera and other water related diseases had reduced tremendously since the inception of RUSAFIYA water and sanitation project in the selected areas compared to when they were fetching water from ponds, streams and wells.

In a healthy environment, there is the tendency for hard work and good recreational activities. Standard of living in this concept could be said to have improved if disease ridden society eventually turn into disease-free society. Where the members could undertake their daily activities without fear of infection from water related diseases. The reduction in the number of times medical treatment was received in the village clinics might not have a direct effect on agriculture but in the case of rural people, if a member of a household is ill the other members automatically abandon that day's work and remain at home thereby wasting the man-hours that could have been utilized on the farm.

5.2.5 FERTILIZER USAGE

Table 5.5 shows the number of bags of fertilizer used by the respondents in all the locations and in the two periods i.e 1989 and 1993.

Table 5.5: Average Bags of Fertilizer Used.

	1989		1993			
LOCATION	Males	Females	Males	Females	% decrease males	% decrease females
Gwagwalada	5.79	7.69	4.29	2.94	25.91	61.77
Nasarawa	6.46	7.88	4.13	4.06	36.07	48.48
Ningi	7.46	10.38	8.92	6.00	17.68	42.19
Cumulative Average	6.61	8.65	5.70	4.33	12.56	49.94

SOURCE: Field survey, 1994

Fertilizer usage of the respondents was related to improved water supply and sanitation of RUSAFIYA. From Table 5.5, there was and indication that except among male respondents in Ningi project location, there have been reduction in fertilizer application among the two categories of respondents in all the project locations. The highest percentage reduction occurred in Gwagwalada among the female respondents i.e 61.77%. It was gathered that the reduction in the use of fertilizer was as a result of its scarcity and high cost. They cited the example that in 1989 fertilizer was about ₦40 per bag but that the same size of bag as at the farming season of 1993, rose to about ₦180. They further stressed that the government subsidised fertilizer was hard to comeby by "just any farmer". The implication of this finding is that improved rural water supply and sanitation cannot on its own improve the agricultural output of the farmers without the other essential input, such as fertilizer, seeds, chemical, loans etc. Thus improved rural water supply might even have a negative effect on agriculture.

5.2.6 LAND HOLDING OF RESPONDENTS

The acreage of farmland owned by farmers is a very valuable physical asset to the rural farmer. The difference in land holding of the respondents both in 1989 and 1993 and the percentage change are discussed in Table 5.6.

Table 5.6: Land under cultivation

	1989		1993			
LOCATION	Males	Females	Males	Females	% decrease males	% decrease females
Gwagwalada	6.8	7.8	7.2	7.4	5.31	0.59
Nasarawa	7.7	8.2	8.1	6.0	6.59	14.71
Ningi	8.9	8.9	9.5	9.3	7.02	5.36
Cumulative Average	7.8	8.4	8.5	7.0	6.38	2.81

SOURCE: Field survey, 1994

Ningi male respondents recorded the highest increase in their land holding i.e average of 8.9 hectares in 1989 to 9.5 hectares in 1993 (about 7.02% increase). Nasarawa females recorded the highest decrease in their land holding from 8.2 hectares to 6.0 hectares in 1989 and 1993 respectively with about 14.7% decrease.

Norman (1972) pointed out that the amount of land a family could cultivate was limited by the labour availability which could be used to cultivate it, and that the household size and the number of labour units in the household were the more important factors. The implication of this to the researcher and policy makers is that from all indication, the land a rural farmer holds is his major physical asset and he will go to any length to increase its size or number of plots as the case may

be.

The data on hectarage supplied by the respondents during data collection could not be ascertained due to lack of record. Therefore, the hectarage should be interpreted with caution.

The average hectarage of all the categories of respondents exceeded documented work of Mijindadi, Norman and the Federal Office of Statistics.

5.2.7 FARM PRODUCE OF RESPONDENTS

Farm produce of the respondents was restricted to specific crops known to be common to the three selected locations. For the male respondents, sorghum (guineacorn) was the produce considered, while rice was the produce considered for the female respondents. The results of farm produce are presented in Tables 5.7 and 5.8 for male and female respondents respectively.

Table 5.7: Sorghum yield in bags among male respondents

LOCATION	1989	1993	% INCREASE IN YIELD
GWAGWALADA	8.8	9.9	11.98
NASARAWA	8.2	11.3	37.83
NINGI	10.9	13.9	27.19
CUMULATIVE AVERAGE	9.3	11.7	25.48

SOURCE: Field survey, 1994.

Table 5.7 showed an increase in the yield of sorghum from 8.8 to 9.9 bags in 1993 in Gwagwalada location, the percentage increase as shown on the table is 11.98%. The highest increase of 37.83% was recorded in Nasarawa project area.

TABLE 5.8: Rice yield in bags among the female respondents

LOCATION	1989	1993	% INCREASE IN YIELD
GWAGWALADA	8.1	9.9	21.40
NASARAWA	9.6	11.3	16.77
NINGI	12.1	13.9	14.36
CUMULATIVE AVERAGE	10.0	11.7	17.04

SOURCE: Field survey, 1994.

From Table 5.8, Gwagwalada project area, recorded the highest increase in output of 21.40% followed by Nasarawa area and the smallest increase was recorded in Ningi area.

The interpretation of the data from the two Tables should be with caution since almost all the respondents do not have documented records of their outputs at the end of the two farming seasons i.e. 1989 and 1993. Most of the output figures were merely based on their ability to recall.

Thus there were no standard figures from previous works against which the figures can be compared.

5.3 METHODS USED BY RUSAFIYA IN INTRODUCING THE PROJECT TO THE STUDY AREAS

Considering the failure of many development projects in rural areas due to their rejection by the people, effort was made to find out how the RUSAFIYA project was able to penetrate into the project areas. In trying to do this a structured questionnaire was administered to the RUSAFIYA personnel on questions about the method used in introducing the project to the selected areas.

The particular question asked pertaining to the method used was "How were you able to introduce the RUSAFIYA project into the rural areas selected for the project?". The response was that they were able to get to the rural areas through the Local Government Council's extension agents trained in community mobilization and participatory techniques. The personnel stressed this point further by explaining that they collected two extension agents from each Local Government Council and trained them in Nasarawa for three months in community mobilization and participatory techniques. That they also exposed these extension agents to workshops and training in similar concept organised by different organizations. One of such workshop was organised by National Water Resources Institute, Kaduna in 1991. The extension agents then serving as leaders were accompanied to the various villages by the RUSAFIYA personnel. The villagers seeing their own sons and daughters being part of the project team developed full confidence and gave all the backing needed by the RUSAFIYA project team to undertake their work.

The villagers were involved in project formulation, selection of water points, contribution of man power and money towards the demonstration of VIP latrine and water points construction. They were also to be ultimately responsible for the operation and maintenance of the VIP latrines and water points. The beneficiaries were made to pay the total sum of ₦1,080 for the hand pump headwork and the cement used for the pump stand and surroundings. They were

also made to contribute ₦1000.00 annually for maintenance and eventual pump replacement.

Since the aim of the project was for the villagers to have a sense of ownership, the RUSAFIYA personnel through the extension agents made the villagers form water and sanitation committee (WASCOM) who in turn were taught how to operate, make repairs in case of breakdown and maintain the VIP latrines and water points. Once in a while the extension agents visited the villages to make sure the water points and VIP latrines were properly maintained since there was no provision for post-completion supervision by RUSAFIYA personnel.

The already established WASCOM members were supposed to maintain the water points and VIP latrines in case of breakdown. According to the RUSAFIYA personnel, the quality of water provided by RUSAFIYA was "very good" compared to the sources of potable water before the inception of RUSAFIYA project. Also the RUSAFIYA water was more regular when compared with the DFRRI water, the wells and streams which dry up during the dry season.

5.4 ASSESSMENT OF RUSAFIYA PROJECT BY RESPONDENTS.

Development projects had been undertaken in the selected project areas. Among such projects was the DFRRI rural electrification and hand pump water supply. These projects according to the villagers were uncompleted and abandoned halfway or completed but stopped functioning after some months. It was against this background that the respondents were asked to assess the RUSAFIYA project.

One of the respondent's views as stated by him was " we now have easy access to water which is clean, less effort i.e no waste of energy in having to boil it like we were advised by the dispenser. No frequent complaints about health". Another farmer has this to say "less cases of ill health often give us time to concentrate on the farm work". Also a female respondent said that the project had improved her economic level and that her standard of living had improved.

About 98% i.e 106 of the respondents expressed that RUSAFIYA project did help in reducing the number of times they received medical treatment in the village clinics. Though from previous section, it was observed that reduction in number of times medical treatment was received does not really mean improved agricultural production all other factors held constant.

All the respondents agreed that there had been a great reduction in distance that used to be trekked to fetch water before the inception of RUSAFIYA project. The reduced distance according to their views automatically means reduction in time spent on fetching water.

In the context of this study, standard of living of the farmer might just be the provision of some basic needs such as potable water, feeder roads, rural electricity, clinics, schools etc. When all these are in place and in adequate supply, the rural farmer will have more time and energy to concentrate on his farm activities. This tends to agree with Buttern (1967) who defined rural development as "almost any form of local betterment which is in some way

achieved through the willing co-operation of the people living together in a defined area". If Buttern's definition is anything to work with, then provision of potable water and decent sanitation to people living in a defined rural area will result into better living and working condition of the people.

Water related diseases such as guineaworm infections, cholera diarrhoea were the common diseases in the study areas. Opinions of authors cited in the literature did indicated that people affected with guineaworm, persistent cholera etc. will have less time to devote to any economic work and in return output from such works are bound to be low. This might not have quantitative evidence when related to agriculture but conclusions could be made from this study that improved health did have effect on agricultural production of the farmers. Since the improved health was a result of sanitation and improved potable water, there is a relationship between improved water supply, sanitation and agricultural production.

5.5 CORRELATION ANALYSIS

The pearson correlation method was used to run the analysis. This method is supposed to show the relationship between the dependent variable (Y) output and the various independent variables. The correlation coefficient (r) between the output and the other independent variables of the two categories of respondents in 1989 and 1993 in the three selected locations are presented below:

Table 5.9: Results of correlation analysis between sorghum output and other independent variables among male respondents in RUSAFIYA project area in 1989

LOCATION	TREATMENT X1	HOUSEHOLD MEMBERS X2	LAND ACREAGE X3	BAGS OF FERTILIZER X4
Gwagwalada	-0.0997	0.6293**	0.7702**	0.6952**
Nasarawa	0.0308	0.6477**	0.9078**	0.7261**
Ningi	-0.2272	-0.1323	0.4663*	0.5414*

SOURCE: Field survey, 1994

** Significant at 1% probability level

* Significant at 5% probability level

Table 5.9 shows significant correlation between output and almost all the explanatory variables. Negative relationship was observed between the output and medical treatment received in Gwagwalada and Ningi project areas. Also the relationship between the output and household members engaged in farm activities was negative in Ningi project area. The negative relationship (coefficient) could probably be as a result of inability of the independent variable to explain the variation in output independently or due to poor data. The correlation coefficient of household members, the land holding and bags of fertilizer used were relatively high in almost all the RUSAFIYA project areas i.e usually above 0.5. Since the analysis in Table 5.9 was that of data before the inception of the RUSAFIYA project, there was an indication that ill health always experienced by the respondents had negative effect on the farm output of the farmers.

5.10 **Results of correlation analysis between sorghum output and other independent variables among male respondents in RUSAFIYA project areas in 1993**

LOCATION	TREATMENT X1	HOUSEHOLD MEMBERS X2	LAND ACREAGE X3	BAGS OF FERTILIZER X4
Gwagwalada	-0.185	0.4870*	0.6206**	0.5976*
Nasarawa	0.1243	0.5554*	0.8497**	0.5433*
Ningi	-0.1257	0.241	0.5473*	0.1829

SOURCE: Field survey, 1994

** Significant at 1% probability level

* Significant at 5% probability level

Table 5.10 showed some correlation between the dependent variable (Y) and the various independent variables. Almost all the explanatory variables showed positive relationship except medical treatment received from the village clinic. The coefficient of correlation of medical treatment received in Nasarawa was low i.e 0.1243. The negative and low relationship could be probably due to the data collected or due to the fact that medical treatment received or improved health cannot alone increase agricultural production. As hypothesised in the literature cited, any development package cannot serve the purpose of development without other important components delivered. Thus the finding indicated that medical treatment received or improved health of the respondents was not strong enough to explain the variation in the output.

Table 5.11: Results of correlation analysis between rice output and other independent variables among the female respondents in RUSAFIYA project areas in 1989

LOCATION	TREATMENT X1	HOUSEHOLD MEMBERS X2	LAND ACREAGE X3	BAGS OF FERTILIZER X4
Gwagwalada	-0.2884	0.6984*	0.9010**	0.5890*
Nasarawa	-0.4327	0.3398	0.5029*	0.3218*
Ningi	0.2740	0.0943	0.6337*	-0.1750

SOURCE: Field survey, 1994

** Significant at 1% probability level

* Significant at 5% probability level

Table 5.11 presents the correlations between the independent variables and the rice produced by female respondents in the RUSAFIYA project areas in 1989. High correlation relationship existed between land holding, household members engaged in farm activities and bags of fertilizer use in Gwagwalada project area. Generally the correlation coefficients were low i.e below 0.5. This imply that the independent influence of the various explanatory variables on the output was weak.

Table 5.12:Results of correlation analysis between rice output and other independent variables among female respondents in RUSAFIYA project areas in 1993.

LOCATION	TREATMENT X1	HOUSEHOLD MEMBERS X2	LAND ACREAGE X3	BAGS OF FERTILIZER X4
Gwagwalada	0.0551	0.3287	0.8688**	0.6493*
Nasarawa	-0.1916	0.0504	0.7023**	0.6571*
Ningi	0.1031	-0.2548	0.4504*	-0.1722

SOURCE: Field survey, 1994

** Significant at 1% probability level

* Significant at 5% probability level

From Table 5.12, negative correlation existed in Ningi between the dependent variable and two independent variables; household members engaged in farm activities and the bags of fertilizer used by female respondents in 1993. The negative correlation in Nasarawa project area was between the medical treatment received and the output. But generally there existed positive correlation between the dependent variable and the independent variables though some of them were quite low. The negative relationship could be due to poor data.

5.6 REGRESSION ANALYSIS

Linear regression was used between the dependent variable (output) and the independent explanatory variables among the two categories of respondents in the project areas in 1989 and 1993. The result are presented in Tables 5.13, 5.14, 5.15 and 5.16.

Table 5.13: Regression results of sorghum output and other independent variables among male respondents in RUSAFIYA project areas in 1989.

	Equation			H/hold	land	Bags of	R^2	$-R^2$	F
	type		Treatment	members	acreage	fert.			VALUE
Location	linear	Constant	X1	X2	X3	X4			
Gwagwalada	coeff.	-1.689	0.114	-0.013	0.429	0.292	0.609	0.526	7.392
Nasarawa	coeff.	-1.569	0.202	0.204	-1.569	0.353	0.835	0.801	24.072
Ningi	coeff.	3.781	0.151	0.070	0.051	0.589	0.479	0.366	4.322

SOURCE: Field survey, 1994

The results from Table 5.13 indicated that the coefficient of multiple determination R^2 were 0.61, 0.84 and 0.48 in Gwagwalada, Nasarawa and Ningi

project areas respectively. That is 61%, 84% and 48% of the variation in output (Y)in Gwagwalada, Nasarawa and Ningi project areas respectively were explained by the independent variables. The computed F-Values showed the significance of the R^2 values since the F-Values computed were greater than the F-Values tabulated in all the three locations.

Though some negative relationship occurred, the regression coefficients were generally positive. When compared with the tabular presentation in previous section the results seemed to be reasonably valid.

Table 5.14: Regression results of sorghum output and other independent variables among the male respondents in RUSAFIYA project areas in 1993.

Location	Equation type linear	Constant	X1	X2	X3	X4	R^2	$-R^2$	F VALUE
Gwagwalada	coeff.	3.569	-0.564	0.156	0.198	0.471	0.436	0.317	3.673
Nasarawa	coeff.	-2.501	-1.507	-0.970	0.657	0.565	0.750	0.697	14.219
Ningi	coeff.	0.7133	0.492	-0.307	0.256	-0.335	0.477	0.367	4.329

SOURCE: Field survey, 1994

From Table 5.14 the R^2 for Gwagwalada, Nasarawa and Ningi project areas were 0.44, 0.75 and 0.48 respectively. This showed 44%, 75% and 48% of the variation in output were explained by the explanatory variables. The F-Values calculated were higher than the F-Value tabulated.

Table 5.15: Regression results of rice output and other independent variables among female respondents in RUSAFIYA project areas in 1989

Location	Equation type linear	Constant	Independent Variables X1	X2	X3	X4	R^2	$-R^2$	F VALUE
Gwagwalada	coeff.	-2.282	-0.979	0.294	0.667	4.386E-04	0.824	0.871	18.517
Nasarawa	coeff.	5.553	0.058	-1.282	0.071	0.631	0.523	0.650	5.104
Ningi	coeff.	-8.472	0.636	1.473	0.525	-0.348	0.614	0.717	6.970

SOURCE: Field survey, 1994

Table 5.15 shows that the R^2 values were 0.87, 0.65 and 0.72 for Gwagwalada, Nasarawa and Ningi project areas respectively. These findings indicated that about 87%, 65% and 72% of the variation in the output are explained by the independent explanatory variables. The F-Values calculated were higher than the tabulated F-Values. This showed the significance of the R^2. Though some of the coefficients were negative, but generally, the R^2 values were within the acceptable range.

Table 5.16: Regression results of rice output and other independent variables among female respondents in RUSAFIYA project areas in 1993

Location	Equation type linear	Constant	Independent Variables X1	X2	X3	X4	R^2	$-R^2$	F VALUE
Gwagwalada	coeff.	-10.365	-1.111	-0.049	1.110	-0.462	0.798	0.724	10.845
Nasarawa	coeff.	-0.028	-1.043	0.063	0.547	0.282	0.568	0.411	3.621
Ningi	coeff.	4.710	-2.961	-0.901	0.661	1.245	0.747	0.684	8.099

SOURCE: Field survey, 1994

From Table 5.16, the coefficient of multiple determination R^2 were 0.80,

0.57 and 0.75 for Gwagwalada, Nasarawa and Ningi project areas respectively. This implies that 80%,57% and 75% of the variation in output could be explained by the independent variables in Gwagwalada, Nasarawa and Ningi project areas. The computed F-Values were all higher than the tabulated F-Values which implies that the R^2 was significant.

The overall results in Section 5.6 indicated that the R^2 values for 1989 though different from that of 1993 was not as expected and as hypothesised. There was an indication of persistent negative relationship between medical treatment received and the output in some of the project locations, this was evident from the negative sign on the regression coefficients among the two categories of respondents in almost all the project locations.

These could have been due to the fact that other inputs such as seeds, mechanised implements e.t.c are inadequate in supply, improved water and sanitation may not have a positive effect on output (farm produce) of the rural farmers.

From the regression results, the regression coefficients of medical treatment received and output in 1993 among the female respondents were all negative.

This result implies that the variation in output of the respondents was not explained by the number of times medical treatment was received by the respondents in the 1993. From the result of the data, in Table 5.3, there was an average reduction from 3.40 to 1.46 and an average reduction of 57.06% among

the female respondents.

There existed positive relationship between the output and the explanatory variables in almost all the locations. The general finding of the regression analysis upholds the validity of the results of the tabular presentation and correlation analysis in previous sections.

An observation made from the overall regression results was that the coefficient of multiple determination (R^2) for the female respondents were generally higher than the male respondents in both years and in almost all the project locations.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS.

6.1 SUMMARY

This study focussed on the contributions of rural water supply and sanitation to agriculture using the RUSAFIYA project in Gwagwalada, Nasarawa and Ningi as a case study.

Instead of relating agricultural production or output to inputs such as seeds, fertilizer, land, agricultural machineries e.t.c, health and amenities necessary for healthy economic production should also be an important focus especially with the consistent shortage in agricultural output in satisfying human consumption. In as much as the conventional agricultural inputs listed above affect agricultural production, the farmer's health, facilities for decent sanitation and other amenities for his every day life also do greatly affect the farmer's ability to perform his farm activities. From the study, it has been obtained that though the increase in farm output after the inception of RUSAFIYA might not have been solely caused by improved water and sanitation, still there existed an increase in output. From the result, it was found out that there was a reduction in time spent in fetching water, reduction in number of times that medical treatment was received in the village clinics. The time saved therefore could be engaged in agricultural activities or other domestic chores. If the time saved coincide with the peak of labour requirement of farm operations the marginal

productivity of such labour is expected to be positive thus labour would have attained some economic value.

6.1.1 SUMMARY OF FINDINGS

The data used for the study were both primary i.e information gathered from the respondents in the study areas and secondary i.e information obtained from RUSAFIYA personnel and the village clinics. The tools of analysis used were the descriptive statistics, correlation analysis, regression analysis and some tabular presentations.

6.1.1.1 DISTANCE TO WATER SOURCES :

The average distance recorded by the male respondents in 1989 was 1.59km while that of 1993 was 0.56km. There was a reduction of about 1.03km i.e 64.8%. For the female respondents, the average distance covered in 1989 was 1.42km while that of 1993 was 0.24km i.e about 70.4% reduction among the female respondents.

6.1.1.2 HOUSEHOLD MEMBERS ENGAGED IN FARMING:

10 members were engaged by the male respondents in 1989 on the average while in 1993, an average of 9 members were engaged by the same category of respondents. There was a reduction of 10%. The average number of household member engaged in 1989 was 8 while that of 1993 was 11 thus resulting to an increase of about 37.5% among the female respondents.

6.1.1.3 TIME TAKEN TO FETCH WATER:

From Table 5.3 the average time taken to fetch water by the male respondents in 1989 was 3.06 hours while that of 1993 was 1.19 hours. 57.5% reduction occurred on the average among the male respondents. For the female respondents, the average time taken to fetch water in 1989 was 3.03 hours while the average time taken in 1993 was 1.08 hours. There occurred a reduction of 62.8% in time taken to fetch water in the project locations. The percentage reduction among the male respondents was lower than that of the female respondents. This could be attributed to the fact that women were probably better at fetching water than the men.

6.1.1.4 MEDICAL TREATMENT RECEIVED BY THE RESPONDENTS:

Though the medical treatment received by the farmers does not seem to affect their production directly but from the descriptive statistics Table in section 5.4 there were indications of improved health through the reduced numbers of time medical treatment was received.

From Table 5.4 the average medical treatment received by male respondents in 1989 was 3.24 while that received by the same category of respondents in 1993 was 1.18 leading to a reduction of 63.58%. From the same Table the average medical treatment received in 1989 among the female respondents was 3.40 while that received in 1993 was 1.46 also leading to a reduction of 57.06%.

6.1.1.5 FERTILIZER USAGE

Amount of fertilizer used was observed to have highly reduced among the two categories of respondents in 1993. The average number of bags of fertilizer used in 1989 was 6.61 while in 1993 it reduced to 5.78 bags among the male respondents. The reduction among the female respondents was even higher than that of the males. In 1989, 8.65 bags of fertilizer were used on the average among the female respondents but in 1993, the number reduced to 4.33 bags.

For the male respondents the reduction was as high as 49.94%. The reduction probably was due to the high cost of fertilizer resulting from inflation and its non-availability to the rural farmers especially in 1993.

6.1.1.6 LAND HOLDING OF RESPONDENTS

Land holding to the rural farmers is the most adorable asset. In fact, wealth could be determined by the amount of land owned. The average size of land cultivated by the male respondents in 1989 was 7.8 hectares while that cultivated in 1993 was 8.5 hectares.

There was an increase of 6.38% in hectarage cultivated by the male respondents in the project areas. For the female respondents, the average size cultivated in 1989 was 8.4 hectares while that of 1993 was 7.0 hectares. This resulted to a decrease of 2.81%. The decrease in hectarage among the female respondents could not be attributed to any particular factor peculiar to them.

6.1.1.7 FARM YIELD

The crop commonly grown among the male respondents was guineacorn (sorghum) while rice was the common crop cultivated among the female respondents in the study areas.

The average yield of the male respondents was 9.347 bags of sorghum in 1989 and 11.72 bags in 1993. There was an increase of about 25.48% in yield among the male respondents. The average yield of rice for female respondents in 1989 was 10.02 bags while that of 1993 was 11.73 bags. Therefore leading to an average increase of 17.04%. The percentage increase of yield recorded was more among the males in all the project areas. This increase can not stand as standard for future studies since verification was not possible. But it could be a base on which data could be compared.

6.1.2 METHODS USED BY RUSAFIYA IN INTRODUCING THE PROJECT TO THE STUDY AREAS.

The RUSAFIYA personnel were able to penetrate the resistant rural people through the use of indigenous extension agents whose aims were to make the rural people have a sense of ownership and belonging. The extension agents in collaboration with the RUSAFIYA personnel made the beneficiaries form the water and sanitation committee (WASCOM) who selected their own leaders among the committee members. The WASCOM executive were trained to operate, make repairs and maintain the VIP latrines and the

water pumps.

Since there was no provision for post completion supervision, the already established, trained WASCOM members were made to replicate the training to the other villagers for future effect. Thus, by the end of the project, almost 60% of the villagers had enough knowledge on repairs, maintenance and operations of the head pumps and VIP latrines.

6.1.3 ASSESSMENT OF RUSAFIYA PROJECT

About 106 out of the 120 respondents confirmed that RUSAFIYA project did reduce the number of times they visited the village clinics for medical treatment. About 70% i.e. 84 respondents now own VIP latrines. The implication of this was that they now maintain decent sanitary habit and spend less time trying to find a place to defecate. They also confirmed that they now spend less time in fetching water especially during the dry season. Also a deduction was made about the health of the respondents before and after the inception of RUSAFIYA project. From the study carried out, the Guineaworm infection, cholera, diarrhoea and skin rashes that were endemic were seen to have reduced or totally eradicated in the study areas.

The general assessment obtained from the farmers was that RUSAFIYA project had improved their living standard generally since they could fetch clean water at time convenient to them and could go to toilet right around their compound instead of the bush they were using before the inception of

RUSAFIYA project.

6.1.4 CORRELATION ANALYSIS BETWEEN OUTPUT AND INDEPENDENT VARIABLES AMONG THE RESPONDENTS.

From the correlation analysis, the result indicated general positive correlation between the output i.e. sorghum and the independent variables among the male respondents. There seem to exist persistent negative relationship between the output and medical treatment received by the male respondents in all the project areas except Nasarawa location where the coefficient were 0.0308 and 0.1243 for 1989 and 1993 respectively. Also there exist negative relationship between the output and the household engaged in Ningi in 1989 while in the same location in 1993, the negative relationship was between output and bags of fertilizer used.

For the female respondents, medical treatment received was negatively related to the output in 1989 in Gwagwalada and Nasarawa project areas whereas in 1993, the negative relationship between medical treatment and output was observed in Nasarawa project area.

Relatively there existed a general positive relationship between output and the independent variable among the female respondents in all the three locations.

6.1.5 REGRESSION RESULTS OF OUTPUT AND INDEPENDENT VARIABLES IN ALL THE LOCATIONS.

The multiple determination R^2 for the two categories of respondents in 1989 were high though with cases of low R^2 values of 0.37 among Ningi male respondents. For the female respondents, the R^2 values were 0.87, 0.65 and 0.72 in 1989 for Gwagwalada, Nasarawa and Ningi project areas respectively.

The F - values calculated were higher than the F - values tabulated thus confirming the significance of the R^2. The regression analysis for 1993 data also indicated high values calculated were also higher than the F - values tabulated. The overall results of the regression analysis showed that the R^2 in 1993 were better than that in 1989.

6.3 CONCLUSION

It was expected that improved rural water supply and sanitation would lead to an increased agricultural production and standard of living of the rural dwellers. It was against this background that a study into one such development project established to improve the water supply and sanitation of the rural people of Gwagwalada, Nasarawa and Ningi project areas was considered.

From the findings, there was increase in agricultural production over what used to obtain. This was evident as output from the two periods obtained showed increase in sorghum and rice yield of the respondents.

The methods of "learning by doing" i.e involvement of the participants in all stages of project did help in the success of RUSAFIYA project. There was total acceptability of the project by the rural people of the project areas.

The method of using the simple available resources and low-cost technology that can be owned by the rural people played an important role in the mobilization method engaged by RUSAFIYA. The rural communities were made aware of the importance of ownership of the water points and VIP latrine.

6.3 RECOMMENDATIONS:

The strategy of communal ownership and sustainability of RUSAFIYA project seems to have been the basic methods of introducing rural water and sanitation scheme into the rural areas involved in RUSAFIYA project. When this is compared with other methods of introducing potable water and sanitation into the rural areas by government projects an improvement in terms of acceptability by the rural people was observed. In view of the overall findings of the study, the following recommendations are made:

1. That development strategies be delivered as a package; consisting of agricultural innovations, water supply, sanitation, and other amenities to rural dwellers. This will enable the rural dwellers to comprehend the package as a whole rather than having them delivered in bits which normally sounds ambiguous and difficult to comprehend especially if previous ones were not successful or if they were rejected by the rural

people.

2. The rural people concerned should be involved in the development project at all levels of the project cycle i.e planning, decision making, implementation and evaluation. This will give the rural beneficiaries a sense of ownership and thus will make them maintain the water points and the VIP latrines constructed.

3. Since women and children are mostly involved in collecting water for domestic use and sanitation, technologies should be geared towards these group of people. The women should be involved in all facets of the project cycle.

4. The body or agent that intends to provide potable water and sanitation scheme to rural areas should have at least two years of post project completion monitoring in their plan of work. This will enable the beneficiaries to convey major problems to experienced hands even after completion. This will also enable the agent or body involved to determine the success or failure of their project.

5. Any agent or body interested in provision of potable water and sanitation must have a baseline data on the health condition of the people. An agent which considers all the recommendations above in its project planning is likely to record success in development project meant for the rural people.

6.4 LIMITATIONS OF THE STUDY AND SUGGESTIONS FOR FURTHER RESEARCH.

1. In view of the qualitative nature of the data collected, the findings from this study cannot be used in similar studies elsewhere without caution.
2. Since the quantitative data collected depended entirely on the recall ability of the rural beneficiaries, the duration of data collection could be extended to say one year so that proper data could be collected on the respondents farm activities, and their health condition could be monitored and correlated to the farm activities and produce.
3. Baseline data on health, agricultural production e.t.c in the areas involved should be obtained so that impact of water supply and sanitation project could be determined quantitatively.

REFERENCES

Abalu, G.O.I (1981)," Rural Development Research in Nigeria; strategy and priorities" . A paper presented at the Institute for Economic Research seminar on social science resources. Priorities for National development Ibadan.

Abasiekong E.M (1987), " Participation of the poor in Development problems and prospects" . Proceedings of the fourth National conference of Nigeria Rural Sociological Association A.B.U Zaria.

Alba, D (1993) Field manual for An Integrated Approach to water Supply and Sanitation (mimeo).

Alubo, S.O (1987)," Rural Development in contemporary Nigeria: A Dialectical critique" . A paper presented at the fourth National conference for Nigerian Rural sociological Association A.B.U Zaria.

Anne, U.W and Ian,B (1977), Water supply and community choice. In Water waste and health in hot climates: John Wiley & son London.

Caruthers, I. D. (1971): Cost-Benefit Analysis and Agricultural Development. Farm Economist 12, 107 - 112.

Caruthers, I. D. (1973): Impact and Economics of Community Water Supply. Ashford Kent: Wye College.

Central Bank of Nigeria (1991): Annual Report of December.

Chuso, U.A (1991)," The impact of DFRRI on agricultural Development in Nigeria: A case study of Sokoto Local Government Area" . An unpublished project for Bachelor of agriculture, A.B.U Zaria.

David, J.B (1977) Health Aspects of Water Supply in Tropical countries. Amsterdam: A.S.P.

Feachem, R.MC. Garry, M, Mara, D(1977) Water wastes Health in Hot climates. A Wiley-Interscience Publication. John Wiley and Sons, London.

Federal Office of Statistic(1957-8) "Agricultural sample survey, Northern Region" Bulletin 3, 1957-8 Lagos Nigeria(*Mimeographed*) .

Fenwick,K.W.H (1966), The short term effect of a pilot Environmental Health project in Rural Africa. The Zaina scheme Reassessed after four years (Nyeri central province Kenya):Ministry of Health.

FMARWRRD,(1992) Plan of action for the water supply and sanitation sector.(Mimeographed).

Guilford, J.p (1971) Fundamental statistics in psychology and Education 5th Edition.

HOTLINE International Magazine (1987). No 18 July 16-31.

IAN.c and David B, (1977) The Economics of community water supply and wastes and Health in hot climates.

IBRD (1967), Economic Development project and their appraisal: cases and principles from the experience of the World Bank . Hopkins press.

IBRD (1976), Village water supply; a World Bank paper Washington D.C.

Idachaba, F.S (1980) Concepts and strategies of Integrated Rural Development; Lesson from Nigeria.

IDRC (1985)," Women issues in water and sanitation. Attempt to address an age-old challenge" . Ottawa.

Kowal, J.M and Knabe,D.T, (1972), An agroclimatological Atlas of the Northern states of Nigeria. A.B.U Zaria.

Long, M. F. (1968)," Why peasant farmers Borrow" . American Journal of Agricultural Economics. Vol.55 No.4 Page 991- 1008.

LRDC (1975), The land resources of central Nigeria phase 1. Interim report on the land forms, soils and vegetation of the Jema'a platform Vol.3.

LRDC (1976), Land Resources of central Nigeria. Agricultural Development possibilities. Vol.1B. The Bauchi plains.

LRDC (1979), Land resources of central Nigeria. Agricultural Development possibilities Vol.3B. The Jema'a platform.

Melichar,E. (1965)," Factors Related to farmers use of credit, least square Analysis of sample survey Data" . Journal of farm Economics. Vol.47,Nov.-Dec. page 1468-1473.

Mijindadi, N.B (1974)," Some farm production characteristics of the Northern States". of Nigeria with Relevance to co-operative functions". A paper presented at a workshop for co-operative officials at Bagauda Lake Hotel, Kano (Nov. 21-26, 1974)

Mijindadi, N. B.(1978)," Integrated Rural Development: Concept and planning implementations - with examples from Nigeria" . Community Development Journal Vol. 13 No.1

Nkom, S.A.(1982)," Rural Development, Popular Participation and Basic Needs". Paper presented at the Seminar on Basic Needs Implications for Nigeria's Economic Development Organised by Center for Social and Economic Research A.B.U. Zaria.

Norman, D. W.(1972), "An Economic survey of three villages in Zaria province: Input - output study Vol 1 Text". Samaru miscellaneous paper 37, IAR, A.B.U. Zaria.

Norman, D. W.(1974), Samaru Research Bulletin 225 Inter- Disciplinary Research on Rural Development.

Ogunfowora, O.Essang, S. M. and Olaide, S. O.(1975)," Resource productivity in Traditional Agriculture: A case study of four agricultural Division in Kwara State of Nigeria" . Journal of Rural Economics and Development Vol. 9 No. 2 page 119 - 131.

Omar, B.O. (1993)," Application of community development concepts and principles to rural water supply scheme" . A paper presented at the workshop on effective planning and management of Rural water supply. ARMTI - ILORIN

Orewa,S. I. (1978)," The Economics of dry season tomato production under the Cadbury tomato scheme in Zaria Area" . Unpublished M.Sc. Thesis A.B.U. Zaria.

Otu, M.F. (1985), "Analysis of the uses and effectiveness of co-operatives Bank Credit in Kaduna State" An unpublished M.Sc. Thesis, A.B.U Zaria.

Roberts, J.S and Jeremy, J.W.(1976), Village Water supply. Economics and policy in the developing World. World Bank Research publication.

Sanni, S.A (1991) "Technological changes in crop production among small holder farmers: a case study of Faskari Local Government Area of Katsina state" An unpublished M.Sc. Thesis, A.B.U. Zaria.

Saul, A. Gerhard, T. David, G. Williams, J. Andrew, K. Otto,L. and Robert, R.(1987), Community Water Supply. The Hand pump option.

Snow, J. (1955), On the mode of communication of cholera. Second edition, London J. Churchill.

Teh Wei Hui (1973) An introduction to Word : functional form page 63.

ne Analyst (1989), Nigeria monthly magazine, published by Dansa publication Limited, Kaduna. Vol. 2 No. 2 April 1989 page 7.

Umalele. L (1976), Rural Africa :Modernization equity and long term development. Published by IBRD.

UNDP (1990). In touch with RUSAFIYA.

UNDP (1991), An Assessment of the UNDP World Bank Water and Sanitation Programme. Report of an Independent Team.

UNDP Source (1991), Spotlight on Africa.

UNDP/World Bank (1990), Community Water Supply. The Hand Pump Option. Executive Summary.

WEDC (1988) Evaluation of Non-Water Supply Components:UNICEF Assisted National WATSAN Programme in Nigeria.

World Bank (1990)," Community Water Supply and Sanitation" . Proceedings of the meeting of the operation and maintenance Working group. Geneva.