RURAL, DEVELOPMENT AND AGRICCULTURAL PRODUCTIVITY THE ROLE OE SASAKAWA GLOBAL 2OOO IN LERE ZONE OF KADUNA STATE

BY

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DECLARATION

I, hereby declare that this thesis has been written by me and that it is a record of my own research work. It has not been accepted in any previous application for a higher degree. All sources of information have been specifically acknowledged by means of references.

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CERTIFICATION

This thesis entitled "Rural Development and Agricultural Productivity : The Role of Sasakawa Global 2000 in Lere Zone, Kaduna State" by Salamatu Idris Isah meets the regulations governing the award of the degree of Master of Science (Economics) of Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

To:

My Mother, for the love we share and for Always being there for me.

And

Jibrin, a friend I have grown close to over the past six years.

With lots of love for the person you are and for the person you will become .....

"the best friend and the best husband".

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A B S T R A C T

This thesis assessed the role of Sasakawa Global 2000 in technology transfer to facilitate peasant farmers' productivity in Lere zone of Kaduna State. The main objectives of the study were to examine the socio-economic characteristics of the farmers in the zone, to examine the Production efficiency of the resources used in production and how they have influenced the farmers' agricultural productivity, with special reference to level of output,level of income and standard of living.

The results of our investigation indicated that the Lere zone of the Kaduna State SG2000 programme witnessed a highly remarkable production efficiency during the period under review,which can partly be attributed to the level of awareness and adoption of the new technological packages of the SG2000. The empirical results obtained showed that the farmers utilized their resources efficiently. For example, the overall significance of the independent variables (Labour and capital) on the dependent variable (output) in the linear estimate analysis was R^2 • 0.6220, while in the log estimate analysis, R^2 = 0.6600. This showed that labour and capital in the estimates accounted for 62% or 66% variation in the dependent variable. Thus, the result was plausible, as it went to prove that labour and capital are not the only

determinants of productivity. Moreso, in the determination of Average value productivity and Marginal value productivity, the observation made from the linear and log estimates analyses indicated an increasing return to scale in the zone, though, capital played a dominant role and tended to have higher average value productivity and marginal value productivity.

For the hypothesis verification, the results indicated that there was a positive correlation between level of output (independent variable) and the level of income (dependent variable). Testing for the overall significant at 5% level of significance, R^2 values in both linear and log estimates showed 87% and 88% respectively. The two values suggested that about 87% or 88% of the variation in the level of income was explained by the level of output (independent variable). Thus, the data supported our hypothesis; new improved technology can boost agricultural productivity and enhance rural development through an increase in the level of income of peasant farmers.

With these key findings we therefore recommend that for continuous effective and sustainable agricultural productivity in Lere zone and in other project states, government should assist the SG2000 programme by providing agricultural incentives to farmers such as tax supports on farm produce and

the provision of fertilizer depots in rural areas. Such efforts will put the new improved technology within a proper context in the country's overall development priorities and planning strategies. Secondly, there is need for constant agricultural profitability studies in order to ensure that farm inputs prices are fixed at realistic levels so that small scale farmers will be able to afford them.

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CHAPTER ONE INTRODUCTION

1.0 Background to the Study

Raising agricultural production is a prerequisite for improving living standard and raising the income level of the rural poor. The ability of the agricultural sector to fulfil this role has varied widely over the past two decades and appeared to be correlated to the nature of technology practiced by peasant farmers (Isah, 1995).

In developing countries in general and in Nigeria in particular, the agricultural sector is considered one of the most productive and important sectors. From the beginning of the thirties until the end of the sixties, the agricultural sector occupied an important position in the Nigerian economy in terms of its contribution to the country's Gross Domestic Product (GDP). Its contribution was as high as 64.3% in 1960. From the begining of the seventies and eighties, the sector's contribution to the GDP started to fall; it was 51.3% in 1970, 20.6% in 1980, 0.7% in 1986 and 1.2% in 1989 respectively (CBN, 1989). However, it is crucial to note that while agriculture's percentage share of GDP between 1970 and 1989 diminished, the absolute value of agriculture's contribution to GDP increased from $2,221 million in 1965 to $19,832 million in 1984 (CBN, 1989). This suggests that although there was a relative decline in agricultural productivity, it

may not necessarily have been absolute.

Much of the research on the obstacles besetting the growth and development of the agricultural sector in Nigeria so far has mainly focused on use of traditional tools in production, and absence of appropriate incentives such as price supports and tax subsidies. The resultant effects of all these on agricultural output is the deepening of low productivity, a huge withdrawal of investment from the sector, an extension of low income and rural poverty.

Nigeria, in its bid to increase agricultural productivity and achieve self-sufficiency in food has over the years embarked on a number of programmes such as Operation Feed the Nation (OFN), Green Revolution (GR) Agricultural Develomnet Projects (ADPs). These programmes were based on modern agricultural technologies whose main objectives have been how to assist small-scale farmers improve their agricultural production system so that sufficient and high quality commodities can be produced to meet population growth, supply the export markets and alleviate the associated problem of rural poverty.

It must be realized that modern sophisticated agricultural technology will not be able to serve the needs of peasant farmers until they understand it and are willing to

make use of it. An understanding of the conditions that persuade such peasant farmers to accept technical agricultural innovations could facilitate increase in food production as efficiently as the new technology itself. Like all technologies, agricultural technologies have no inherent value, their value are only manifested by the result achieved when they are properly applied to serve the needs for which they are meant.

The intention in this study is to determine the effectiveness of technology in engendering agricultural development, by evaluating the role of Sasakawa Global 2000 (SG 2000) in technology transfer to facilitate rural farmers productivity and at the same time bring about rural development in the form of raising the income level and standard of living, and creating greater opportunities for human development not only in Lere Zone alone but to all agricultural communities.

1.1 Statement of the Problem

A common goal in rural development strategies is restructuring the production base for the substantial improvement of production and productivity, so that financial and material resources can be generated for achieveing a better standard of living (Baba, 1982). Yet, despite all

efforts such as the introduction of Operation Feed the Nation (OFN), Green Revolution (GR) and other agricultural programme as well as concerted extension efforts of the federal, states, local government and other agro-related parastatals in Nigeria, it has been observed that there have been insignificant changes in the attitudes, and hence the output of farmers. The adoption of innovations by farmers is still poor, resulting to low level of agricultural productivity relative to population growth. To this extent, alot of questions have been raised concerning what strategy can be used to raise agricultural productivity and achieve optimum production result. In relation to this problem, some research questions were designed to examine how SG 2000 has influenced the agricultural productivity level of the peasant farmers in the project zone. Some of the questions asked were;

a. How large is the farmers' farmland?
b. How long have they been farming?
c. Which of the technological packages do they prefer and reasons for the preference?
d. Since the inception of the project, what can they say about its impact on their level of income and standard of living?
e. What is the average output per hectare?
f. Have they benefitted from any form of training?

1.2 Objectives of the Study

As earlier stated, the major objective of the research is to asses the impact of Sasakawa Global 2000 (SG 2000) in technology transfer to facilitate peasant farmers productivity in Lere zone. However, the specific objectives of the study are:-

1. To examine the socio-economic characteristics of the farmers in the project area.
2. To examine the production efficiency of the resources used in production and how they influenced farmers' agricultural productivity.
3. To examine the extent to which the programme has influenced the level of income and standard of living of the peasant farmers in Lere zone.
4. To make recommendation based on the findings of the study.

1.3 Hypothesis

From our objectives, one hypothesis can be deduced within the context of this study, which is that;

The introduction of new improved technology can boost agricultural productivity and enhance rapid rural development through an increase in the level of income of peasant farmers.

1.4 Justification

A majority of African population lives in the rural areas and basically depend on agriculture for survival. Agriculture in the rural areas is mostly the peasant type hence, the level of income in these areas is very low. This fact accounts for the abject poverty and low welfare level in the rural areas. However, this can be reversed and their standards of living improved upon if agricultural productivity can be raised. This study would show ways by which agricultural productvity in the rural area could be improved upon if targeted carefully at areas where the right conditions exists within a technological break-through strategy that seeks to achieve both productivity and sustainability so as to raise the living standards of the rural areas.

Lere zone was chosen as a case study area in this research. The preference for the zone is because modern technologies have been available in a timely fashion. Also a large cadre of extension workers have been used in this area by previous agricultural projects to train farmers in the use of modern technologies. Moreso, with the introduction of SG2000 programme, over three quarters of Lere zone cultivated area is now cropped with maize each year (personal communication). Also, the zone with its large number of villages and accessibility to road networks provided a

convinient source of cross-sectional data for the empirical study.

1.5 Methodology

The study makes use of both descriptive and analytical tools. Descriptive tools include the use of graphs, charts and tables while the quantitative tools include regression and correlation analysis. This tool of analysis is used to determine;

1. Total agricultural production and the amount of labour used in production.
2. Total agricultural production and the amount of capital used in production. This will be looked at from the point of view of total value of improved seeds and chemical fertilizer.

Another tool of analysis is the costs and returns tool. This was used to evaluate the performances of the case study area over the years, (from the inception of the programme to date, 1993-1998) with specific focus on the gross income, net income, total yields, average yields, total cost and average cost of production.

1.5.1 Sources of Data

The main sources of data upon which the empirical analysis is based are both primary and secondary. The reason for this is to enable the researcher achieve some of the stated objectives in the study. The primary data was obtained through the use of both structured and unstructured questionnaires, and interview of both farmers and some officials of the SG2000 project in the study area. While the supplemented cross-sectional secondary data was obtained from the SG2000 headquarter in kano, SG2000 annual publications, journals, magazines and from related unpublished theses. Data on population size of each local government under Lere zone were obtained from the secretariat of the local government concerned as well as from the district heads.

The study was undertaken in 20 selected villages in Lere zone. A total number of 200 farmers were selected as respondents. Two major considerations influenced the selection of the villages. Firstly, they are the major maize producers, and secondly, it was based on locational consideration in terms of accessibility. The selected villages include; Tashan Muntari, Bawa Gari, Unguwar Sarki, Dan Daura, Unguwar Goje, Jumari, Yadi, Juran Kari, Mariri, Federi, Zanbina, Kadiri, Jagu, Kadaru I, Garu Yadi, Sabon-Birni I, Kauru I, Kauru II, Kwanar/Bauda I, Kwanar Bauda

(women).

The sampled farmers from the 20 villages for the survey were drawn using a modified version of a simple random sample known as systematic selection. This version is a method of selecting units from a list or proxy list (Warwick *et al.*, 1975). In this case, a proxy list of rows of farmlands found side by side along an area was used. Each tenth farm was selected and its owner interviewed. The farmers were also stratified on the basis of years of experience with the programme. 10 farmers were considered as respondents from each of the 20 villages. This stratification was necessary so as to ensure that data on seperate strata are easily collected as well as to ensure that the combined information is collected with less variation in the means of the sample.

1.6 Scope and Limitation of the Study

This study covers a period of 6 years, that is from the inception of the project to date (1993 - 1998). It also covers 20 selected villages in the zone who are considered major maize producers.

The obvious limitations of this study include time factor that would make it impossible to interview all the farmers in

the zone. Also this study is mindful of the fact that the two variables in the model, labour and capital are not the only variables which influence the level of agricultural productivity. Thirdly, the study will also be limited by the nature of the responses supplied by the farmers and that of the secondary data available to the researcher.

1.7 Organisation of the Study

This study is in five chapters. Chapter One deals with the introduction. It defines the problem statement, the objective, and hypothesis. It contains justification for the study, methodology, and sources of data. It also identifies some of the obvious limitations that may preclude a detailed coverage of the study.

Chapter Two reviews related literature. It opens up with conceptual framework amd then reviews theoretical and empirical literatures related to the study.

Chapter Three focuses on the genesis of the SG2000 project, its objectives, success and failure, within the period under study. This chapter also presents the description of the case study zone and findings on socio-economic characteristics of the people.

Model specification and analysis of empirical results are presented in Chapter Four.

Chapter Five summarises and concludes the study. Recommendations based on the findings of the research are also made in this chapter.

CHAPTER TWO LITERATURE REVIEW

2.0 THEORETICAL LITERATURE

2.1 The Concept of Rural Development

Every country has its "poor area", places where the incidence of poverty is unusually high by national standards. For years, governmental and non-governmental agencies have deviced various programmes to target extra resources to these areas with the aim of reducing poverty (Ravallion, et. al, 1997).

The concept of rural development has been viewed from multiple perspectives - political, social, economic and institutional by many authors. This concept has therefore been found to be very important under various circumstances as a foundation for a nation's development. Moreover, to understand "true" rural development, one must understand what "true" development itself entails. Rural development is a process of not only increasing the level of per capita income in rural areas, but also the s
population (Isah, 1995). In the early 1950s, the concept of rural development was almost synonymous with economic growth. Seer (1977), saw development as a reflection in the improvement of living standard of the rural and general

population from the clutches of poverty, unemployment and inequality. Todaro (1977), saw development as a multi-dimensional process which involves the re-organisation and re-orientation of economic and social system. He suggested that economic development implied attaining various developmental goals, with economic growth being one of such goals.

Theoretically, rural development represents a comprehensive development of the rural areas both in terms of standard of living as well as increase in income. To reiterate that rural development is concerned with people, improvement in their standards of living through the raising of their income, Mabogunje (1980) added that such improvement must be a "self-sustaining basis" and that it could also arise : "through transforming the socio-spatial structure of their productive activities". According to the United Nation Economic Commission for Africa (UNECA, 1994), "rural" connotes agriculture and other occupation, while agriculture connotes crop and animal husbandary practices. Thus, rural development can be defined as a "process according to which a set of technical, social, cultural and institutional measures are implemented with and for the inhibitants of the rural areas, with the aim of improving their socio-economic conditions in order to achieve harmony and balance both on the regional and national levels". Qurash et al. (1996) referred to rural areas by common usage as under developed when the poor fall-

short of a level of economic welfare deemed to constitute a reasonable minimal either in some absolute sense or by the standard of a specific society. Thus, it is not surprising that rural development in most literature is linked with poverty alleviation.

Going by the above definitions of rural development, three important features emerge, which are;

1. Improving the living standard of the subsistence population which involves mobilization and allocation of resources so as to reach a desirable balance over time between the welfare and productive services available to the subsistence rural sector.
2. Mass participation which requires that resources be allocated to low-income regions and classes, and for productive and social services to actually reach them.
3. Making the process self-sustaining which requires development of appropriate skills and implementing capacity and the presence of institutions at the local, state and national level to ensure the effective use of existing resources and to foster the mobilization of additional financial resources for continued development of the subsistence sector.

2.2 Importance of Rural Development to Agricultural Productivity in Nigeria's Economic Growth

Toyring (1992) stressed that if people are serious as a nation to build a great Nigeria of our dreams, we must first start by building the country's over 100,000 communities into great society in order to promote the well-being of the rural majority and production of a surplus size.

Koinya (1989) connotes rural development as important to the development of man, the unfolding and realization of his creative potential which will enable him to improve his material conditions and living through the use of resources available to him. And it is a process by which a man's personality is enhanced. In support of this, Adams (1995) pointed out that the objectives of any country are to improve the well-being of the rural population and to facilitate the use of surplus agricultural production to promote industrial development. The above statement implies that a common goal in rural development strategies must focus on restructuring the production base for the substantial improvement of production and productivity. Through such improvement, financial and material resources can be generated for achieving a better standard of living.

Lele (1975) was of the view that a way of improving the

standard of living of low income people residing in the rural areas was by making the process of their development self-sustaining. In support of this view, William (1981), Adedayao (1983), Okorie (1987), all saw rural development as the "improvement and transformation of space with a view to enhancing the quality of life of the inhabitants". Willam (1981) signified rural development as a strategy which would improve the economic and social life of a specific group of people - rural poor. Anker (1973) saw rural development as a strategy, policy and programme for the development of rural areas and the promotioon of activities carried out in such areas with the ultimate aim of increasing the physical and human resources.

From the above discussions on the importance of rural development, one can see that the issue has been analysed both from the stand point of an increase in production which is through agriculture, and from the stand point of social advancement arising from a higher level of income and consumption and the satisfaction of human needs above the basic.

2.3 The Concept of Agricultural Productivity

Sumanth (1987) in his definition of productivity, pointed out that some people think that the greater the production ,

the greater the productivity. According to him, it is not necessarily true that increase in production result from an increase in productivity. "Production is concerned with the activity of producing goods or services while productivity is conecerned with the efficient utilization of resources (inputs) in producing goods or services (output). Economists defined productivity as the ratio of output of goods and services to the input factors. Amadi (1987) defined productivity in a nutshell as a measure of how effective resources are combined and used in order to accomplish specific, desirable result. Thus, it concerns quality, service and profits. Akunnusi (1987) also defined productivity in the same way as the ratio of some output to some input, and as a measure of how well resources are combined and utilized to accomplish specific results. He expressed it simply as:

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Results achieved}}{\text{Resources consumed}}$$

From the various definitions above, we can define agricultural productivity as the ratio of agricultural production to the resources used in providing it. In other words, it is a ratio of input to output as Nwaroh, (1987) put it. Others like Kendrick (1983) saw it as "what you get out of agricultural activity for what you put in".

2.4 Importance of Agricultural Productivity Improvement in Nigeria

The present world-wide economic depression compels more and more non-profit and service-oriented organisations to focus greater attention on agricultural productivity. The need for this orientation is even greater in developing countries like Nigeria which cannot favourably compete in the world market with the more highly developed countries that have higher technology in the quality and quantity of food produced. Many countries of the world have long recognised the importance of agricultural productivity, its impact on the quality of life and the need for continued productivity growth which is the cornerstone of sustainable economic growth amd price stability. Increasing agricultural productivity is crucial in the early stages of a nation's development in order to ensure survival. In late phases, it is equally mandatory to generate necessary innovations in rural economy.

Tawose (1995) pointed out that there is a direct relationship between rural development and agricultural productivity, such that, if rural economy is neglected, there will be negative growth in agricultural productivity and conversely if there is improvement in agricultural productivity in rural areas, there will be an increase in the level of income and standard of living, and this will cause a

positive impact on the agricultural growth of the whole economy or the level of per capital income. In support of this, Baustista (1991) considered an increase in agricultural productivity as the engine of growth. He strongly supported an agricultural based development because he saw it as capable of generating mass employement, alleviating poverty as well as an income redistribution programme. Baustista (1991) further pointed out that an improvement in agricultural productivity will solve the debt service burden of most developing countries since it is a foreign exchage conserving sector. This, he said is possible, because of the linkages of the sector with the rest of the economy which represent the key to rapid, broad-based and self sustaining economic development.

2.5 The Concept of Technology Transfer

The concept of technology raises several problems in relating it to agricultural productivity. Howevever, in its general conception, technology refers to knowledge -- the art of doing things. In the realm of production, technology involves the art of combining inputs, including equipments, machinery, labour, raw materials and skills to produce some given level of output. Technology also includes knowledge of the abiility to re-arrange inputs to respond to variations in relative factor prices. Technology as defined by most writers (See Norman, 1973; Stoneman et al., 1993 and Copper, 1994) was

seen as the application of scientific knowledge towards the improvement of a production process. For example, Norman (1973) conceived technology as the sum total of konwledge, skills and method relating to the production, distribution and consumption of goods and services including the organisation thereof. Copper (1994) saw technology as a major vehicle for bringing about rapid changes in the economic and social conditions of people. In summary, Stoneman et al. (1993) put it simply as the knowledge necessary for the production of a particular output. And that the complexity (or simplicity) of the knowledge depends on the specific output concide.

In defining technology transfer, Ijere (1983) said that it was the transmission and subsequent assimilation of methods and techniques of production from one given locality to another. According to him, in agricultural production, technology comprised of three main aspects;

1. Mechanical technology - this is concerned with machinery, tools, equipments, etc.
2. Biological technology - this deals with new improved seed etc.
3. Chemical technology - these are referred to as the various chemicals e.g insecticides, herbicides, fertilizers, etc.

However, in the discussion of the merits and demerits of

technology transfer, Ogbudinkpa (1986) was of the view that adapting to technology is a solution to Nigerian agricultural productivity. Ogbudinkpa (1986) outlined five fundamental states towards adaptive technology. These are awareness, interest,, careful evaluation, trial and adoption. In addition, UNCTC (1988) saw technology transfer as an issue of effective transfer, such that, the process of effective technology transfer does not end with the requisition of technologies, it implies the assimilation and diffusion of these technologies in host country as well as the development of indegeneous capacities for adaption and innovation.

2.6 Choice of Appropriate Technology

The efficiency of agricultural productivity in any country is a reflection of the level of technology prevailing in it. The low rate of productive efficiency identified for most crops in Africa suggests that the efficiency with which scarce agricultural resources are converted into food and raw materials has been inadequate. Stewart (1978) pointed out that the choice of product predetermines the choice of technology. Such that if the choice of technology involves importation at a real cost (foreign exchange and other wise) then, this must be justified by producing an output which can be sold at remunerative prices, and such output should also save an earn foreign exchange. Osifo (1987) stressed that for

technology to exert its maximum impact on improvement of productivity, the ambient environment must be conducive not only for the control of supply of technology but also for the control of technology which is an objective of economic development. Ndu (1987) also added that technology that is alien to the socio-cultural orientation of a people was not appropriate. This means that an appropriate technology must meet or suit or be easily adopted to the socio-cultural demands of the people it is designed for.

Marilyn (1978) pointed out that the problems facing Africa rest largely on the development and dissemination of new types of technologies which are appropriate to existing conditions. According to her, for the transfer of appropriate technology one must consider such technologies not being as complex as those which have so far been transfered from the western countries. They should not be as unsophisticated as the traditional technologies which are currently employed by millions of people in Africa. However technologies should be simple and cheap enough to harmonise with local human and material resources and land themselves, to achieve widespread production. Shumacher (1973), introducing the theory and need for appropriate technology, emphasised that it should be a technique of production by the masses and not mass production. In his own word,

> "Appropriate technology is the technology of production by the masses, making use of the best modern knowledge and experience, conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources, and designed to serve human person instead of making him the servant of machines".

This statement has helped to sum up what appropriate technology to be adopted by peasant farmers in order to achieve increase in production.

2.7 Determination of Agricultural Productivity

Several factors have been considered as important determinants of agricultural productivity by many authors Demery et al (1987) pointed out the importance of input price, level of income, rural infrastructures, technology or spending on research. According to them, in the pursuit of profits, farmers have to bear the cost of inputs. Norminal output costs are high. Hence, input prices are a very imporant element of agricultural productivity. The prices of relevant inputs like fertilizers, pesticides, improved and high yield varieties of seeds, tractors etc, are important determinants. The authors speaking on the level of income, stated that income level has a positive impact on agricultural output to

the extent that the higher farmer's income, the higher the level of production, ceteris paribus. This is mainly explained by the fact that with a higher level of income, the farmer can easily acquire the much needed inputs that can help boost productivity. Technology or spending on research as stated by Demery et al (1987) is perhaps the key variable if one has to raise substaintial output in a region like sub-sahara African. According to them, an increase in research in the sense of technological advance can help reach the twin goals of agricultural output growth and environmental conservation, through land use intensification. However, they gave a warning that some of the advanced technologies such as fertilizer may in the long run reduce agricultural productivity.

The authors futher pointed out that a deficiency in infrastructure can wipe out all other production incentives in an area. Thus, improving technology or adjusting input price may not be all that is needed to increase the output and incomes of farmers. More often than not, the farmers located in areas with little access to roads, transport, communication, agriculture services, marketing facilities and so on, improving technology may be a neccessary condition for restoring incomes but not a sufficient one if farmers cannot get the supplies and services they need. Hence, infrastructure investments may be required to give the farmers the capacity

to increase output and yields. From these points above, the importance of inputs in the attainment of production target under a modernized agriculture has been traced as having a long way of raising substantial profit of farmers and higher farm incomes. Joint planning committee (ANR, 1974), emphasised the importance of supply and access to farm input as an efficient way of achieving prroductivity in agriculture. In the report submitted by the ANR (1974) pointed out the the availability of all inputs for production at reasonable prices and in convenient manners was seen as essential for achieving efficient productivity in Nigerian agricultural sector.

Nlandu (1996) in his study of how price and macroeconomics policies affect agricultural supply, observed how government policy can create constraints in input market to affect production in agricultural sector. He observed that timely availability of fertilizer is essential. For instance, phosphate now being imported by the government or public sector is rarely delivered on time and usually not in sufficient quantity. And despite the fact that the importation of fertilizer is always late, year after year, the government seems unable to respond to the problem. Fertilizer policy is imposing large hidden costs on farmers, including search costs for scarce supplies, uncertainty about the availability leading to panic buying, depressed yields through lack of availability at required time. Therefore, these costs

mean that any benefit to farmers from lower prices is being dissipitated. For example, in Nigeria, the author observed that the fertilizer pricing policy has harmful intersectoral effects. Such that Natural gas prices for fertilizer corporations in Nigeria are held below prices for other users with the objectives of reducing the price farmers would pay for the purchase of fertilizers. The implication of this policy is that the Natural gas pricing only helped in reducing the availability of gas use in industries, since in an energy deficient country like Nigeria, this is an expensive way to offset agricultural pricing policies. Another observation made by Nlandu was that credit facilities affect productivity in agriculture. He pointed out that higher credit use is correlated with higher input use, and possibly higher output. Thus, credit is important in alleviating poverty, particularly in financing small-scale farmers in the rural areas. In support of this, Lipton et al (1993) stressed the improtance of physical capital especially the amount of land, farm equipment owned, and credit facilities as crucial to the well-being of poor people who derive income mainly from their labour. Alleviating poverty according to them should begin with reducing biases against the development of rural areas and making credit available to peasant farmers so as to increase their agricultural productivity. Qurashi et al. (1996) also pointed out the importance of credit to agricultural productivity. They stated that to promote

agricultural productivity and economic growth, a nation must make more credit available to agricultural small-holders. That subsidizing farm input prices (interest rate) is not the way to help marginal borrowers, instead thay can be helped through fixed cost subsidies and self selected targeting. According to this research, Qirashi et al (1996) emphasised that small-scale farmers are more likely to face credit constraints due in part, to lack of collateral security. And also, small-scale farmers are likely to be constrained by low quality natural resources particularly land which limits the range of crops that can be efficiently grown. Thus, farmers may be unable to change their crop production techniques.

Other factors that determine agricultural productivity as pointed out by other writers are land, labour, increased yield seeds and level of technology etc., Central Bank of Nigeria/Nigeria Institute for Social and Economic Research (C.B.N/NISER, 1991), pointed out that low rate of technological adoption is a determinant of low productivity in agriculture and that the reduction and outright elimination of subsidies on all agricultural machinery like tractors, harvesters, planters and harrows, following deregulation has reduced the pace of adoption of technological innovation in agricultural productivities. This, they observed compelled continued application of traditional technologies. There is evidence to prove that even the tractor hiring units run by

state government are now of little relevance, as tractors were either absolute or in a state of disrepair. The report (C.B.N/NISER, 1991) further pointed out that technology has the drudgery which characterises farming activities in most developing countries and thus enhancing productivity.

Norman (1974), observed that labour flow into small-scale agriculture is a major constraint to agricultural productivity. Evidence suggests that compared to Asia, labour availability in Africa was frequently a greater constraint to increasing agricultural productivity than was the availability of land. Norman (1974) observed that on the average, African small-holders devote only about 1,000 man hours per adult per year to agricultural activities. Compared to up to 3,000 man hours in several Asian countries. As a result, technological innovations which require intense labour input may not result in the full realization of potential production increases.

Cleave (1974) supported this view by saying, there is a seeming paradox of farm labour shortage combined with an apparent labour surplus. The explanation he gave for this lies in the way labour time is allocated in Africa agriculture; i.e in the seasonality of labour usage, in the allocation of time between farm work, non-farm work and leisure. Thus, these two factors influence the amount of labour allocated to agricultural work at any given point in

time. These factors frequently, pose a constraint to increasing productivity limiting the effectiveness of interventions introduced through programmes. It is therefore important to note that, the level of agricultural productivity in a country itself cannot be easily and significantly increased in the presence of the constraining factors already mentioned above. It should be appreciated that unless the identified inhibitive factors are eliminated, our present efforts to revive our depressed economy can not be achieved. However, bringing the economy back to the path of self-sustaining growth or minimising the inhibitive factors of growth would amount to exercise in fertility.

2.8 Empirical Literature

A study by Adam (1995), using the Cobb-Douglas production model, revealed the dominant role of land for agricuttural productivity. He observed that the coefficient for land variable, which measures the production elasticity of land was positive and highly significant for the crop cultivated. According to the findings, a 10% increase in the availability of land tend to increase the total value of the crop output (sugar cane) by 8.2% for a bottom income quantile farmer, and 8.9% for a top quantile farmer. By constrast, the production elasticities of other inputs - labour, capital and water were fairly low for all the crops cultivated. Also in a study

earlier carried out by Winch (1976), using the "cost-route" approach to determine the importance of land, labour and other inputs in rice productions, he observed that the production strategies were providing rice producers with high finacial returns but at high cost to the economy.

In another similar study, Olayemi et al (1971) used the net farm income analysis to analyse the profitability of farm enterprise. This method involves computations leading to the determination of gross revenue and total cost for the production period. The model used was;

$$NFY = TR - (TVC + TFFC)$$

where NFY = Net profit income

TR = Total revenue

TVC = Total variable cost

TFC = Total fixed cost

The objective of their study was to identify the cost return and profitability or loss per hectare with total revenue representing the value of the output. While their total cost was made up of the variable cost (labour, capital) and fixed cost (land). The computed returns were used to derive various profit measures including net income and the enterprise gross margin. However, the limitation of this model was it's inability to define how optimum returns can be

attained from limited resources. All it shows was the monetary cost and returns from production process but did not specify how the various inputs used in production affect the level of output. They did not specify the contribution of each factor input employed in the production process so that the marginal value product can be known for efficient use in future production process.

Another empirical study was undertaken by Ukpabio (1978). He tried to show the role of new advanced technology over indegeneous one in increasing return to scale of farmers. Using the gross margin analysis to determine the marginal value productivity of factors used in production, he categoried the farmers into two groups __ the small scale farmers (the farmers who used the indegenous technology) and the large scale farmers (who used the new advanced technology). He observed that farmers who adopted the new technology scored the highest input-output ratio because they used larger quantity of each of the resources to get highest returns. This according to him was reflected in their high productivity. The researcher also observed that the large scale farmers made most efficient use of their resources and thus, had the higher indices of performance and more labour efficiency. Using the marginal value productivity model to estimate labour, capital and land for farmers that adopted the new technology, the result for land was N93.19 (Naira per

hectare) while for labour and capital was N66.92 and N8.05 (Naira per hectare) respectively. The return to scale for this group of farmers was recorded as 1.36. For the farmers using the indegenous technology, the marginal value productivity estimates were N75.80 for land, N2.68 for labour and N7.74 for capital respectively. (All were measured in Naira per hectare). The return to scale for this group was recorded as 1.25. The implication of this study carried out by Okpabio (1978) shows that new technology can contribute to cost reduction and innovation which would lead to better way of production. It also enhanced the quality of production as well as the safety of farmers. The study also pointed out that technology development can have a synergetic relationship with agricultural productivity, in that, better technology can lead to the development of better, more efficient and more productive farmers.

However, the limitation of this study is the coefficient of multiple determinantion (R^2) for the inputs land and labour in the production of one of the crop (guinea-corn) by the peasant farmers (the low quatile farmers). The R^2 was very low for all the crops (guinea corn, millet and sugar cane) grown by the low quatile farmers. The R^2 was 0.0307, which was less than theoretical value of 0.5000. Also the R^2 value for the large scale farmers who adopted the new technology was 0.474. Comparing the 0.474 value with 0.0307, it means the included

variables in the regression did not explain about 70% of the resultant output of the low quatile farmers, while about 53% of the output of the large scale-farmers was also not explain by the independent variable. This only implies that some other factors which were quite important in determining return were not included in the model. However, the conclusion drawn from this study was that as a result of improved farm technology, there was a positive impact in farmers productivity, hence increase in the level of income.

James (1996) using the Cobb-Douglas production function, conducted a survey of 185 farmers to analyse how factors used in production determines the cost and returns in rice production. In his findings, he observed that labour was the most critical requirement factor in rice production among the 186 farmers. From land preparation to harvesting and post-harvesting operations, a total of 40,8333 man-days of labour were expended by all the farmers, accounting for about 52.66% of the total cost of production. In the same study, it was observed that net returns per hectare increased with increase in farm size, while the total cost of production per hectare decreased with increase in farm size.

In the evaluation of the impact of Kadawa pilot scheme in Kano, Baba (1975) showed the trend in production and productivity of farmers (40) who benefited from the programme.

He observed that an average of 37,000 kilograms of tomatoes per hectare of land and 3,000 kilograms of wheat per hectare (1.2 tons per acre) were produced due to new irrigation technology adopted by the farmers. This high yields considerably stepped up the income of the benefited farmers -- estimated at N1,038 per hectare of tomatoes (or N420 per acre) and N445 per hectare of wheat (or N180 per acre).

In the same study, the input cost estimation for labour accounted for 81% of the total cost of tomatoes output and 53.8% of wheat output. The conclusion from this empirical study is that farmers are receptive to agricultural technology innovations to increase their productivity.

In another study, Nweke (1981) and Abd-ella et al (1981) found out that there is a positive correlation between the number of years of education and agricultural progressiveness. Marlaine et al (1980), found that an average 4 years of schooling resulted in 7.4% imporvement in output. Similarly, in a recent survey of farmers using a metal-analysis, (a simple extension of Cobb-Douglas production function in which education was included) Phillip (1994), confirmed the findings of Marlaine et al (1980) that schooling had a positive effect on farm productivity. In another related study on the determinants of agricultural productivity, Oludimu (1987) examined the pattern of inter-

relationship between productivity level on the quality of life of the rural people. His findings showed that the coefficients of all the variables turned out to be significant, and also carried positive sign(s). Thus, as farm size and capital increases, farm income also tend to increase. However, an increase in the number of labour employed tended to have negative impact on farm income. In a survey carried out by Lopez et al (1995), showed how farmers wealth affected output. They pointed out that there is a positive relationship between the level of agricultural production and an increase in credit of farmers and that an increase in credit availability resulted in an increase in output and hence, increased credit led to higher hired labour. In the same study, they observed that the purchase of input was a function of the level of income. In their study, Neil et al (1996) concluded that net profit per hectare of maize, using the recommended level of modern input is E93.60 and the net profit using the recommended level of input was E752.30. This analysis showed that farmers adoption to modern practices may produce a marketable surplus, therefore, the desire to produce a marketable surplus may be a motive for adopting modern technology by peasant farmers.

From the literature so far reviewed above, it could be seen that although the Sasakawa Global 2000 (SG2000) has been in operation in Nigeria for long, no empirical study has so

far been undertaken to ascertain the extent to which the program has been successful or otherwise. This study therefore is an attempt to fill the gap in the literature by evaluating the role of SG2000 in Nigeria and to asses how its new technological package has helped in producing positive results in the study area.

CHAPTER THREE AN OVERVIEW OF SASAKAWA GLOBAL 2000

3.0 GENESIS OF SASAKAWA GLOBAL 2000

3.1 Study Area

The Lere zone of the Sasakawa Global 2000 (SG2000) project was created in 1993 with its headquarters in Saminaka. The zone is made up of three Local Government Areas, namely, Kauru local government with population size of 127,937, Igabi local government with population size of 298,029 and Lere local government with population size of 221,058. The zone lies between 11°19'N and 10°5'S Longitude and 6°0'E and 7°45'W Latitude of Kaduna State (See Figure 1).

3.2 The Setting of the Project

The origin of the Sasakawa African Association (SAA) was as a result of the severe sahelia draught of the early 1980s which affected many African countries. In 1984, the late Ryoichi Sasakawa, Chairman of the Sasakawa Foundation of Japan (now the Nippon Foundation) mobilized funds to send emergency food aid to the 20 severely affected counries. However, when he recognised that the famine was a syptom of an underlying malaise in food production, Norman Borlaug, a Nobel peace

laureate was contacted to find out whether the green revolution principle as applied to some Asian countries which subdued chronic outbreaks of famines could be applied in Africa also. Norman Borlaug opined that research products and information existing could greatly expand food production in Africa, but the major constraint was that improved technologies were not reaching the small-scale farmers who grow most of the African food. Indeed feeble extension systems were failing to link research and small-scale farmers.

With these findings in 1985, Mr. Sasakawa sponsored a workshop in Geneva to assess the possibilities for doubling or tripling the yields of cereal crops in Africa. A plan which included mounting projects to diffuse improved agricultural technololgy to small scale farmers emerged from this meeting, with Mr. Sasakaawa agreeing to fund the pilot projects. Hence, the Sasakawa Africa Associatioons (SAA) was registered as non-profit, tax exempt organisation in Geneva in 1986. At about the sametime, former United States president, Jimmy Carter, who was also deeply concerned about Africa's food crisis, offered to engage National Leaders in Africa in discussion about critical economic and agricultural policy issues. Consequently, Sasakkawa Africa Association (SAA) and Global 2000, a program of the Carter Centre in Atlanta combined forces to form a partnership called Sasakawa - Global 2000.

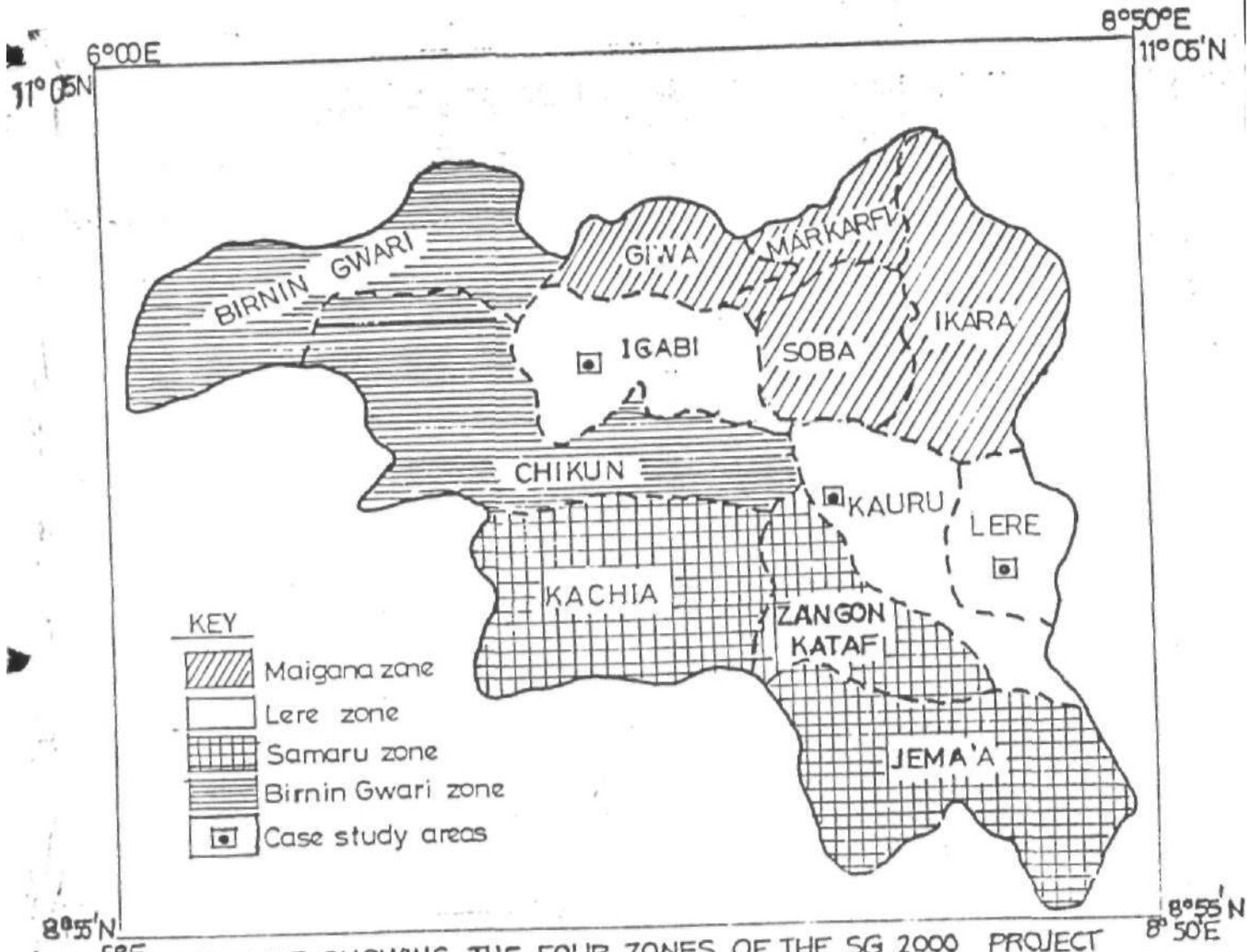


FIG.1. MAP SHOWING THE FOUR ZONES OF THE SG 2000 PROJECT IN KADUNA STATE.

3.2.1 The Objectives of the Project

In order to encourage sustainable development, equitable and responsible use of resources in agricultural productivity of African farmers, the diffusion of improved technologies to small-scale farmers through extension agents in the production of cereal crops such as maize, sorghum, wheat, rice etc formed the broad objective of the Sasakawa Global 2000.

Other specific objectives are;

- Assisting in developing quality extension services through training and provision of some logistic support.
- Strengthening of linkages amongst research extension services and farmers in order to transfer the improved technology from researcher to farmers.
- Oraganising credit facility, the supply of inputs and market for the harvested crops.
- Assisting in cereal seeds production.

3.3 Components Considered in Selection of Project Countries

Although SG2000 projects are located in diverse countries, the core approach to the problems of small farmers is similar. Before starting a new project, SG2000 determines that, there is a pool of technology appropriate for the country which could have a significant impact, the citizens

are poor, the country is food insecure, and it makes sure the government is committed to agricultural development. On these bases, SG2000 and the concerned government would draw up a memorandum of understanding that lays out the responsibilities of both parties. SG2000 insists on working through government agencies rather than setting up a parallel organisation outside the government. That helps to ensure that the national extension agency benefits from the lessons learned and will retain them when the project draws to a close.

To establish demonstration plots in a community, extension workers enlist farmers who agree to provide labour and a piece of their land in order to try out the new methods. The plots are usually large -- 1,000 to 5,000 square meters. This is in order to provide a convincing demonstration of the recommended technology and to reward the participating farmer with a significant economic return. On plots of this size, after tilling the soil, seeding the crop, battling weeds upto the harvest, farmers can reap an impressive payoff. SG2000 supports training sessions for extension workers and participating farmers in the community at key time during the growing seasons. Farmers and extension agents learn the value of ploughing, planting seed of an improved variety, applying fertilizer, weeding and harvesting.

3.4 Adoption of the SG2000 Project in Nigeria and its Achievements

The SG2000 project started in Nigeria in 1992 as a result of a formal request to the Association by the Federal Government after its spectacular success in other African countries. The project started with two states, Kano and Kaduna. In Kaduna State, the project was first introduced in Lere and Maigana zones of the Agricultural Development Project (ADP) with 9 villages, and a total number of 100 farmers. With the success recorded in this two zones, the project was later extended to other states of the Federation, e.g Jigawa, Katsina, Gombe and Bauchi States. Since its inception in the various states, the SG2000 through institutional structures for extension delivery, has promoted good quality hybrid seeds production, appropriate planting dates, timely and proper application of fertilizers, etc. It has also helped farmers solve the problem of inadequate input supplies by providing fertilizers and seeds to its cooperative farmers on credit. These are immediately recovered as soon as crops are harvested. The provision of these farm input on credit represented the strongest incentive so far given by the previous and present agricultural projects. As a result, this has created confidence and appreciation on the project by most farmers adopting the hybrid maize or wheat technology, especially when one considers the troubles farmers go through

when they independently struggle to obtain fertilizer.

Results in the past years (since innception) indicates that farmers are doubling and tripling their yields due to the technological packages. For example in the Management Training plots (MTPs), farmers now realize 5-8 ton/ha instead of 1.25 ton/ha of maize that farmers used to realize before (Jaryum, 1996). Also, the number of Management Training Plots (MTPs) over the years have increased steadily from 98 in Kaduna State in 1993 to 1,700 in 1996. In Jigawa State, the number also rose from a mere 24 in 1994 to 275 in 1996. This increase is due mainly to the increasing number of farmers who show interest in participating in the project every year (See Table i)

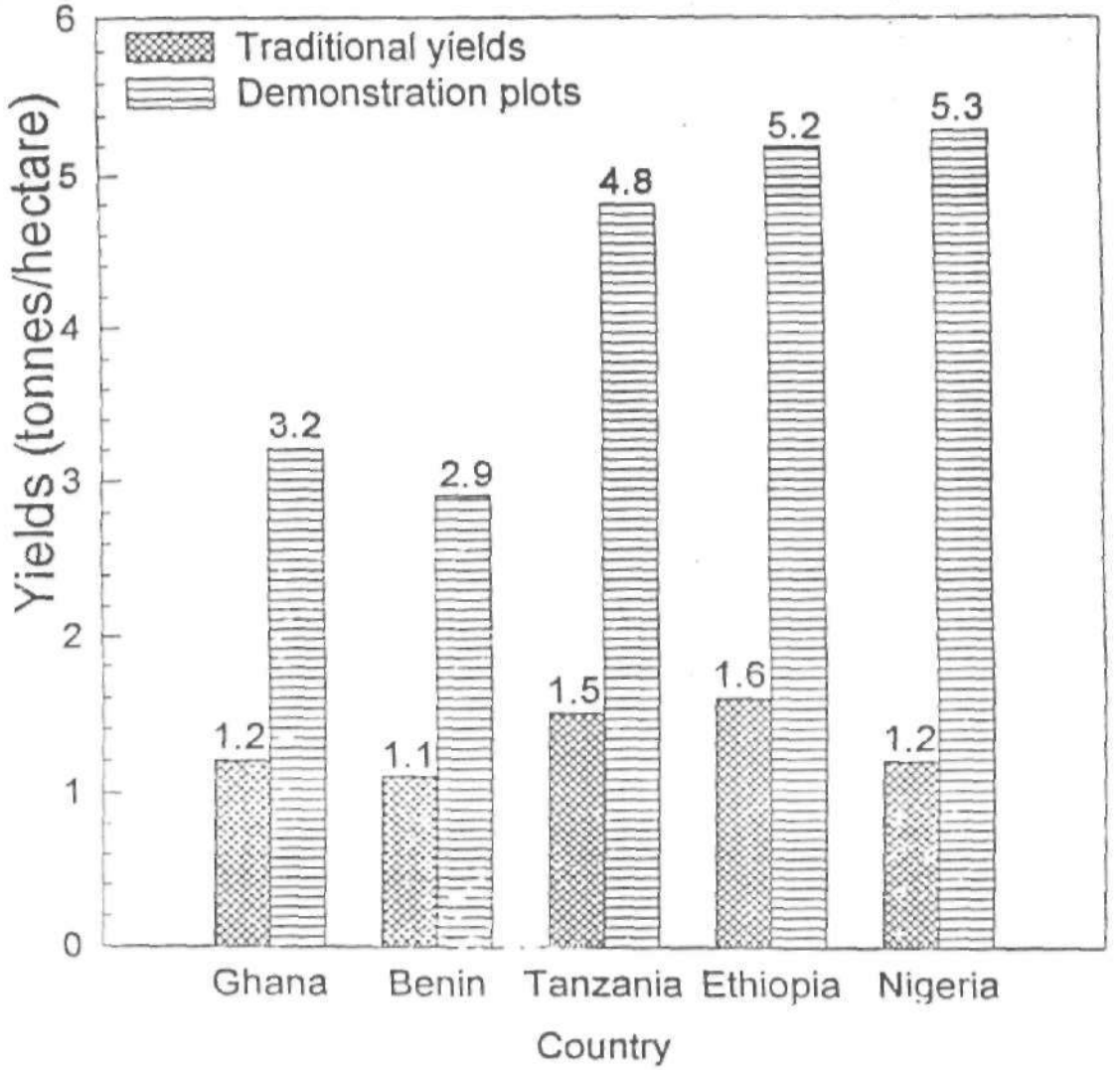


Figure 2: Maize grain yields in five SG2000 countries

[Source: computed from Sasakawa African publication (booklet) 1996]

In Figure 2, the bar chart shows the various performances of the SG2000 technology in five countries. There had been a remarkable increases in the level of output (yields) in the various countries, though Nigeria had the highest yields of 5.3 tonnes per hectare in 1996. This indicated about 4.1 tonnes over the traditional yields that farmers used to realize before the SG2000 programme. Ethiopia followed with 5.2 tonnes per hectare of demonstration plots yields per hectare. However, the general conclusion based on the chart is that in all the five countries, the general performance of demonstration plots yields using the SG2000 technology had yielded a remarkable increase over the yields farmers used to realize when they were using the non-improved seeds. Thus, the broad objective of doubling or tripling cereal yields in African countries had been a reality in the project countries.

Table 1 shows the summary of achievements in the various project states in Nigeria since the inception of the SG2000 programme. Comparing the figures with the National average grain yield, tonnes per hectare of 1.73 in 1994 - 1996, it can be seen that the average grain yield in the Management Training Plots (MTPs) in the SG2000 project states was 100% higher than the national average yield. This even becomes more meaningful when the costs and returns from the production of hybrid maize and that of traditional open pollinated variety (OPV) in same project villages are compared (See Table ii).

Table 1. Average Grain Yield in Maize and Wheat

Year	Number of farmer	Average grain yield (tonnes/ha)
	Kaduna State	
1993	98	3.8
1994	344	2.6
1995	254	5.2
1996	1,700	5.1
1997	N/A	(3.2)
1993-1994	Kano State	
1994-1995	N/A	(2.5)
1995-1996	"	(2.7)
1996-1997	"	(3.2)
	275	4.6,(4.0)
	Jigawa State	
1993-1994	24	4.8
1995	116	4.2
1996	300	4.1
1997	N/A	(4.9)

values in parenthesis are for wheat.
N/A = Not avaialable
Source: Sasakawa Global 2000 annual reports (1995-1997)

As shown above, the average grain yield ton/ha in Kaduna State in 1993 was 3.8, this rose to 5.2 ton/ha in 1995. The reason for this rise was as a result of an increase in the number of farmers in the Management Training Plots. The number of farmers in 1993 when the project was introduced was only 93, but in 1995, the number was as high as 254 farmers. However, comparing the average grain yields recorded in 1993-1995, with the nation average yield, which was 1.5 ton/ha, the performance of the state was high. In 1996, the number of farmers in the SG2000 MTPs rose to 1,700 with an average yield in maize of 5.1 ton/ha. The average yield recorded in

1997 was in wheat production, about 3.2 ton/ha. In Kano state, the performance of the SG2000 technology was also high, though the average yields recorded from 1993-1997 was in wheat production except in 1996, where that of maize was also recorded. In 1993-1994 the average wheat production was 2.5 ton/ha, this rose to 2.7 ton/ha in 1995, and again as high as 4.0 ton/ha in 1997, respectively. Jigawa State recorded an average yield in maize production of about 4.8 ton/ha in 1994 and 4.2 ton/ha in 1995 respectively. This however was different in wheat production, the average yield recorded in the state was 4.9 in 1997.

From the data provided in Table I, we can say that so far, the performance of the SG2000 project in the three states has been a success. And the adoption rate of the two technology is also encouraging as more and more farmers take part in the Management Training Plots.

Table II. Average Costs and Returns From Hybrid and Open-Pollinated variety in the SG2000 Project Villages - 1994.

Item	Unit of measure (N)	Hybrid	Open-pollinated variety
Hired labour	N/ha	2275.00	1785.00
Family labour	"	1920.00	1320.00
Seed	"	900.00	380.00
Fertilizer	"	1811.00	1126.14
Other costs*	"	520	72.00
Total cost	"	7425.00	4683.14
Gross return	N/kg	14520.23	8167.45
Net return	N/ha	7095.23	3479.31

* Other costs include transportation and agro-chemical expenses.
Source: Computed from SG2000 reports (1994).

The data in Table II broadly shows that hybrid maize production was more profitable than open-pollinated variety in the project villages. The wide disparity in the total cost of production per hectare may be explained by the fact that hybrid maize requires high labour at the harvesting stages as a result of the higher yield obtainable compared to open-pollinated variety in which higher cost of seeds and higher quantities of fertilizer are required.

3.4.1 Assessment of SG2000 in Lere Zone

For the purpose of implementation and achievement of goals and objectives, the SG2000 project is divided into four zones in Kaduna state. The zones are;

1. Maigana zone: consisting of 15 villages
2. Samaru zone: consisting of 14 villages
3. Lere zone : consisting of 65 villages
4. Birnin Gwari zone : consisting of 11 villages

However, the discussion on this section will evaluate the overall picture of the cost return relationship of the Lere zone with specific focus on average gross income, net income, land size and average yields, since the inception of the SG2000 programme (1993-1998).

A cost return analysis of a farm shows the profitability of the farm enterprise and often the efficeincy with which factors of production are put to use. If the returns are higher than the cost, then the farm can be said to be making profit, and this profit generated from this source may be put into economic use. The gross farm income was calculated by multiplying the total quantity of crop harvested by the price (See Table III). The table shows the income statement of the zone. The net farm income represents the difference between the gross farm income and the total cost per hectare. The total cost however, is calculated by summing up all input cost, e.g of seeds, fertilizer, labour used in sowing, land preparation, harvesting etc., and other inputs.

Table III. Average gross income, net income per hectare per village in Lere zone (1993-1998).

Year	Land size (ha)	Average gross income (N)	Average net income (N)	Average yield (kg/ha)
1993	*N/A	*N/A	*N/A	*N/A
1994	*N/A	*N/A	*N/A	*N/A
1995	63.5	54,168.8	44,130.2	5.2 tons
1996	145	73,261.0	51,041	5,635kg
1997	155.45	89,259.56	50,814.62	5,578.60kg
1998	*N/A	*N/A	*N/A	*N/A

*N/A = Data not available

Source: Computed from SG2000 annual reports.

Between 1995-1997, average gross farm income was estimated at N54,168.8 in 1995, N73, 261.0 in 1996 and N89,259.56 in 1997 respectively. This shows an increase of about 74% between 1995 and 1996. In 1997, the average gross farm income again rose up to N89,259.56 compared to the previous year, 1996 which was N73,261.0, this shows an increase of about 82.1% on the average per hectare in the project zone. The general average net income recorded in the zone between 1995 and 1997 was estimated at N44,130.2 in 1995, N51,041 in 1996 and N50,814.62 in 1997 respectively. Thus, between 1995 and 1997, there was an increase in the level of net income of about 87% (on the average).

Looking at the average yield per hectare per village in

the zone, in 1995, the average yield recorded was 5.2 tonnes per hectare. While in 1996, the average yield per hectare per village was given as 5,635 kilograms and 5,578.60 kilograms in 1997 respectively. Between these two years, there was a fall in the average yield. This could be due to low amount of chemical fertilizers used or as a result of low rainfall.

In the various years under study, the project zone (See Table III) witnessed a significant progress in the size of land cultivated. For example, in 1995, a total of 63.5 hectares were cultivated. This rose up to 145 in 1996 and 155.45 hectares in 1997 respectively, showing a 93.3% increase in size of hectares cultivated by farmers since the inception of the project.

The prevailing average cost per hectare per village in 1996 was estimated at N22,220, while the total cost in the zone for all the villages was estimated at N3,221,856. However, in 1997, the total cost of production was estimated at N5,975,954 for the zone, and N38,442.94 was estimated as average cost of production per hectare per village for the zone.

The general conclusion that can be drawn in the 6 year period under review (1993-1998) is that the performance of agricultural output in Lere zone has trended upward

particularly the output of maize and wheat. Between 1993-1996, a positive average growth rate of yields was estimated to be 5.2 tonnes per hectare in the zone. This positive trend in the output of the crops is an indication that the objective of the SG2000 agricultural project is being met.

3.5 Socio-Economic Characteristics of the People in Lere Zone

Farmers' output and their overall production efficiency are influenced by a number of factors with varying degrees of complexity. Some of these factors are farmers' inherent socio-economic characteristics,technical knowledge of the existig agricultural technologies,sources of finance and the socio-economic environment under which they operate. Most of these factors are outside the control of farmers and must be taken as given.As such,the objective of this sub-section is to report the findings of research with reference to the above mentioned factors and some other basic characteristics of the sample area.

Generally, agricultural production is the major economic activity of the people. The agriculture of the area can be describe as being one of small-scale subsistence farming in which cash-crops play a small but significant part. Cultivated land appear to be plentiful with the size of holding

fragmented into small plots, ranging from 1-6 hectares.The main crops are maize and sorghum,usually interplanted with cowpea. Lere zone of the SG2000 consists of both upland and lowland types, thus, giving it a considerable scope for agricultural development.Other subsidiary occupations such as trading, tailoring, barbing, weaving and fishing though practised in the area are considerd secondary to agriculture.

3.5.1 Sex Distribution of Farmers

The first socio-economic variable analysed is sex distribution of the farmers. The table below (3.5.1) shows that the majority of the farmers are men (84%) and farming is their primary occupation. From the table, only about 16% of the respondents were women. This indicated the dominant participation of men in farming activities in the zone despite the springing up of women organisations,government concern over the gender issues and high encouragement on women participation in agricultural development in Nigeria through family support programme (FSP), and the family economic advancement programme (FEAP). Alot of efforts is still needed in this zone to encourage the participation of women in farming.

Table 3.5.1. Sex distribution of farmers

Sex	Frequency	%
Male	168	84
Female	32	16
Total	200	100

Source: Field survey, 1998.

3.5.2 Farmers' age

Another socio-economic factor that was considered is farmers' age. The table below shows that 46.5% of the farmers belong to the young-age category (31-40), 25% of the farmers belong to the middle -age category of 41-50 years, while 16.5% belong to old-age category (51-60). According to the data shown, it appears that an overwhelming majority of the farmers belong to the young and middle - age categories . This proportion of people can be considered to be physically fit, which posits that there exists a relatively low proportion of old people in Lere zone. This also reveals that the prospect of higher agricultural productivity is high in this zone if the necessary rural infrastructural facilities or incentives are put in place to motivate the young category of farmers to stay in their rural areas.

Table 3.5.2 Frequency distribution of farmers' age

Age	Frequency	%
11-20	6	3
21-30	11	5.5
31-40	93	46.5
41-50	50	25
51-60	33	16.5
61 and above	7	3.5
Total	200	100

Source: Field survey, 1998.

3.5.3 Educational Background of Farmers

It is significant to note that education influences productivity by affecting farmers' ability to comprehend the production system and complicated information relating to modern technology, and their ability to adjust quickly to farm management practices. In other words, despite the crucial role of education in helping farmers to adjust to fast - changing agricultural technologies, of the 200 farmers interviewed, about 52% had no formal education such that, literacy in informal education is higher than that of the formal education in the zone. However, this does not presuppose a substitution for formal education, rather such form of education only constitute an integral component of the socio-cultural, political and religious setting of the farmers. Again, since the farmers are mostly exposed to religious education, it serves as an effective channel in

presenting infomation about agricultural innovations to them.

Table 3.5.3 shows the educational level of farmers in the zone. About 19.5% attended primary school, 9% had secondary education, while 9.5% and 6.5% attended polytechnic and advanced teachers college respectively, whereas the majority of the farmers (52%) had no formal education at all, while 3.5% went to university.

Table 3.5.3 Educational level of repondents

Educational level	Frequency	%
No formal education	104	52
Primary school	39	19.5
Secondary school	18	9
Advanced Teachers College	13	6.5
Polytechnic	19	9.5
University	7	3.5
Total	200	100

Source: Field survey, 1998.

3.5.4 Farm Size

Farm size is one of the key factors in determining productivity level of an area. Under the SG2000 program, the level of output is assumed to be positively related to farm size. That is, an increase in farmland leads to an increase in the level of output. Table 3.5.4 shows that majority of

the respondents interviewed, 32% had 1-2 hectares, 19% had 3-4 hectares, and 7% and 5% of them had 5-6, and above 6 hectares respectively. This analysis shows that majority of the respondents are small-scale farmers considering their farm size. Only 5% could be termed medium scale farmers (those having more than 6 hectares). Alot has to be done here to encourage expansion of land holding by the respondents so as to increase production capacity. Though there is a dramatic impact of the present and previous projects in the zone in relation to large farm lands now compared to the past, when the average farm size was only 0.25 hectare.

Table 3.5.4 Farmland size distribution

Farmland size	Frequency	%
less than 1 hectare	24	12
1-2 hectares	64	32
2-3 hectares	28	14
3-4 hectares	38	19
4-5 hectares	22	11
5-6 hectares	14	7
6 and above	10	5
Total	200	100

Source: Field survey, 1998.

3.5.5 Farmland Holdings

Land tenure system has a number of disadvantages for moving agriculture from subsistence level to market - oriented production. The severity of the land tenure problem is more

pronounced in Lere zone where land is usually owned by leasing and the system of inheritance tends to perpetuate fragmentation of holdings among male heirs. Another contribution of the land tenure problem in the zone is the lack of ownership rights (land belongs to the community). This has created a disincentive for long-term investment and higher cost of production for farmers who have to purchase or rent such land.

Table 3.5.5 Frequency distribution of land tenure system and farm organisation in the study area.

Tenure system	Frequency	%
Inheritance	99	49.5
Purchase	57	28.5
Lease	31	15.5
Family land	13	6.5
Total	200	100

Source: Field survey, 1998.

From table 3.5.5 above, one important observation from the data is that about 49.5% of the farmers acquired their farmlands through inheritance, for this reason, it is expected that the cost of production for this group of farmers will be lower than those who purchased (28.5%) or leased (15.5%) their farmland. The data also reveals that though land pressure had increased with the introduction of agricultural projects year after year, farmers claimed they were still better off than before and attributed this largely to the profitability of

farming with new improved technological packages. Thus, they can purchase more farmland in order to increase production yields and level of farm income.

3.5.6 Farm Experience of Farmers

Investigating farmers' years of farming experience can form a basis for infering how productive and viable a particular farm technique has been. Table 3.5.6 shows that farmers' experience in farming range from one to fifty years. About 31.5% of the respondents have been farming for 11-20 years; 25% have been farming for 21-30 years, 15.5% for 1-10 years and 16.5% and 11.5% have been farming for 31-40 years and 41-50 years respectively. The general observation here is that the majority of farmers in this zone fell between the ranges of 11-20 and 21-30 years of farming experience. This confirmed the productivity and viability of the present agricultural technologies introduced in the zone.

Table 3.5.6 Years of Farming Experience

Years	Frequency	%
1-10	31	15.5
11-20	63	31.5
21-30	50	25
31-40	33	16.5
41-50	23	11.5
51 and above	Nil	Nil
Total	200	100

Source: Field survey, 1998.

3.5.7 Labour Usage

Agricultural labour is either hired or provided communally in this zone, though, family labour is also common --Men, women and children all contribute to farm labour. It was observed from the data on table 3.5.7 that all the farmers in this zone carried out their production activities from land preparation to harvesting using one or combined form of labour. The most prevalent labour among the farmers was communal labour locally known as "gayya". Both men and women provide labour under the "gayya" system whereby family members, neighbours and sometimes committee of friends or farmers club come together as a group on each person's land in rotation. In this form of labour, no wage is involved. The table below (3.5.7) shows a total of 160 (80%) of the respondents used both hired and communal labour. The hired labour in this area is based on a contractual agreement between the farmers and the labourer(s). In this case, the labourer(s) are shown the area where the operation is to be carried out first, based on the labourer observation of the area, and the knowledge of the nature of the job, a deal is then struck. The determinant of the amount to be paid, depends on the type of operation to be performed, for example, sowing, weeding, fertilizer application and harvesting, etc. From the table, about 15% used animal traction for farm activity, 5% used family labour, while 80% used both hired and

practice. Thus, in the zone, farmers can reap as high as 200,000 bags of maize depending on farm size and the adoption rate of the improved technological packages.

Table 3.5.8. Distribution of Respondents According to Gross Farm Output (Maize)

Gross farm output	Frequency	%
less than 10 bags	10	5
10-20 bags	18	9
21-30 bags	15	7.5
31-40 bags	20	10
41-50 bags	20	10
51-60 bags	30	15
60 and above	87	43.5
Total	200	100

Source: Field survey, 1998.

3.5.9 Sources of Farmers' Finance

There are signs that farmers respond positively to economic's incentives like credit which permits them to adopt economically and technologically proven agricultural innovation. Institutional loan in this study area is very low as only 2.5% of the farmers depend on co-operative banks loan. Table 3.5.9 shows that about 85% of the respondents use their proceeds from the sale of their farm produce to finance farm activities. This suggests a dramatic transformation in the study area as a result of a viable new agricultural technology. However, 7.5% of the farmers still depend on family and relatives support to finance farm activities and

5% used their personal income to finance their farm activities. With the data presented by table 3.5.9, credit is not an important source of finance this is because many farmers do not have collateral security required by banks, and the very high interest rate charged by money lenders are discouraging to the farmers.

Table 3.5.9 Sources of farmers' Finance

Source	Frequency	%
Farmers' personal income	10	5
Money lenders	Nil	Nil
Cooperative banks	5	2.5
Proceeds from sale of farm produce	170	85
Family and relatives	15	7.5
Total	200	100

Source: Field Survey, 1998.

3.6 Other Variables that Affect Productivity

The discussion in this section is based on the second objective of this study which seeks to asses the awareness, adoption and impact of the Sasakawa Global 2000 (SG2000) project in Lere zone. The rating and the awareness assessment of the agricultural project on the farmers in the zone is generally high, most of the farmers recognised the existence and the role the SG2000 has played in raising the prodcutivity and income levels in the zone. For example, the SG2000 provides information on fertilizer brands, fertilizer

companies, price of fertilizers and optimum time of supply to the farmers through their extension agents and field assistants.

3.6.1 Farmers Preferences for Technological Packages

Productivity in agriculture appears to require a systematic application of a well-balanced package of inputs. The introduction of new technological package coupled with better management practices are essential requirements for successful adoption of an innovation. It is only when all components are practiced optimally that maximum returns can be realized.

Table 3.6.1 shows that about 75% of the respondents prefered the improved seeds and fertilizer packages, while 12.5% prefered sowing and spacing between plants and land preparation respectively. Sowing and spacing are practices that appear new to the farmers in this zone. Farmers are used to certain number of plants per hole to ensure that some survived under difficult and unpredictable rain conditions. Therefore, it is not surprising that the two practices are the least prefered practices. However, if the complete packages are to be adopted in full by the majority of the farmers, some work needs to be done by the SG2000 programme about these two practices. Farmers must be made to realize

the importance of following these practices, otherwise, the packages will never be fully adopted by farmers. All the respondents testified that the preferences are not based on the difficulties involved in the application of the packages because the techniques are easy to diffuse. For example, the reasons given by the 75% of the respondents who prefered seeds and fertilizer were that they helped in providing high and quality yield at harvest while sowing and spacing saved time and protect the crops from diseases.

Table 3.6.1 Frequency distribution of farmers preference for technological packages.

Technological packages	Frequency	%
Improved seed and chemical fertilizer	150	75
Land preparation	25	12.5
Sowing and soacing	25	12.5
All the above	Nil	Nil
Total	200	100

Source: Field survey 1998

3.6.2 Technical Knowledge and Adoption of the new Technological Packages by Farmers

In a farmer's effort to adopt modern agricultural technology, he is faced with diverse factors and their related variables. Among these are attitudinal and environmental factors which from all indications, affect his adoption

behaviour. To achieve optimum production results in the SG2000 program, a farmer must properly combine single factor panaceas such as good land preparation, improved seed, proper fertilizer dosage and application etc.

In order to know the rate of adoption of the SG2000 technological packages, all the respondents were asked if they were aware of, and use all the entire packages for maize or wheat production. A farmer who responded that he was aware of a practice in the packages was asked to describe the practice. Because the practice was satisfactorily described, the farmer was credited with knowledge of that practice by the researcher. With a positive response, it was further assumed that the farmer who accurately defined the practice understood the practice and consequently adopted it.

Thus, Table 3.6.2 presents the result of the technical knowledge and use of practices related to the new improved technology. From the table, it appears that a large proportion of the respondents were aware of, and adopted the recommended practices irrespective of their educational background. About 100% of the respondents knew the optimum time, proper dosage and application of fertilizer, 90% were aware of the optimum time for land preparation and cultivation, 80% knew the age of seedling, while 50% knew the optimum plant population (spacing). As far as use of the

practices is concerned, the study indicates that the use of improved seeds, optimum time and proper dosage of fertilizer and its corporation into the soil, and land preparation were all prefered and adopted by the farmers.

However, from the table, we can see that a low percentage of the farmers did not answer the questions on technical practices. This does not mean they did not practice or adopt the technological packages. For example, 20% answered incorrectly on the age of seedling, 10% answered incorrectly on the optimum time of land preparation while a fairly high percentage (45%) answered incorrectly on optimum plant population per unit area and 50% did not visit demonstration plots.

Table 3.6.2 **Frequency distribution of technical knowledge and adoption rate of new method of production by farmers.**

Subject of question	Farmers answering correctly (%)	Farmers answering incorrectly (%)
i. Recommended age of seedling	80	20
ii. Optimum time of land preparation and cultivation	90	10
iii. Optimum plant population		
iv. Optimum fertilizer dosage and time of application	55	45
v. Visit to demonstration plots	100. 50	- 50

Source: Field survey, 1998.
(the index of measuring technical knowledge is calculated as

sum of all correct answers divided by incorrect answers multiplied by 100).

Reasons were provided by the respondents who reported adopting the practices, five of these reasons were to obtain increases in crop yields and income, availability of technical guidance by field assistants and extension agents, the desire to gain recognition in the community and lastly, the proven effectiveness of the study. Thus, it is obvious from the study that the farmers knew the benefits of adopting modern agricultural technology. It is also clear that there were more than economic motives behind farmers' adoption of technology, such that the incentives for adopting agricultural technology by farmers could appear to be derived from the technical efficacy of the information about the practices, economic feasibility of the practices in terms of increasing yields and income, social compatibility, proven effectiveness of practices or availability of the various inputs required for the successful adoption of the practices.

3.6.3 Changes in Agricultural Productivity

The proven effectiveness of the practices above suggests that many farmers in the zone were achieving yield performances for their crops that are far above average levels. Table 3.6.3 represents farmers' responses to the sharp increase in the production of maize crop. 50.5% gave

their reason as due to adequate supply of modern inputs, availability of land, while 49.5% attributed it to effective extension services. Field assistants and extension agents in addition testified that optimum plant population per hectare, sufficient fertilizer use and availability of suitable varieties of improved seeds are the major technical causes of the remarkable high productivity level in the zone.

Table 3.6.3 Farmers' reasons for the change in agricultural productivity

Reason	Frequency	%
i. Availability of land	101**	50.5**
ii. Supply of necessary input	101**	50.5**
iii. Effective extension services	99	49.5
iv. Adequate market systems	Nil	Nil
v. Credit facilities	Nil	Nil
Total	200	100

** - Multiple response

Source: Field survey, 1998.

To summarise the findings in this section with regard to first and second objectives of the study, the data revealed that the introduction of SG2000 and the adoption of its new farming techniques had a significant impact on traditional cropping pattern, level of awareness, agricultural productivity, land tenure system, level of income and the standard of living in the Lere zone. With the availability of

new improved seeds and chemical fertilizers at the right time, it is now possible to grow maize in a year in many command areas without fear of not having high yields. In other words, a farmer who uses the recommended practices can predict how many bags or kilograms of maize he will get at the end of a cropping season and how much his net income will be. This signifies the level of confidence farmers in this zone now have in profitable and efficient technological packages. Moreso, the positive changes in agricultural practices in this area as a result of SG2000 programme has affected both men and women in a number of ways. For example, in the past, the farmers had learnt farming techniques and practices from their parents, such that, there was a smooth transition of skills and knowledge from one generation to the next. This method of acquiring knowledge from first hand experience has been broken by the SG2000 through institutionalisation of information on the use of the introduced technological packages. Thus, a sharper differeciation of output yields of farmers had been achieved.

Lastly, a significant impact of this programme which was also obvious in the zone was the increase in the level of income and standard of living of the farmers who adopted the technology. About 80% (160) of the respondents can now boast of owning additional farmlands which were purchased with proceeds from the sale of farm produce. Some of them 20% (40)

even were proud owners of commercial vehicles (like buses and taxies), motor bikes, houses, cattles, tractors and threshing machines, etc.

CHAPTER FOUR MODEL SPECIFICATION, DATA PRESENTATION AND ANALYSIS

4.1 Model Specification

The specification of the study model follows the Cobb-Douglas production function as adopted from Adams (1995), Jayne (1994), Patrick *et al.* (1996). The preference for the model follows from several previous studies undertaken in the area of agricultural economics. Among the often claimed advantages of this model, two are particularly worth mentioning. First, it serves in the choice of degree of freedom, an advantage specially important in a small sample case like the one that was used here. And secondly, the regression coefficient provides direct estimate of elasticities of inputs.

Thus, the production function considered is of the following form:

$$Y = AX_1^{\alpha 1} X_2^{\alpha 2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots X_n^{\alpha n} \ldots\ldots (1.0)$$

where

Y = Agricultural output

X_1 = Amount of labour hired

X_2 = Amount of capital

A is a constant which captures technology and α_1, $\alpha_2 \ldots\ldots\ldots\ldots \alpha_n$ are coefficients (elasticities) of labour,

capital inputs etc.

The Cobb-Douglas type function above help in formulating the following linear and log regression models;

$$Q = F\ (LB + CP + Ui) \ldots\ldots\ldots\ldots (1.1)$$

where

Q = Gross value in Naira of output

LB = The total value in Naira of labour hired in production

CP = The total value of capital (i.e money used in the purchase of improved seed and chemical fertilizer)

Ui = Error term that takes care of other factors affecting production.

Equation (1.1) is then transformed into a regression form as;

$$Q = A + ß_1LB + ß_2CP + Ui \ldots\ldots\ldots\ldots\ldots (1.2)$$

Hence, the regressed functional form of the equation (1.2) will give the following estimated regression equation

$$Q = \alpha + \hat{ß}_1LB + \hat{ß}_2CP + Ui \ldots\ldots\ldots\ldots\ldots (1.3)$$

Where $ß_1$, $ß_2$ refers to the parameters to be estimated and Ui is the error term. Q is the dependent variable, while LB and CP are the independent variables. The B hats ($\hat{B}$s) are coefficients used to measure the effect of labour and capital in production.

In the log form, equation (1.1) becomes

$$\log Q = \log A + ß_1 \log LB + ß_2 \log CP + Ui \ldots\ldots\ldots (1.4)$$

The regressed functional form of the equation (1.4) gives the

following estimated logarithmic regression equation;

$$\log Q = \alpha + \beta_1 \log LB + \beta_2 \log CP + Ui \ldots\ldots\ldots (1.5)$$

With all variables remaining as defined in equation (1.3) above.

In an attempt to establish empirically the stated hypothesis of the study, the specified relationship is regressed as;

$$Y = F(Q) \ldots\ldots\ldots\ldots\ldots (2.0)$$

where Y = Gross net income

Q = Gross value of output.

The regressed function will thus be;

$$Y = a + b_1 Q + Ui \ldots\ldots\ldots\ldots\ldots (2.1)$$

4.2 Expected Result

As a preliminary estimate of the role and effectiveness of the Sasakawa Global 2000, and based on the stated hypothesis, we expect that the level of output should be positively infleuneced by new improved technology in the form of improved seeds, chemical fertilizer, land preparation, sowing and spacing and adequate skill in technical knowledge. Furthermore, it is also expected that a positive relationship exists between labour capital and total level of output.

However, the inference that can be drawn from the first method of analysis which regressed output (dependent

variable) against labour and capital (independent variables) is that , if the dependent variable responds positively to the set of explainatory variables included in the models , we can conclude that agricultural productivity (output) can be influenced by labour and capital. Moreso, if the parameters estimates obtained are inelastic and insignificant at 5% level of significance, then we can conclude that labour and capital are ineffective in stimulating agricultural productivity.

In an attempt to establish the above relationship empirically, T-test, F-test, and coefficient of determination (R^2) were used at 5% level of significance to determine the statistical reliability of the variables as implied in the regression. The T-statistics calculated would be compared with the T-table values, if the T-values calculated are greater than the T table values, it therefore means that the changes in the economic relationship being studied are statistically significant.Similarly, the F- statistics calculated would be compared with F- table values , if the F- value calculated is greater than the F- table value , it therefore means the systematic relationship between the dependent and independent variables are statistically significant.Thus, we would accept our null hypothesis. The coefficient of determination was used to measure the rate at which the dependent variable was explained by the independent variable. If the coefficient of determination is greater than 50% , it therefore means that a

significant propotion of the dependent variable has be explained by the independent variables. The Durbin- Watson statistic of aproximately 2.0 would be an indicative of the absence of auto correlation.

4.3 Presentation of the Regression Results

In relations to our model specification in sub-section 4.0 the results obtained for the first equation which regressed output (the depended variable Q) against the independent variables (Labour and capital) were as follows;

a. Linear estimates

$Q = 4796 + 1.3062\ LB + 6.3950CP$

$(1.050)^* \quad (2.964)^* \quad (3.114)^*$

$R^2 = 0.6222$

F-statistic = 13.996

D-W = 1.271

b. log estimates

$\text{Log } Q = 1.6490 + 0.3433 \text{ Log } LB + 0.4922 \text{ Log } CP$

$(2.487)^* \quad (2.834)^* \quad (3.104)^*$

$R^2 = 0.6600$

F-statistic = 16.503

D-W = 1.347

From a cursory look at the results, one would observe that all the two factors (labour and capital) had a significant regression coefficients and also with highly significant coefficient of determination (R^2) in the two form of analyses.

In the linear regression results, the effect of labour and capital on agricultural productivity was high. All the parameter estimates were significant at 5% level of significance and they all carried positive signs (see summary in table 4.3.1)

Table 4.3.1 Estimate of Cobb-Douglas production function; linear analysis.

Variable	estimated coefficients
Labour (LB)	1.3062
	(2.964)*
Capital (CP)	6.3950
	(3.114)*
Constant	47958
	(1.050)*
N	20
R^2	0.6222
F**	13.996
D-W	1.271

(* - numbers in parenthesis are t-statistics at 5% level of significance)

From the table, the estimated coefficient for capital

variable which measures the production coefficient of capital was positive and highly significant. For example, the coefficient of capital was 6.3950 and that of labour was 1.3062. The results indicated that, any 10% increase in the amount of labour and capital employed, led to 13.06% and 63.95% increase in agricultural productivity respectively. The efficiency parameter, (α) = 4796, showed positive technical efficiency of the resources. The value inplied that productivity in the zone during the survey period, had increased. The analysis also revealed the dominant role of capital in influencing agricultural productivity in this zone. Testing for the significance of overall parameters using F-test, our regression was statistically significant, because F-calculated value (13.59) was greater than F-tabulated value (3.59). The R^2 = 0.6222 was also quite high,this showed that the dependent variables (Q) was explained by 62% variation in independent variables such as labour and capital (X_1 and X_2) even though, they are not the only determinants of agricultural productivity. The rest are captured by the constant, 47958. Using the Durbin-Watson test, there was existance of auto correlation which make it inconclusive because the value is less than two (1.271). Though the model did not have auto correlation since both R2 and T values were high. Thus, we accepted the hypothesis.

Table 4.3.2 Estimate of Cobb-Douglas production function; log analysis.

Variable	Elasticity coefficients
Labour (LB)	0.3433
	(2.834)*
Capital (CP)	0.4922
	(3.104)*
Constant	1.6490
	(2.487)*
N	20
R^2	0.6600
F**	16.502
D-W	1.343

(* - numbers in parenthesis are t-statistics at 5% level of significance)

As shown in table 4.3.2, the results obtained are plausible with positive signs and significant t-statistics. However, the elasticities (coefficients) seem to be very high with positive serial correlation. The elasticity coefficient of capital which measures the production elasticity of capital was positive and highly significant, that of labour was also significant, all at the 5% level of significance.

The elasticities of labour and capital were 0.3433 and 0.4922 respectively. This indicated that any 10% increase in the amount of labour and capital employed led to 3.43% and 4.92% increase in the amount of output respectively. In other words a 100% increase in the amount of capital used in production would increase the total value of output by 50%, while labour would increase the total value of output by 34%. The efficiency parameters ($\hat{\alpha}$) = 1.6490 showed a positive

technical efficency of the resources. This value also implied that productivity in the zone had increased during the survey period.

The dominant role of capital in influencing agricultural productivity was also revealed in this analysis. Moreso, testing for the significant of overall parameters using F-test, our regression was statistically significant because F-calculated value (F**) = 16.503 was greater than F-tabulated value (3.59). The R^2 = of 0.6600 was quite high; this showed that the dependent variable (Q) was explained by 66% variation in the independent variables (X_1 and X_2) even though they are not the only determinants of agricultural productivity. Using the Durbin-Watson test, there was the existence of auto correlation which make it inconclusive to accept or reject our hypothesis . This is because thecalculated value which was 1.343 was greater than the tabulated lower limit point (dL = 1.01) and less than the tabulated upper limit point (dU = 1.54).

In the two results, R^2 value in the log estimate was slightly higher than the R^2 value in the linear estimate analysis. The log function was regarded as a better fit.

To determine the marginal productivity of each factor variable specified in model (4.1) the tables below were used.

Table 4.3.3(a), Means of variables from Cobb-Douglas function by income; linear analysis estimate

Variable	Mean
Output (Q)	274718
Labour (LB)	63458
Capital (CP)	22498

Table 4.3.3(b): Average and marginal values of inputs-labour and capital from linear analysis estimates

Variable	Productivity value
Labour;	
AvP**	4.329
MvP**	5.655
Capital;	
AvP	12.211
MvP	78.089

** = Average value productivity of an input (AvP) is calculated as

$$AvP = Vi/xi = AP$$

While marginal value productivity (MvP is claculated as

$$APi(E) = MP$$

where V = the mean value of gross output

x = the mean value of ith input

AP = average productivity

E = elasticity (coefficent) of each input)

From table 4.3.3(b), the marginal productivity of capital was 78.089 and that of labour was 5.655. In other words, holding other things constant, for each additional capital used in production, the zone will realize 13.8 times as much in the value of gross output compared to when labour is used.

Table 4.3.4(a): Means of variables from Cobb-Douglas function by income; log analysis estimate.

Variable	Mean
Output (Q)	12.509
Labour(LB)	11.031
Capital (CP)	10.087

Table 4.3.4(b): Average and Marginal values productivity of labour and capital inputs; log analysis.

Variable	Productivity Value
Labour;	
AvP	1.134
MvP	0.389
Capital;	
AvP	1.240
MvP	0.610

From table 4.3.4(b) it is noteworthy that the average productivity and marginal productivity from the log analysis estimate were very low when compared with the results in the linear analysis estimate. In the table, the marginal productivity of labour and capital were 0.389 and 0.610 respectively. The marginal productivity of capital was slightly higher than that of labour by 0.23 times. In other words, holding other things constant, for each additional capital used in production, the zone will realize 0.23 times as much in the value of gross output compared to when labour is used.

With regard to the results and discussions so far, the

general conclusion from the above estimations are that both labour and capital estimated coefficients in the linear analysis and the elasticities coefficients in the log analysis, determine the agricultural productivity of Lere zone, though, capital coefficents and elasticities are relatively higher than labour coefficients and elasticities. The linear analysis estimates confirmed that farmers in the zone had justification for efficient use of resources in the production of maize as recommended by the SG2000, as there was an indication of increasing return to scale following the results on marginal productivity of capital (78.089) and labour (5.655) respectively. Hence, we can say that agricultural productivity can be positively influenced by labour and capital when efficiently used by farmers.

The regression estimate of equation 2.0 yielded the following;

a. Linear estimates

$$Y = -6946.4707 + 18138.1616Q$$
$$(-0.383)^* \qquad (10.976)^*$$

$R^2 = 0.8700$

F-stat = 120.481

N = 20

D-W = 1.603

(* = number in parenthesis are t-statistics at 5% level of significance)

b. Log estimates

Log Y = -0.358174 + 1.0359 Log Q

(-0.727)* (11.376)*

R^2 = 0.8779

F-stat = 129.407

N = 20

D-W = 1.568

In both regression estimates above, which regressed income (dependent variables, Y) against the independent variable (output, Q), the results obtained are plausible and all the parameters appear to be significant at 5% level of significance except the constant term. From the linear analysis estimate, the results obtained showed that the independent variable (output) was significantly related to the level of income (dependent variable). The coefficient of output was 18138.1616, this value is very high and significant because the T - test calculated value of 10.976 was higher than the T - tabulated value of 2.093. This indicated statistical reliability of the variables. Moreso, testing the overall significance of the parameters using F-test at 5% level of significance, the calculated value of 120.481 was greater than the F - tabulated value of 4.41. Thus our

regression was statistically significant as R^2 = 0.8700. This indicated that output accounted for about 87% variation in net income level of the peasant farmers. Thus, from indication, output was found to be positively and significantly related to the level of income. Using the Durbin - Watson test, there was no existence of auto correlation as the calculated value which was 1.603 was greater than the tabulated lower limit point (dL =1.20) and upper limit point (dL =1.41). Therefore, the data from linear analysis estimate can be said to support our hypothesis.

Similarly, the results obtained from the log analysis estimate showed that the independent variable (output) was significantly related to the level of income (dependent variable). The coefficient of output was 1.0359. This value showed that for any 10% increase in output, income level will increase by 10.36%. Also testing for the overall significant of the parameters, (R^2 = 0.8779) indicated that output accounted for about 88% variation in the level of net income. Using the Durbin -Watson test, there was also the absence of auto correlation as the calculated value which was 1.568 was greater than the tabulated lower limit point (dL =1.20) and the upper limit point (dU =1.41). Thus, the data from this analysis also supported our hypothesis -- output and income are positively and significantly correlated.

Conclusively, the results obtained using the two functional analyses (linear and log estimations) were both plausible, though the log regression can be regarded as a better fit because of its high R^2 value of 0.8779 when campared to the linear R^2 value of 0.8700. However, the positive signs of the explanatory variable, and the fact that output (Q), coefficients in the analyses were very significant indicating that the new improved technology introduced by the Sasakawa Global 2000 had raised the agricultural productivity of peasant farmers resulting in an increase in the level of income and hence, standard of living. Thus, the apriori expectation of the SG2000 technology transfer to small-scale farmers could be said to have been largely fulfiled.

CHAPTER FIVE SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary

The broad objective of this research was to assess the impact of Sasakawa Global 2000 (SG2000) in technology transfer to facilitate peasant farmers agricultural productivity in Lere zone, with special reference to the level of income and standard of living. Other specific objectives were to examine the socio-economic characteristics of the farmers as well as to examine the extent to which the programme has influenced the farmers' agricultural productivity in terms of production efficiency of the resources used.

Based on the findings of the study, it can be said that new improved technology has contributed to agricultural productivity, enhanced innovations, quality of production as well as the development of more efficient and productive farmers. The findings in relations to the second objective of the study, indicated that some achievements have been recorded in the zone. For example, there was increase in farmers output, level of income, adoption rate to new improved technological packages was high, and the productivity level of the zone has also witnessed a remarkable increase. These findings were verified in the frequency distribution tables

in chapter four. The findings in chapter four revealed that in its effort to achieve its aims and objectives, the SG2000 has not only helped in developing effective extension services and packages, but has also trained extension aids to provide urgently needed technical pieces of advice to farmers. Other efforts of SG2000 were in the provision of effective outlet of farm inputs. This it does by providing the necessary information on fertilizer, improved seed companies, input prices, time of input supply, etc.

One important impact revealed by the findings in this study is the increase in farm sizes and standard of living. The findings showed that most of the farmers' income comes from proceeds from the sale of farm produce, and most of the income is being used in the purchase of more farmlands, commercial vehicles, houses and in financing other business ventures. Income also realises is used in the purchase of farm implements like threshing -machines and other farm impliments.

5.2 Conclusion

Conclusively, three key findings emerged from this study. First, the study showed that as a result of new improved technological packages (improved seeds, chemical fertilizer, good land preparation, optimum time of sowing and spacing between plants, proper fertilizer dosage and its corporation

into soil) introduced by SG2000, the agricultural productivity of Lere zone has increased and consequently the income level.This finding was confirmed in our hypothesis in chapter four using both linear and log analysis estimates. Testing the hypothesis at 5% level of significance using F - test, the results revealed that 88% of the variation in income (Y, dependent variable) was explained by output (Q), the independent variable. In other words, for any increase in the level of output produced in the zone, level of income in the zone will increase by 88%.

Secondly, the study revealed that the farmers in the zone utilised fully the available resources for production. The verification of this was seen in the regression results of chapter four, which show the production efficiency of labour and capital on the level of output, and the average and marginal productivities of the factor inputs. Thus, the results confirmed that the diffusion and adoption of new agricultural technologies by small-scale farmers hold the key to progress and if properly managed, can be highly economically and socially profitable.

Lastly, the study revealed that an introduction of any new improved agricultural technologies within a technological break-through area like Lere will not only represent an increase in output but will make a relatively large

contribution to the development of the rural area. Therefore, the promotion of new agricultural technologies and adoption among farmers in Nigeria perhaps may continue to be a step in the right direction in raising agricultural productivity.

5.3 Recommendation

Based on the findings of this study, the following recommendations are profered in order to sustain the use of modern inputs as well as to consolidate the gains of the SG2000 programme.

1. For continuous effective and sustainable agricultural productivity in Lere zone and in other project states, government should assist the SG2000 programme by providing agricultural incentives to farmers such as tax support on farm produce, and provision of fertilizer depots in rural areas. Such effforts will put the new improved technology within a proper context in the country's overall development priorities and planning strategies.
2. There is need for constant agricultural profitability studies in order to ensure that farm input prices are fixed at realistic levels, particularly, those of basic inputs like improved seed and fertilizer, etc.
3. Since farmers have acknowledged the use of improved

seeds and chemical fertilizers, it is pertinent to improve/increase production capacity of the local fertilizer plants in order to increase supplies at reduced cost.

4. The government should try to encourage and promote simple but cost-effective agricultural technologies that would help combat some of the problems still facing peasant farmers; for example, the development of Regional specialization in the production of a crop. This will help to provide incentives for export earnings.

5. Government should remove constraints that prevent small-scale farmers from having easy access to credit. Access to credit facilities will enable the diversification process by financing higher costs of production. It also reduces the risk of adoption of new production techniques and increases large scale production.

6. As a preliminary to implementing measures aimed at involving women in the extension programme, it would be useful to ascertain the number of men and women employed as agricultural field assistants by the agricultural services. Efforts should be made to recruit more women staff, with priority given to Hausa speakers who may be then trained and deployed to work with rural women. However, as a corollary

to this, men extension workers should receive some re-orientation training to make them more explicitly aware of the scope of women farmers activities.

7. There is still a need for farmers to be educated on management oriented problems like land management, post-harvest management and marketing of produce etc.

8. The socio-economic and cultural problems in developing agricultural technology has been for long neglected and many projects have failed because of this neglect. For socio-economic and cultural constraints to be fully contained, researchers and policy makers should understand the farmer, what he has, what he can do with what he has. This will ensure that the farmer's situation is taken into account in the design and evaluation of future agricultural technology.

9. Finally, both policy makers and researchers need to improve the socio-economic conditions of farmers and to develop site-specific technologies in order to improve farm management practices and enhance agricultural productivity. Not only will this remove the vast differences in resources use efficiency of existing technologies but it will also facilitate the adoption of intensive method, e.g pest control management, crop processing etc. This

approach will herald a second generation farmers.

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Appendix A: Total Yields and Total Cost of Production per Villages

Village Name (Unit)	Code	Totaal yield per villages (N)	Total cost of labour per village (N)	Total cost of capital per villages (N)
Tashan Muntari	1	360,360	118,314	21,210
Ung. Sarki	2	346,853	66,592	27,270
Ung. Goje	3	333,580	62,650	27,270
Dan Daura	4	330,408	47,036	24,240
Bawaa Gari	5	321,035	68,171	24,240
Ung. Jumari	6	309,140	62,729	24,240
Kauru II	7	289,198	61,590	25,755
K/Bauda I	8	287,300	64,110	24,240
K/Bauda (women)	9	279,994	94,160	25,755
Kadiri	10	269,009	56,889	21,210
Zinbina	11	262,483	51,822	19,695
Fadere	12	251,524	72,970	22,725
Jagu	13	249,145	51,850	18,180
Kudaru I	14	248,235	51,272	22,725
Garu Yadi	15	242,983	58,992	19,695
Kauru I	16	242,879	60,385	27,270
Sabon Birni I	17	240,435	57,300	22,725
Mariri I	18	237,081	47,930	21,210
Juran Kari II	19	199,264	50,420	15,150
Yadi II	20	193,453	43,975	15,150

Source: Computed from SG200 annual report 1996.

Appendix B: Forms of Labour and cost per villages (Naira in '000)

Village name (Unit)	Code	Cost of sowing (N)	Cost of app. fert. (N)	Cost of weeding 1 & 2 (N)	Cost of land preparation (N)	Cost of Harvesting (N)
Tashan Muntari	1	5,040	4,340	38,500	27,300	43,134
Ung. Sarki	2	3,482	6,135	13,275	11,550	32,150
Ung. Goje	3	3,065	7,143	10,751	12,140	29,550
Dan Daura	4	3,360	8,250	11,240	16,560	27,626
Bawa Gari	5	1,896	3,535	14,070	16,100	32,570
Ung. Jumari	6	1,599	3,090	11,760	16,100	30,180
Kauru II	7	3,360	5,177	12,192	14,289	26,572
K/Bauda I	8	3,640	6,040	8,430	18,600	27,400
K/Bauda (women)	9	10,500	19,220	11,890	22,450	30,100
Kadiri	10	3,535	5,265	12,260	10,515	25,314
Zinbina	11	4,560	6,840	6,842	11,830	21,750
Federe	12	6,100	9,330	21,100	15,750	20,790
Jagu	13	1,500	2,732	8,530	14,200	24,890
Kudaru I	14	3,482	7,714	7,090	8,836	24,150
Garu Yadi	15	4,430	6,240	10,050	12,885	25,387
Kauru I	16	2,908	4,990	15,322	13,474	23,691
Sabon Birni I	17	6,140	8,020	6,380	9,060	27,700
Mariri I	18	2,845	6,375	7,150	11,130	20,430
Jwaan kari	19	1,970	2,850	10,070	11,400	24,130
Yadi II	20	2,300	3,370	5,940	10,400	21,965

Source: Computed from SG200 annual report 1996.

Appendix C: Forms of capital and cost per villages (Naira in '000)

Villages name (Unit)	Code	Cost of seed (N)	Cost of fertilizer (N)
Tashan Muntari	1	3,570	17,640
Ung. Sarki	2	4,590	22,680
Ung. Goje	3	4,590	22,680
Dan Daura	4	4,080	20,160
Bawa Gari	5	4,080	20,160
Ung. Jumari	6	4,080	20,160
Kauru II	7	4,335	21,420
K/Bauda I	8	4,080	20,160
K/Bauda (women)	9	4,335	21,420
Kadiri	10	3,570	17,640
Zinbina	11	3,315	16,380
Federe	12	3,825	18,900
Jagu	13	3,060	15,120
Kudaru I	14	3,825	18,900
Garu Yadi	15	3,318	16,380
Kauru I	16	4,590	22,680
Sabon Birni	17	3,825	18,900
Mariri I	18	3,570	17,640
Juran kari II	19	2,550	12,600
Yadi II	20	2,550	12,600

Source: Computed from SG2000 Annual report 1996.

Appendix D: Total cost of production and net income per villages (N' 000)

Village name (Unit)	Code	Total cost of production (N)	Gross income (N)	Net income (N)
Tashan Muntari	1	139,524	360,360	220,836
Ung. Sarki	2	93,862	346,853	252,991
Ung. Goje	3	88,404	333,580	245,176
Dan Daura	4	91,276	330,408	239,132
Ung. Jumari	5	85,454	309,140	223,686
Kauru II	6	87,345	289,198	201,836
K/Bauda I	7	88,350	287,300	198,950
K/Bauda (women)	8	119,915	279,994	160,079
Bawa Gari	9	92,411	321,035	228,624
Kadiri	10	78,099	269,009	190,910
Zinbina	11	71,517	262,483	190,966
Federe	12	95,695	251,524	155,823
Jagu	13	70,032	249,145	179,113
Kudaru I	14	73,997	248,235	174,238
Garu yadi	15	78,687	242,983	164,290
Kauru I	16	83,110	242,879	159,763
Gabon Birni	17	76,995	240,435	163,440
Mariri I	18	66,110	237,081	170,971
Juman Kari II	19	65,570	199,264	133,694
Yadi II	20	59,125	193,453	134,328

Note: Net income = gross income - Total cost of production

Source: Computed from SG2000 Annual report 1996.

Appendix E: Land size per villages (measurement in hectare)

Village name (Unit)	Code	Land size
Tashar Muntari	1	3.50
Ung. Sarki	2	4.50
Ung. Goje	3	4.50
Dan Daura	4	4.00
Bawa Gari	5	4.00
Ung. Jumari	6	4.00
Kauru II	7	4.25
K/Bauda I	8	4.00
K/Bauda (Women)	9	4.25
Kadiri	10	3.50
Zinbina	11	3.25
Federe	12	3.75
Jagu	13	3.00
Kudaru I	14	3.75
Garu yadi	15	3.25
Kauru I	16	4.50
Sabon Birni I	17	3.75
Mariri I	18	3.50
Juran Kati II	19	2.50
Yadi II	20	2.50

Source: Computed from SG2000 Annual report 1996.

APPENDIX F:

DEPARTMENT OF ECONOMICS, A.B.U.ZARIA

QUESTIONNAIRE ON THE ROLE AND IMPACT OF SASAKAWA GLOBAL 2000 TECHNOLOGY TRANSFER IN FACILITATING PEASANT FARMERS' AGRICULTURA PRODUCTIVITY IN LERE ZONE, KADUNA STATE

INTRODUCTION

I am a student of the above named institution undertaking aresearch work on the role and impact of Sasakawa Global 2000 (SG 2000) agricultural project in Lere zone, Kaduna state. The purpose of this research is to show the importance of technology transfer in raising output and productivity levels in the agricultural sector. In this study attempt is made to establish, quantitatively,the relevance of technology transfer in agricultural development process. I would be very grateful if you could fill in this questionnaire, any information here will be used for the purposeof research only and will be treated strictly confidential.

Please tick/comment where applicable

SECTION A: BACKGROUND INFORMATION

1.Name of farmer (optional):.....

2.Sex: Male [ ] Female [ ]

3.Town/village:.....

4.Age:.....

5.Marital status:.....

6. Number 0f children (if any):.....

7.Level of education (tick appropriate)

(a) Islamic education [ ] or Christian knowledge [ ]

(b) Primary school [ ]

(c) Secondary school [ ]

(d) A.T.C [ ]

(e) O.N.D [ ]

(f) H.N.D. [ ]

(g) University degree [ ]

(h) Others (specify).....

8. How long have you been farming?

(a)5-10 years [ ]

(b) 11-20 years [ ]

(c) 21-30 years [ ]

(d) 31-40 years [ ]

(e) 41-50 years [ ]

(f) 50 years and above [ ]

9. How large is your farmland?

(a) Less than 1 hectare [ ]

(b) 1-2 hectares [ ]

(c) 2-3 hectares [ ]
(d) 3-4 hectares [ ]

(e) 4-5 hectares [ ]

(f) 5-6 hectares [ ]

(g) More than 6 hectares [ ]

10. How did you acquire the land?: .....

11. Which of the following forms of labour do you use on your

farm?:

(a) common labour [ ]

(b) hire labour [ ]

(c) both (a)&(b) [ ]

(d) animal traction [ ]

(e) family labour [ ]

12. What is your average output ?:

(a) less than 10 bags [ ]

(b) 10-20 bags [ ]

(c) 21-30 bags [ ]

(d) 31-40 bags [ ]

(e) 41-50 bags [ ]

(f) 51-60 bags [ ]

(g) above 60 bags [ ]

13. What are your sources of finance?:

(a) personal income [ ]

(b) Money lenders [ ]

(c) Co-operative banks [ ]

(d) proceeds from sale of farm produce [ ]

(e) Family and relatives [ ]

(c) The desire to gain recognition in the community [ ]

(d) The proven effectiveness of the practices [ ]

24. Since the inception of the project, what can you say about it's impact on your level of income and standard of living?.....

.....

.....

25. How many houses did you own before the project?.....

26. Since the inception of the project how many houses do you now own?.....

26. State other assets (if any).....

27. How successfully has SG2000 been undertaking it's activities?

(a) very successful [ ]

(b) Successful [ ]

(c) Not successful [ ]

28. Have you benefited from any form of training undertaken by SG2000?.....

29.State what type (if any).....

30. How often do you get visit from the extension agents?.....

31. What are some of the constraints you encountered in carrying out some of the practices introduced by SG2000 in your area?.....

32. What contribution do you make towards the implementation of the SG2000 in Lere zone?.....

33. Comparing this present project (SG2000) and the previous

govenment agricultural projects which do you prefer?.....

.....

34. Give reasons to support your answer.....

.....

.....

APPENDIX G :

DEPARTMENT OF ECONOMICS, A.B.U.ZARIA

INTERVIEW QUESTIONS FOR SG 2000 OFFICIALS ONLY

PERSONAL BACKGROUND

1. Name (optional):.....

2. Sex: Male [ ] Female [ ]

3. Age:.....

4. Occupational status:.....

5. Level of education:.....

6. Years of (working) experience:.....

INFORMATION ON THE ROLE AND IMPACT OF SG 2000

7. Are the rural dwellers aware of all the technological packages you provide?:.....

8. How do the farmers adapt to these new changes in technology?

. . . . . .

.....

9. Do you think your recommendations are too scientific for rural dwellers?:.....

10. Has the introduction of the programme improved the agricultural productivity of the farmer?:.....

11. What can you say about the level of income and standard of living of the rural

dwellers since the inception of the program?:.....

.....

.....

12. Has there been any changes in the level of output?:.....

13. What is the average output per hectare?:.....

14. What is the average farm size in this area?:.....

15. What are the problems facing farmers generally in your area?.....

16. How many farm families are in this area?:.....

17. What are some of the activities you undertake in this area?.....

.....

.....

18. How do you acquire the farm inputs you give to these farmers?:.....

.....

.....

19. Are they adequately distributed?:.....

20. Do the farmers pay for this provision or are they based on loan?:.....

21. Which of the agricultural innovations is most used by farmers?:.....

22. Give reasons for preference?:.....

.....

23. So far, have the aims and objectives of the project been achieved in this area?:.....

.....

24. What problems are you facing recently in carrying out your services?:.....

.....

.....

25. Could you please suggest possible solutions to these problems?:.....

.....

.....

.....