FACTORS DETERMINING LOAN REPAYMENT PERFORMANCE AMONG THE I.A.D.P. SMALL SCALE FARMERS IN MACHAKOS AND KAKAMEGA DISTRICTS

by

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DECLARATION

This is my original work and has not been presented for a degree in any other University.

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TABLE OF CONTENTS

		Page
ABSTRACT		(v)
ACKNOWLEDGEMENTS		(vii)
LIST OF TABLES		(viii)
LIST OF FIGURES		(ix)
LIST OF ABREVIATIONS		(x)
Chapter 1:	INTRODUCTION AND STATEMENT OF THE PROBLEM	1
1.1	A Brief Review of Kenya's Agricultural Sector	1
1.2	Statement of the Problem	2
1.3	Objectives and Hypothesis	7
1.4	Organisation of the thesis	8
Chapter II:	BACKGROUND INFORMATION	10
2.1	Sources of Credit	10
2.2	Provision of Credit in the Past	11
2.3	The main recent Credit Schemes S.P.S.C.P. and I.A.D.P.	13
Chapter III:	LITERATURE REVIEW	18
Chapter IV:	METHODOLOGY	32
4.1	Location of the Study Area	32
4.1.1	Creteria for Selection of the Study Area	32

		Page
4.1.2	Kakamega District	32
	a) Geographical Location of Kakamega District	33
	b) Geological Properties ..	33
	c) Climatic Pattern	33
	d) Population Density and Growth	34
	e) Agricultural Land Use ..	34
4.1.3	Machakos District	37
	a) Geographical Location of Kakamega District	37
	b) Geological Properties ...	37
	c) Climatic Pattern	37
	d) Population Density and Growth	38
	e) Agricultural Land Use ..	39
4.1.4	Comparison of the Two Areas	40
4.2	Data Sources	40
4.3	The Effective Sample for this Study	43
4.4	The Analytical Model	44
Chapter V:	THEORETICAL CONCEPTS OF THE ANALYSIS	46
Chapter VI:	RESULTS OF THE ANALYSIS	55
6.1	The Main Characteristics of the Samples	58
6.1.1	The Kakamega Sample	58
6.1.2	The Machakos Sample	59
6.1.3	Comparison of the two Samples	67

		PAGE
6.2	Multicollinearity	68
6.3	Justification for Regression Analysis	76
6.4	Results of the Regression Analysis and Discussion	77
6.4.1	The Machakos Sample for Maize	77
6.4.2	The Machakos Sample for Cotton	83
6.4.3	The I.A.D.P. Results - Maize Versus Cotton	86
6.4.4	The Kakamega Results - Maize	87
6.5	Test of Hypothesis	91
Chapter VII:	CONCLUSION AND RECOMMENDATIONS	97
7.1	Summary and Conclusion	97
7.2	Recommendations directly from the Study	101
7.3	Recommendations not directly from the Study	104A
7.4	Future Research	104A

BIBLIOGRAPHY .....

APPENDICES .....

ABSTRACT

The problem in this study was to determine factors that influence loan repayment performance among the I.A.D.P. small scale farmers, and to assess the importance of these factors. In view of the excessive loan defaulting found in many credit programmes in Kenya, an investigation of the factors influencing repayment will form a basis for improvement of loan performance in many credit programmes.

The literature suggested that productivity of loan financed enterprises and factors related to it is one of the main factors influencing repayment. It also suggested that farmers motivation is one of the other main factors. If agreement were forthcoming as to which particular productivity factors were involved then part of the role of the credit programmes would be interpreted as requiring a strengthening of its responsibilities towards this end.

The status of loan repayment performance among I.A.D.P. farmers was determined and related to factors postulated to have influence on repayment performance. The analysis revealed that loan repayment performance was low (20%) and that the yields of the loan financed enterprises were extremely low compared to the yields of the model

farm plans of the I.A.D.P. Three main variables were found to affect repayment significantly; use of purchased inputs, family size and crop yields. Education, and farm wealth do not influence repayment significantly.

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LIST OF TABLES

Table		Page
1.1	Machakos District Co-operative Union C.P.C.S. Repayment Performance	5
1.2	S.P.S.C.P. 1975/76 Loan Granted and Recoveries as at 31-12-1977	6
4.1	Rural Population - Kakamega District	35
4.2	Rural Population - Machakos District	39
6.1	Properties of the Kakamega Sample Crop - Maize	57
6.2	Properties of the Machakos and Sample Crop - Maize and Cotton	61 & 62
6.3	Distribution of Cotton Yields in Mbiuni among the Sample Farmers	65
6.4	Distribution of Use of Purchased Inputs for Cotton at Mbiuni	66
6.5	Comparison between Kakamega and Machakos Sample - Maize	67
6.6	Correlation Matrix - Maize - Machakos ..	70
6.7	Correlation Matrix - Cotton	72
6.8	Correlation Matric - Kakamega - Maize	74
6.9	Comparison Between Cotton and Maize Results	86

LIST OF FIGURES

Page

1. Effect of Credit on Production Function 48

2. Possible Results on Production after Credit Use 50

LIST OF ABBREVIATIONS

1.	C.B.S.	-	Central Bureau of Statistics
2.	MoF	-	Ministry of Finance and Planning
3.	C.P.C.S.	-	Co-operative Production Credit Scheme
4.	S.P.S.C.P.	-	Small-holder Production Services and Credit Project
5.	A.F.C.	-	Agricultural Finance Corporation
6.	K.T.D.A.	-	Kenya Tea Development Authority
7.	I.A.D.P.	-	Integrated Agricultural Development Programme

CHAPTER I

INTRODUCTION AND STATEMENT OF THE PROBLEM

1.1 A Brief Review of Kenya's Agricultural Sector

Kenya comprises 575,000 square kilometers of land and a population of approximately 15,322,000 people (CBS, 1979). However because of adverse climatical and ecological conditions less than one quarter of the land area is actually productive agriculturally. (Kenya, CBS, 1978). The Agricultural sector dominates the Kenya economy, contributing 29.9 percent of the gross domestic product. Over 70 percent of total exports are agricultural commodities (Kenya CBS, 1979). The 1979-1983 Kenya Development plan stipulates that more than 80 percent of the total population is directly dependent on the agricultural sector for their livelihood. (Kenya, MoF, 1979).

Kenya's agriculture consists of a large scale farm sector and small scale farm sector. The small scale farm sector is becoming increasingly important as far as the gross marketed output is concerned. The relative share of the small farm sector in the value of gross marketed output has grown rapidly in the last two decades and currently stands at about 56 percent.

(Kenya, CBS, 1979, p. 94). One of the main objectives of the Kenya Government in the 1979-1983 development plan is the improvement of farm productivity in the small scale farm sector. This objective if accomplished, will go a long way in raising the living standard of Kenya's predominantly rural population. Due to land shortage problems the main strategy in the same plan is to stimulate more intensive land use and development of the marginal areas. (Kenya, MoF, 1978, p. 210). Land use intensification requires use of improved technologies in the farming practices. Improved technologies involve use of fertilizers, pesticides, and improved seed varieties besides improved tillage and husbandry practices.

1.2 Statement of the Problem:

Since Independence (1963) the Government of Kenya has stimulated land use intensification through provision of credit to both small scale farmers and large scale farmers. The credit programmes are based on the assumption that many farmers cannot improve their farming practices due to lack of adequate capital to purchase the necessary farm inputs. Studies have shown that most small scale farmers are unable to accumulate capital and that lack of credit is a crucial

factor limiting farm development. In the presence of new technology Schultz (1964) notes that credit is almost certainly required for puchase of new farm inputs. In Kenya privsion of credit is made through commercial banks, parastatal bodies and credit schemes sponsored by the Government through the Ministries of Co-operative Development and/or Agriculture.

However, the credit provided to the farmers has to be repaid to sustain the credit facilities for development in the long run. Loan repayment is necessary to ensure the smooth running of credit projects and to provide funds for future lending. Any credit scheme has therefore to make sure that the percentage of unrecovered loan funds in low. If the farmers fail to repay, the loans will in this case serve as subsidy to a selected group of farmers. However this would be contrary to the Government's aim. Government requires equal distribution of development in the small scale farm sector

Some of the Government's credit schemes have had and are still experiencing problems as far as loan repayment is concerned. If this continues it will violate Government's efforts to intensify land use in the small scale farm sector. Table 1.1 and 1.2 show repayment performances of selected credit schemes implemented by the Government through the Co-operative movement.

From both tables 1.1 and 1.2 it can be observed that repayment performances of some of the credit societies under those particular credit schemes were very poor while performances of others were quite reasonable. The type of credit for both credit schemes was seasonal production credit. For example on table 1.1. Kithangathini Co-operative Society has a repayment percentage of 71.7 percent while most other societies are below 10 percent and some have not recovered even 1 percent. Table 1.2 shows that repayment figure for Luanda is 61.3 percent and for Kisumu is 60.8 per cent. These figures are much better than for most other unions, for example, Embu which is 7.56 per cent and Malakisi with 7.7 per cent. This illustrates that it is possible to have better repayment performances while in some societies the repayment is extremely poor. But at this juncture it is not possible to determine why some societies had much better repayment rates that others, especially when we consider that these varying figures are from similar schemes and regions.

Taking into account that good loan repayment is essential for the continuation of more credit schemes, it is important to investigate factors underlying loan repayment

Table 1.1: Machakos District Co-operative Union C.P.C.S. Repayment Performance as of September 1972

	(K.Shs.) Loan Amount Allocated	(K.Shs.) Loan Amount Outstanding	Repayment Percentage
Iveti	123,000	121,850	0.93
Kakuyuni	60,000	55,850	6.92
Kikima	44,500	34,900	21.57
Kalalani	81,000	71,445	11.80
Kithangathini	48,600	14,010	71.17
Kitwii	48,600	41,300	15.0
Matangulu	340,000	340,000	0
Mbilini	96,300	88,300	8.31
Mitabeni	60,000	40,800	32
Muesuni	74,000	74,000	0
Mupuki	12,000	8,283	31
Total	1,000,000	891,738	18.06

Source: Von Pischke, J.D., Small Farmer Credit in Kenya, A.I.D., Washington D.C., 1973, p. 119.

Table 1.2: S.P.S.C.P 1975/76 Loan Granted and Recoveries as of 31-12-1977

Union	Loan Amount (K.Shs.)	Repayment (K.Shs.)	Balance (K.Shs.)	Repayment Percentange	Average Loan Per farmer (K.Shs.)
South Nyanza	254,503.40	82,479.25	172,024.15	32.4	764.00
Kisumu	353,240.75	214,909.80	138,340.95	60.8	985.00
Victoria	355,342.25	152,430.65	149,600.65	42.8	831.00
Embu	797,656.00	60,286.25	757,369.75	7.56	1,284.00
Nambale	243,550.90	99,113.75	144,437.75	40.7	995.00
Luanda	101,387.00	62,223.80	39,163.20	61.3	904.00
Malakisi	387,654.45	30,110.90	357,543.55	7.7	1,010.00
Rachuanyo	358,046.95	69,589.40	288,457.55	19.4	957.00
Kakamega	313,031.65	156,463.45	158,168.40	50.5	648.00

Source: Kenya, Ministry of Co-operative Development, Annual Report 1977, p. 12.

performance. This greatly assist in trying to improve the loan repayment performance among the small farmer credit schemes. This study will make an attempt to identify the factors influencing repayment performance and the extent of their importance. The study is based on one of the major Government Credit Schemes launched in 1976, the Integrated Agricultural Development Programme (I.A.D.P.). Background information about this programme will be given later in the text.

1.3 Objectives and Hypothesis

The first objective of this study is to determine the loan repayment status of farmers participating in the I.A.D.P. The study will focus on Machakos and Kakamega districts only. It was not possible to include more districts because data from other districts lacked complete information on the relevant questions of the questionnaires. The second objective is to identify the economic, and as far as possible human and environmental, factors influencing loan repayment performance. The third objective is to compare the yield estimates on which the I.A.D.P. loan repayment ability was based with the actual crop yields. It is hoped that the findings of this research will contribute

towards the improvement and design of a credit programme which is more economically viable for the nation as well as beneficial to the small scale farmers.

The following hypotheses will be tested:-

1. That there is no difference in repayment performance between farmers with very little farm-assets value and relatively wealthy farmers in the two study areas. 'Wealthy' in this context refers to the value of farm assets by an individual farmer.

2. That most of the small-holder farmers participating in the I.A.D.P. do not achieve the crop yields estimated in the model budgets of the I.A.D.P. on which the repayment ability is based.

3. That production inputs have a greater effect on loan repayment performance among the I.A.D.P. small-holders than socio-economic variables like education and farm wealth.

1.4 Organisation of the Thesis

As already shown, Chapter 1 gives some basic information about Kenya, discusses the problem, objectives and hypothesis of this study. In Chapter II background information about the use of credit by small scale farmers in Kenya is given. This was found necessary because the

whole study is based on one of the many credit programmes in Kenya. Studies carried out in Kenya and elsewhere concerning loan repayment are discussed in Chapter III. Chapter IV discusses sources of data, and methodology employed in the data analysis. Chapter V examines the theoretical concepts on which this study is based. In Chapter VI the regression results of the study are analysed and discussed in relation to the environment of the study areas. Finally Chapter VII gives the conclusion and recommendations based on the findings of this study.

CHAPTER II

BACKGROUND INFORMATION

2.1 Sources of Credit

The oldest farm-credit-providing institutions in Kenya were initiated to serve the colonial European-dominated agriculture. These institutions are:-

i) Commercial banks

ii) Kenya Farmers Association

iii) Agricultural Finance Corporation

After Independence these institutions were remodelled to facilitiate the transition from a European dominated commercial agriculture to one based on African ownership. The Settlement Land Trustees was created at this time to cater for the transition to African ownership predominantly in the form of small holdings.

The newer farm credit institutions are those introduced to directly promote the development of small holder agriculture: the cash crop authorities, the co-operative movement and a variety of experimental programmes. These include (i) The Kenya Tea Development Authority (.K.T.D.A.), Pyrethrum Board, National Irrigation Board, Cotton Lint and Seed Marketing Board, Horticultural Crop Development Authority

and Chemelil and Mumias Sugar Out-growers Schemes; (ii) the Co-operative Societies especially those associated with coffee production and the more recent schemes like the Co-operative Production Credit Scheme, Farm Input Supply Scheme, the Small-holder Production Credit Service Programme, and the Integrated Agricultural Development Programme.

The major source for small farmers in terms of volume of credit and number of borrowers is the Co-operative Movement. Of the estimated 1.2 million small-holders fewer than 250,000 have access to formal credit. The co-operative movement has approximately 500,000 rural members and about 20 percent enjoy access to co-operative credit, provided largely in kind. The K.T.D.A. and the Pyrethrum Board programmes also provide credit to small-holders in kind.

2.2 Provision of Credit in the Past

Credit is usually in the form of long, medium and short term loans. Long term credit is mainly for land purchase, medium term for farm development including buildings and equipment, and short term for seasonal inputs. Small-scale farmers mainly require short term credit. Most of it as already noted is provided in kind, in the form of planting materials and

seasonal inputs.

Many of the small-holder programmes are crop-oriented in the sense that they cater only for specific crops for example, K.T.D.A. and Pyrethrum Board. They do not take an integrated approach for the whole farm. The advantages of the crop-oriented small-holder programmes are that input packages can be readily devised and that collection procedures are simplified by deductions being made from the proceeds of cash crop deliveries. These factors clearly encourage the development of these programmes. A major short-coming, up until now, has been that the institutions associated with each crop have single-mindedly pursued their own production programmes. Thus, there is little provision made for the delivery of inputs for subsistence crops, even though any surplus generated would effectively be a cash crop. These represent opportunities which are unexploited. However a number of more recently established programmes have sought to offer packages of production inputs which are supported by extension advice, for example, the Small-holder Production Services and Credit Project, Farm Input Supply Scheme and the Integrated Agricultural Development Programme. This study

is based on the I.A.D.P. and this calls for a review of the credit programme which is given below.

2.3 The Smallholder Production Services and Credit Project and Integrated Agricultural Development Programme in Kenya.

(a) The S.P.S.C.P. programme was implemented in 1975 and covered several districts in its first phase. The objective of the SPSCP is to develop the capacity within the co-operative system to organise and implement a programme which will provide comprehensive production and marketing services for food crops to small-holders. Responsibility for organising and implementing the programme is shared jointly by the Ministry of Agriculture and the Ministry of Co-operative Development. The programme includes the selection and delivery of inputs required for specific crop combinations; farmers training in the use of those inputs and training for the proper management of credit by participating farmers. The system requires co-ordination between the project implementation group and the extension staff and includes the provision of marketing services.

However, there has been the problem of uncontrolled marketing for the food crops which in some cases serve as security crops. In such cases it is not easy to enforce repayments through the marketed sales. It must be realised that the programme does not require the loanee to offer any security in the form of property except a security crop through which repayment deductions are made. The amount of loan given to each farmer in a co-operative society is always two-thirds the estimated expected value product of the security crop[1] which if possible should be non-food and marketed through the Co-operative Department.

(b) Integrated Agricultural Development Project (I.A.D.P.)

In its endeavour to both broaden its agricultural production base and bring about a more equitable distribution of development to rural areas, the Kenya Government has introduced its Integrated Agricultural Development Programme (1976). The programme is

[1] Expected value products are estimated in the I.A.D.P. model farm plans. In some cases the estimates may not be correct in which case the co-operative Department might give even more loan funds that the real value product which the farmers can afford to pay back.

intended to provide the future major thrust of assistance to small farmers throughout the country. Compared with past efforts the programme has two important innovative features. These are:-

i) It seeks to promote a "whole farm" approach in contrast to the single crop approach which has characterised past efforts. This objective is made necessary by the absence of any predominant crop or farming activity in many of the target areas which have hitherto been left out of the development process.

ii) It also seeks to encourage the development of project planning and implementation responsibilities at the local (administrative district) level.

In the short run the programme so far has not fully addressed all the constraints and needs arising out of the activities envisaged. In particular, technical packages and innovations have not been fully developed for all crops. Therefore the programme's implementation continually needs to be flexible so as to respond to previous experience and reflect this in its annual work plans. Average crop

packages for the two areas of this study (Kakamega and Machakos) are given in Appendix 2 and 3 while the model enterprise budgets for maize and cotton for the same areas are given in Appendix 7, 8, and 9. Maize and cotton are the two crops whose loan repayment is analysed in this study.

The programme is administered along the same geographical pattern as other Government services. The district is the basic level at which most programme activities are approved and executed after approval at the national level. The lowest administrative unit is a sub-location, several of which form a location; locations make up a division, several of which form a district; several districts form a province. The approval of a location to participate in project activities are governed by criteria such as extent of past exclusion from projects, potential for development, availability of necessary infrastructure and availability of institutions capable of making an early contribution to development. Fourteen districts in Eastern, Central, Nyanza and Western provinces are already participating in Phase I of the programme.

The project area includes a wide variety of soil and rainfall regimes but the pre-selected

locations fall into either of two broad ecological zones, namely a high potential zone with coffee as the main cash crop and with maize and beans as the main food crops and a low potential zone where cotton is the predominant cash crop. Other cash crops in the low potential zone include maize, groundnuts, sorghum, millet and sunflower. The higher potential zone has a higher rainfall while the low zone has a less reliable precipitation.

The day to day administrative operations of the I.A.D.P., are very similar to those of S.P.S.C.P. Inputs are loaned in kind to small farmers with less than KShs. 800/- farm income from crops per year. In receiving the credit the farmers agree to apply the inputs as recommended by the extension agents. In addition the farmer agrees to grow the combination of crops suggested and to follow practices set forth by the land and farm management division of the Ministry of Agriculture with respect to time of planting, spacing of seeding, application of fertilizer, dust and sprays and weeding.

CHAPTER III

LITERATURE REVIEW

Studies relating to loan repayment performance have been carried out in Kenya and in other developing countries. They give different views about loan repayment performances by small scale farmers but they have some observations in common. In the following section these studies and their findings will be discussed in relation to the objectives of this study.

Determination of repayment performance of the farmers in the I.A.D.P. is one of the objectives of this study. Vasthoff (1968) analysed the repayment performance of farmers under the Agricultural Finance Corporation loan scheme. His analysis focused on small scale farmers in Kenya who were issued with loans between 1963 and 1966. The duration of loans varied between one year and six years, including seasonal credit as well as long term credit. Vasthoff observed that repayment situation for all the loan funds as of June 1966 was very discouraging. Of the 108 sample farmers 70 of them were in arrears. He determined the repayment position of each of the six provinces of Kenya from the arrears overdue as a percent of principal billed up as of June 1966. The figures for the six provinces ranged from 8

percent to 52 percent. Vasthoff did not identify the factors influencing repayment, but noted that loan collection procedures through marketing organisations could improve the repayment position of small scale A.F.C. loans. This observation seems logical as exemplified by the Kenya Tea Development Authority (Von Pishcke, 1973, p. 135).

While Vasthoff's recommendation for improving repayment positions would be compatible with most credit programmes it would be misleading to check only for proper control procedures through marketing organisations and not analyse other factors, which as described later are of paramount importance. Factors at the farm level where the grass - root problems lie are the primary factors influencing performance. Unfortunately comparisons of the repayment status of loans collected through marketing organisations and that of loans collected from individual farmers have not been reported because they are outside the scope of this study.

The second objective of this study is to determine the factors influencing repayment performance for farmers participating in the I.A.D.P. Towards a similar end Hansworth (1973), Marima (1978) and Von Pischke (1977) have made contributions from the empirical findings of their research in

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Kenya. Incidentally they all conducted their research on settlement schemes in the Rift Valley Province.

Hansworth's study was based on the One-Million Acre Settlement Scheme. She explained loan repayment performance by the following variables; nature of crops, agricultural innovation perception, attitudes and motivation, knowledge and skills, social institutions and social obligations, economic status and communication. All these variables were found to be bearing on loan repayment performance but were of varying importance. Hansworth found that the basic reason why farmers were not repaying loans was because they did not have sufficient farm incomes.

The most crucial factor according to her was the farmer's economic status which she judged by the amount of income per year. However, she noted that there were some farmers who had sufficient incomes but were simply unwilling to repay. She also observed that although the farmers she studied were using improved farm technology including application of fertilizer and use of improved seed varieties, most of these were so thinly applied that productivity could hardly be improved by such use. For example she recorded that a bag of maize seed (10 kgs) was used to cover one and a half acres or more while the recommended level was 10 kgs per acre. Similarly, fertilizer use was stretched beyond its usefulness.

It is worthwhile to note that loans issued under settlement schemes were issued to all farmers who were settled on former European farming areas to enable them to pay for the land they had been settled on. Therefore the issue of repayment capability was not the uppermost criteria on which the loans were issued.

Hansworth's study is based on an analysis of the whole farm; this study on the other hand is based on the single enterprise approach and is therefore not directly comparable to Hansworth's analysis. Although Hansworth stresses that economic status as the most important factor influencing repayment she does not give any idea of how important it is compared to the other variables she studied.

The other variables that Hansworth included in her study, for example, attitudes and motivation, knowledge and skills, social institutions and obligations, were found to bear on repayment performance but the report gives no information about the extent of their importance. Knowledge and skills, for example, are gained through farming experience and since most of the farmers she interviewed had been farmers for a long time, an interaction between these factors can be expected which unfortunately is not discussed in her study.

Nevertheless, differences in attitude to repayment towards Government and non-Government sources of credit do exist. Osuntogun (1972) writes that a typical Nigerian farmer considers his Government as a member of his extended family. He reports that two loan clerks who were interviewed in Western Nigeria estimated that about 80 percent of their combined 2,000 borrowers considered their loan as a gift from their Government while only 20 percent realised that repayment was necessary. Osuntogun also reports that this attitude towards repayment obligation is encouraged by politicians. Onagoruwa (1964) the General Manager of Co-operative Bank Limited in Nigeria has remarked that there have been instances when farmers strolled into his office to say: "We have been told that money has been deposited with you for our benefit and we need to ask for it. Give it to us". The realisation that such socio-behavioural factors can adversely affect repayment performance provides a useful insight while explaining the performance in economic terms.

Marima (1979) analysed a sample of farms in the settlement areas of Uasin Gishu district to work out better farm plans. Although the main objective of his study was not to study factors influencing repayment performance, he observed that loan repayment performance was poor mainly due to poor

crop productivity. He also noted that some farm families owned more land (40 acres and over) than they could utilize effectively with their existing labour supplies. Settlement schemes where plot sizes were 15 acres and less were found to be better repayers that the schemes in which the plot sizes were 40 acres and over. This finding suggests that the land: labour ratio in a farm is a factor influencing repayment performance. Labour capacity on a farm can be estimated by the family size and this study includes family size as one of the factors influencing repayment performance. Marima also noted that some farm families could well afford to pay but because of lack of motivation they failed to repay. Marima's two main factors to explain loan repayments are: (a) productivity and (b) motivation.[1] His study therefore supports Hansworth's main argument that productivity is the most important factor explaining repayment. However neither author gives the degree to which these factors influenced performances in their particular cases.

Von Pischke (1977) analysed the relationship between repayment performance of A.F.C. loans in settlement areas of Rift Valley Province and several other variables, for example, family size,

[1] Motivation in this context refers to the willingness with which the farmer will repay the loan due to interest in the benefits associated with loan repayments.

off farm [illegible] net worth[2] and age of the farm manager. He found that [illegible] non-farm income had no correlation with loan repayment. With respect to family size the study reports that farm families of more than seven persons were slightly worse payers than those below seven. According to Morscadi (1977) bigger farm families can affect repayment in two ways. (a) Repayment performance may improve with bigger farm families due to the additional labour provided if labour was in any way a constraint. (b) Performance may deteriorate due to the increase in consumption for bigger farm families if land is limited. With respect to a farm's networth, Von Pischke found that the wealthier farmers are not as risk averse as poorer farmers and they are better prepared to absorb risk. It follows that the wealthier farmers are more likely to try out new innovations. If productivity is improved by the use of new technology, farm income will also increase if other issues like prices remain favourable. The main objective of a poorer farmer is to ensure sufficient food supplies. Von Pischke's finding that

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[2] Von Pischke's net worth was arrived at as the balance between total farm income and the farm expenditures. Therefore it was a measure of farm income.

net worth is significantly related to repayment again supports Hansworth's hypothesis that productivity is a major determinant of loan repayment.

The third objective of this study is to compare the model farm plans of the I.A.D.P. with what is achieved by the participating farmers. Von Pischke (1973) states that probably the greatest single reason for the continued poor repayment performance is that farmers participating in credit programmes have failed to achieve the output of crop produce expected in the model farm plans under which the programmes were established. He stresses that this is important because the plans are the basis on which repayment schedules are derived. On the same issue Ijose (1972) notes that a high incidence of default is closely related to the economic criterion used in the granting of loans. He also notes that the accuracy with which farm plans and budgets are drawn is the cornerstone of credit programmes. Unfortunately Ijose does not support his statement with empirical findings and neither does Von Pischke. Comparison between farmers' achievements and the I.A.D.P. model farm plans may provide proof for these statements.

Besides the factors quantifiable by economic research, Von Pischke mentioned the following factors which might also have influenced repayment performance. These factors were mentioned during

informal interviews: (a) Many farmers in the settlement areas do not expect to pay back loans for land. They fought for this land before independence and they do not expect to be asked to buy the land. (b) Many farmers feel that the absence of any follow ups against defaulters demonstrates to rural people that the Government is not willing to enforce loan contracts. A general feeling is that if arrears are not paid back, they will be written off and that will be the end of the matter. (c) Some farmers regard loans as a kind of relief fund. There is no evidence on how far such arguments may influence repayment performance of the farmers but beyond any doubt they influence the farmer's attitude and therefore it is not possible to ignore them totally.

Besides the factors at the farm level, the nature of a credit programme may also influence repayment performance. Intensive credit allocation is where credit issued tends to be quite selective. Giving a few selected farmers large amounts of credit contains the danger of permitting the borrowers finances to out-run his managerial and risk-bearing capabilities especially during the initial period of adaptation to credit-supported technologies (Von Pischke, 1978, p. 15). If this happens, the borrower may not generate enough cash flow from his new activities to repay the loan which permitted him to undertake it. The possibilities of such

occurances whilst not supported by data cannot be ruled out. Extensive credit allocation (where credit is allocated indiscriminately) also tends to lead to financial problems due to the fact that more borrowers are included who have little intention of repaying or who are very close to the subsistence level. Other factors expected to have influence include:-

(a) Partial use of innovations for reasons of risk aversion may not improve the farmers productivity substantially and this might lead to poor repayment.

(b) Loan misuse may also cause poor productivity.

Some of Von Pischke's statements as has already been noted are not supported by empirical evidence. Nevertheless they are plausible, and other authors seem to hold similar views, for example Onagoruwa (1964) and Donald (1976).

Donald (1976) discusses the impact of credit on small scale farmers in developing countries. He states that there are two factors which might adversely affect repayment, according to two schools of thought. One is that small-scale farmers cannot repay loans due to inadequate incomes. The other is that farmers are simply unwilling to repay. He recommends that with respect to inadequate incomes, the principal remedy is provision of credit closely tied to

increase his productivity and income enough to exceed his repayment costs. However he notes that credit programmes with high productivity are not the only ones with high repayment and nor do gains in productivity always bring high repayment rate. His remedy of closely associating credit with new technology is quite acceptable but it cannot be the sole solution.

Donald states that if farmers learn that default can be tolerated while they still continue receiving credit, they are reluctant on the repayment. Roberts (1972) shares a similar view with Donald by noting that poor loan productivity is the major problem contribution to low repayment performance. However, he states that if the ability to pay were the only factor involved defaults would always be higher among poor farmers and would increase only when incomes fell. Therefore, although loan productivity is certainly a factor which contributes towards repayment performance it seems illogical to accept a mechanical relationship between farm income and repayment performance as a general explanation, in view of the extensive defaulting caused by richer farmers.

Overall, research aimed at investigating loan repayment performance which has been reviewed in this chapter clearly indicates that the ability to repay is of paramount importance as far as repayment

performance is concerned. Ability to repay has been described in a variety of ways but they all have similar implications. Hansworth stresses the economic status of the farm and Ijose also concludes that the economic criterion on which the loans are issued is a most important factor. Von Pischke notes that probably the greatest single reason for the continued poor repayment performance is the failure to achieve adequate crop produce while at the same time Donald stresses inadequate farm income as the main reason for poor repayment performance in many credit programmes. All the above reasons imply that poor repayment performance is due to poor loan productivity and thereby inadequate farm income.

Therefore it would seem that all factors pertaining to and contributing to farm income per se are determinants of loan repayment performance. Nevertheless, although emphasis has not been put on factors not connected with farm productivity, a few of the authors have suggested that such factors could also adversely affect repayment performance. Donald in particular warns that we should not expect a mechanical positive relationship between loan productivity and repayment performance. Von Pischke as previously noted points out that the outlook of farmers towards Government-supported credit and general unwillingness of farmers to repay are other

factors which might influence repayment performance. Non-farm income and non-farm expenses like school fees are some of the other factors that are likely to influence repayment performances. However these variables could not be included in our analysis model due to lack of data concerning the variables.

In this study several of the factors postulated to influence repayment performance will be regressed against loan repayment rate of the I.A.D.P. loanees. These factors may be directly or indirectly related to loan productivity and therefore repayment performance. The approach taken is the single enterprise approach and not a whole farm approach; therefore most of the variables considered are directly related to the loan financed enterprises. These factors are:

1) Crop yield in kilograms per hectare
2) Use of purchased inputs in Kshs. per hectare
3) Family size (adult units)
4) Value of farm assets (Kshs.)
5) Crop area in hectares
6) Level of education (years of formal education)

In the following chapter a section is devoted to describing data sources and will reveal some of the data limitations. All data used in his study were obtained from the I.A.D.P. survey conducted by

the Ministry of Agriculture in 1977. The information includes basic farm data like household data, data on particular crop enterprices, and finally data on loan amounts issued to farmers and amounts repaid.

CHAPTER IV

METHODOLOGY

4.1 Location of the Study Area

4.1.1 Criteria for the Selection of the Study Area

The literature review showed that the ability to pay is a major factor influencing repayment performance. Ability to pay is enhanced by the level of the agricultural potential associated with the locality of the loanees' farms. Therefore it was obvious that the selection of one area of high agricultural potential and another of low potential would serve the purpose of verifying this observation.

Many of the surveyed districts with high agricultural potential were dominated by coffee as the main cash crop. Most farmers in the coffee zones were not very keen on receiving credit for other crops due to the recent boom prices for coffee in 1976 and 1977. It therefore seemed advantageous to select an area out of the coffee zones so as to eliminate the coffee influence. In addition data from most other surveyed districts was limited than for the selected

area. Taking into consideration the above observation, Kakamega district was selected to represent the high potential area.

Machakos was selected to represent the low potential area partly due to the absence of other surveyed areas with a low potential and partly because data from Machakos was less limiting than from other districts.

4.1.2 Kakamega District

a) Geographical Location of Kakamega District

Kakamega district in Western Province forms part of the high potential land of Western Kenya. It is part of the catchment area for Yala and Nyando, the main rivers in Western Kenya. It is one of the highly populated areas of Kenya.

b) Geological Properties

All agricultural land in the district is classified as high potential. Soils are relatively fertile having been derived from volcanic and basement complex rocks. They largely consist of an association of dark brown sandy loams with yellow-red loamy sands and dark red friable clays.

c) Climate

Kakamega has mean monthly temperatures ranging from 69^{o}F to 72^{o}F. The mean annual

rainfall for the district ranges between 1250 mm and 2000 mm, the main rainy months being April, May and June which is also the peak of agricultural activity. There is less agricultural activity during the short rains (August through October). The mean annual rainfall for the study area is 1770 mm and the area has a probability of receiving at least 1270 mm of rainfall in four out of five years.

d) Population Density and Growth

In 1975 the average population density was estimated at 280 persons per square kilometer, and the annual growth rate at 3.9 percent. Within the district population density varies greatly. In Bunyala location the sample area for this study, population density in 1975 was estimated at 149 persons per square kilometer while the corresponding figure for Maragoli was estimated at 800 persons per square kilometer. Table 4.1 shows population density and growth rates in various divisions of the district.

e) Agricultural Land Use

Maize is the most important enterprise for farmers in Kakamega district. Some is grown for home consumption and some for cash. On

Table 4.1: Rural Population - Kakamega District with Special Reference to the Study Location

Administrative Unit	Population		Average % p.a. growth rate	1975 Estimate	Area Sq. km.	Density
	1962	1963				
Kakamega District	600,000	782,600	Approx. 3.9	980,000	3,520	280
Vihiga Division	140,800	216,663	6.2	292.000	389	750
Mumias Division	51,900	80,021	6.2	108,000	597	180
Hamis Division	50,900	80,021	6.3	103,000	164	628
Lugari Division	25,700	40,268	6.4	55,000	570	96
Butere Division	67,800	105,462	6.1	138,000	350	394
Central Division	104,100	124,581	2.6	141,000	386	365
Lurambi Division	110,100	128,461	2.2	143,000	860	166
N. Kabras Location	-	35,062	-	39,000	248	157
S. Kabras Location	-	39,145	-	45,000	224	191
Bunyala Location	-	22,255	-	25,000	167	149
Butsotso Location	-	32,019	-	36,000	221	162

Source: Kakamega District Development Plan 1974 - 1978, Republic of Kenya April 1976.

average maize in Kakamega district occupies between 80 and 100 percent of the cultivated land per household. It is often intercropped with beans, finger millet, groundnuts and cowpeas. Hybrid maize varieties have rapidly been adopted due to their higher yielding potential. Maize marketing in the district is Government controlled through the Maize and Produce Board which is charged with the responsibility of purchasing all quantities of saleable surplus maize offered by farmers. But, it is estimated that less than 25 percent of saleable surplus maize from small scale farmers is actually sold to the board, the remainder being sold in small rural markets.

Other food crops in Kakamega district include pulses, bananas, millet, groundnuts and sweet potatoes. Cash crop development is low compared to other areas of Kenya, for example, Nyeri, Kiambu or Meru. Any sizeable cash crop growing was first taken up in the more populated areas of Kakamega due to the need for higher returns per acre than would have been given by subsistence crops. Cash crops include coffee, tea, sugarcane and sunflower.

4.1.3 Machakos District

a) Geographical Location of Machakos District

Machakos District, situated in the Eastern Province of Kenya, stretches from the Tsavo River in the South to within a few kilometers of Nairobi City and up to the Tana River in the North. Most of the land in the district is of medium or low potential.

b) Geological Properties

The soils are mainly friable clays, sandy clay loams and loamy sands which generally tend to be hard but lightly friable when moist. They also have a high fequency for capping under the rain drop impact. The soils in the drier areas are shallow due to the presence of petroplinthite (Murrum) horizones. The soils therefore present hardships to farming activities.

c) Climatic Pattern

Rainfall in Machakos is of marginal regime and ranges between 500 mm and 800 mm per year. The reliability of rainfall varies greatly from year to year. The rainfall trend is bimodal with a long rainy season in March, April and May and short rains in October, November and December. The marginality of the rainfall at Machakos is not due to the total amount of

rainfall falling during the season but it is influenced by the length of the rainy season and the predictability of rainfall. The area is occasionally hit by draught which usually results in famine - for example, in 1971, and 1975. The uncertainity of rainfall is a serious hazard to farming.

d) Population Density and Growth

The population density of Machakos as of 1969 was ranging from 200 persons per square kilometer in the more fertile areas to 30 persons per square kilometer in the low dry southern areas. But there are big variations in population growth rates and in some areas it is double the national average which is 3.5 percent. Table 7 shows population densities in various divisions of the district.

Table 4.2: Rural Population of Machakos Disctrict with special Reference to Study Location

Administrative Unit	Total Population 1969	Area Sq. Km	Density
Machakos District	707,204	14,156	50
Eastern Division	103,995	1,115	93
Western Division	120,515	203	100
Yatta Division	76,348	2,248	28
Southern Division	146,687	6,134	24
Central Division	130,422	2,272	57
Northern Division	114,442	654	175
Kangundo Location	39,998	148	271
Matungulu Location	40,524	176	230
Mwala Location	17,000	177	99
Mbiuni Location	16,387	153	107

Source: Kenya Population Census, Republic of Kenya, 1970

(e) Agricultural Land Use

A variety of cash crops and food crops are grown in Machakos. These include coffee, cotton, maize, beans, pigion peas, sunflower, sorghum, green grams and passion fruit. Maize is widely grown since it is the main food crop. Both the local and the draught resistant Katumani variety are grown. Individual livestock holdings by small farmers in Machakos are modest in number.

due to the absence, for the most part, of communal grazing areas and lack of adequate forage.

4.1.4 Comparison of the Two Areas of Study

The two areas of study are remarkably different in agricultural potential with respect to rainfall, soils and landscape. Kakamega as already mentioned is the better suited of the two. In Machakos soil erosion, inadequate rainfall, and poor soils are some of the hardiships that farmers have to cope with.

4.2 Data Sources

All data used in this study were obtained from the Ministry of Agriculture Monitoring and Evaluation Unit for small-scale farm development. The unit is part of the I.A.D.P. project discussed earlier. To monitor the impact of the credit programme, the Ministry of Agriculture maintains the regulation that a representative sample of farms has to be surveyed each year and the data analysed. As this gives the opportunity to analyse a much larger sample than would be possible with a primary survey, given the time and funds available, the I.A.D.P. survey was

used as the data source. Considering the nature of this study, accurate information on amounts of loans issued and repayments could only be obtained from records kept by the body undertaking the issuing of loans. To avoid misuderstanding and to show the limitations of the I.A.D.P. data, a brief description of the I.A.D.P. survey is given below.

The I.A.D.P. survey is the responsibility of the Ministry of Agriculture. The 1976/77 survey districts of Central, Nyanza, Eastern and Western Provinces were selected according to the number of farmers who had received I.A.D.P. loans in February-March 1977. In each of the selected districts one location was drawn randomly out of all the locations in the district. A location was considered suitable for selection when it had a co-operative society and at least 50 co-operative members who were I.A.D.P. loanees. A systematic random sample of 40 farmers per co-operative society was finally selected for survey purposes.

The procedure for designing the sample of course has its own shortcomings. The survey sample is biased due to the conditions which had to be fulfilled before a

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The procedure for designing the sample of course has its own shortcomings. The survey sample is biased due to the conditions which had to be fulfilled before a

co-operative society was considered, for example, it had to have at least 50 I.A.D.P. loanees. This means that all the societies with fewer loanees than 50 were automatically exempted. The co-operative society had also to operate in the same agro-economic zone, which is another limitation. Nevertheless an alternative source of data for such a study was not available and the author had therefore to work with the I.A.D.P. survey data with all its limitations.

The survey was carried out from the beginning of 1977 and will continue until 1980. The recruitment of field supervisors and enumerators was done six weeks before the launching of the survey. The recruitment was based on the ability to speak the local language and a minimum of division III in the East African School Certificate. A five week course for the enumerators and supervisors was conducted by the Ministry of Agriculture and Central Bureau of Statistics. Refresher trainings lasting three days are conducted at the provincial level every 5-6 months. Each enumerator is responsible for collecting data from 40 respondents. The data is filled out on questionnaire sheets which are already

coded for computer analysis. The eleven-page questionnaire includes data ranging from basic information on all the I.A.D.P. financed enterprises and loan repayments. Each respondent selected was approached individually by the enumerator and the data were placed directly onto the questionnaires. The design of the questionnaires was to a certain degree confusing which allowed some misinterpretations by the enumerators. Those shortcomings have been taken care of.

4.3 The Effective Sample for this study

From the 14 survey districts, two districts were chosen for the purpose of this study as stated earlier. The 14 survey districts fall into three agro-economic zones and the two sample districts were chosen with an aim of representing two different agro-economic zones. The two districts as mentioned earlier are Kakamega and Machakos. The original sample for this study was 80 farmers, 40 from each district. Out of these samples, 4 farmers were excluded due to errors encountered when the questionnaires were examined. A much larger sample would have been emlpoyed, but, due to computation problems with the Central Bureau of

Statistics, it was not possible.

4.4 The Analytical Model

The main purpose of this study is to establish the relationship between loan repayment performance and several other factors postulated to influence the loan repayment performance among small scale farmers. To determine the factors that influence repayment performance and the extent to which they do so, the linear regression model was employed. Non-linear models were tested but the linear model gave more reasonable results than the non-linear ones. Therefore it is the results of the linear model that are presented in Chapter Six. In general the model is usually specified as follows:

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6).$$

Specifically the model is as follows:

$$Y = c + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$$

Where c = Intercept Coefficient

b_1 = Regression Coefficient

Y = Loan Repayment rate (measured as amount in shs. repaid by the farmer as a percent of total amount

payable including interest after one crop year).

X_1= Use of purchased inputs (measured in K.Shs.)

X_2= Value of purchased inputs (measured in K.Shs.)

X_3= Yield (in kilograms per hectare.)

X_4= Family size (in adult units.)

X_5= Education (in no. of years of formal education.)

X_6= Crop area (in hectares.)

E = Error term.

E - The error term occurs due to (1) measurement error made in determining Y the dependent variable. (2) Stochastic error which occurs due to the inherent irreproducibility of biological and social phenomen.

CHAPTER V

THEORETICAL CONCEPTS OF THE ANALYSIS

The literature review clearly gave evidence that the level of farm income is one of the major determinants of loan repayment. Any analysis on loa repayment has therefore to direct major attention to all factors contributing to income per se and/or stimulating income or farm output. It does not have to be stressed in a study of this kind that output i agricultural production is a function of the main factors of production. These are land, labour, management and capital.

But we also know that the level of output is always determined by the most limiting factors; for example land use in marginal areas is limited by labour available during the planting and weeding seasons. Likewise the level of fertilizer application is controlled by the amount of available cash to purchase it. This has serious implications for this study as data available does not necessarily reflect the cause-effect relationships between the factors of production on one side and th output level in the other.

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A second problem is whether or not resource allocation in small scale farms is optimal. Major misallocation of resources in farms, creates a

factor of variation in the farm income, which is not measurable. Studies relating to the efficiency of resource allocation among peasant farmers have shown that peasant farmers are efficient in their resource allocation - Hopper (1965), Sahota (1968), Massell and Johnson (1974), Worgin (1975). In Kenya studies in efficiency of resource allocation were carried out by Worgin (1975). He showed that small-scale farmers are efficient in their resource allocation but under conditions of risk and uncertainity, profit maximisation is done after the higher-ranked goal of risk minimisation. Findings by Mook (1973) seem to contrast with Worgin's findings. Mook in his study in Vihiga division of Kakamega district concludes that farmers were misallocating resources by using too much labour in expense of land.

As we have no evidence to dismiss either of these findings, justifications for these observations have to be supported by more studies concerning allocation of resources. However as optimal allocation is never achieved in all farms this factor will remain a source of unexplained variation in repayment performance.

The third problem, probably the most important, is whether we can directly relate repayment to factors of production and consumption as proposed in the previous chapter. The main reasoning is as

follows:- Many studies have shown that for the majori of peasants in rural areas, cash is one of the most limiting factors in production - Schultz (1964), Vasthoff (1968); Credit for the peasant as under I.A.D.P. will enable him to increase his crop inputs. Holding other conditions constant, yields will be improved through the increased use of such inputs like improved seed, fertilizer, dust and sprays and labour which caters for timeliness of farming operations. In theoretical terms credit under such conditions will shift the production function as illustrated in figure 1.

Figure 1. Effect of Credit on the Production Function

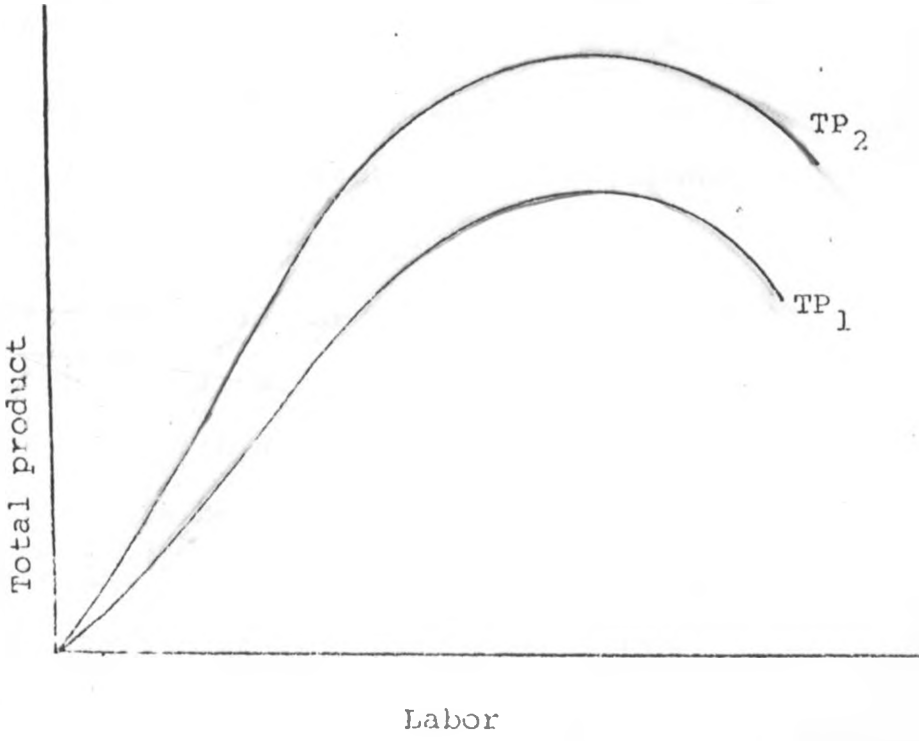


Figure 1 is a simplified situation of what is theoretically expected before and after use of credit. On curve TP_1 the farmer is using a certain level of inputs for production of crop x. Through use of credit which enables him to increase level of such inputs as fertilizer, seed, dust and sprays and therefore gets better returns from his labour, his whole production surface is expected to be higher, thereby achieving higher yields. However for these results to be achieved certain assumptions have to be made:-

1. That the inputs provided by use of credit had been a limiting factor in production of the crop.
2. That the farmer is operating under the objective of profit maximisation.
3. That the environmental factors such as rainfall, soils conditions and temperatures are favourable for the production of the crop.

The increase in yield per unit of land should be large enough to facilitate repayment of the credit and leave the farmer with a surplus which he can market such that he is better off than when he was operating on the production surface TP_1. This will prove that the farmer is actually benefiting from the credit facilities.

However in the event that credit is not utilised efficiently negative results may be encountered. In summary three possible outcomes are distinguished:

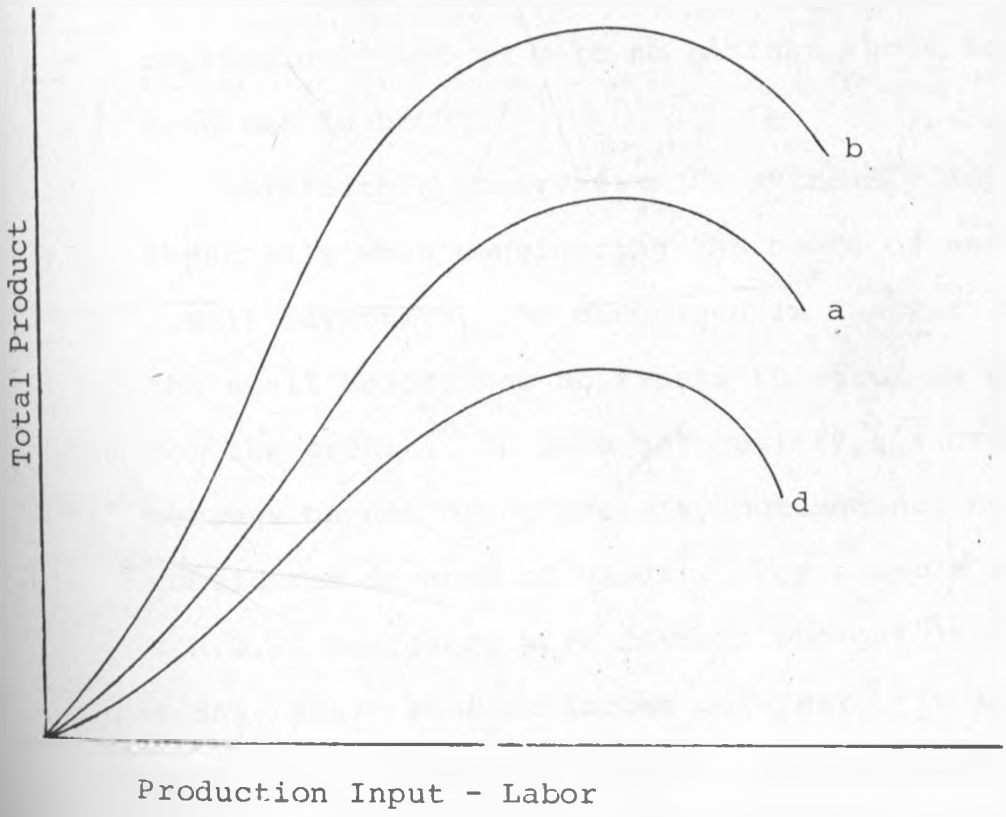
i) Total production may increase

ii) Total production may remain constant

iii) Total production may decrease.

This is illustrated by figure 2.

Figure 2. Possible Results on Production after Credit Use



If the farmer remains on surface a, his yields have not increased and he cannot afford to repay the credit; he is in a more difficult situation than before because he is unable to repay and therefore he is in debt. If he operates on surface d in Figure 2 after the use of credit, he is in a worse situation and repayment is also impossible. All three alternatives are possible and have been known to occur. In connection with these outcomes Galbraith (1952) posed a major question, "When is credit in agriculture an instrument of progess and when is it an instrument of stagnation and repression? Let us make no mistake about it; it has been and is both".

Galbraith's observation is extremely important especially when considering the needs of small-scale credit borrowers. As discussed in Chapter I (I.A.D.P.) the small holder has no assets to offer as security for the credit. He does not qualify for credit because he can offer security but because he is considered in need of credit, For example the I.A.D.P. borrowers were farmers who get less than K.Shs. 800/- as farm income per year. It is the anticipated increase in production and income which serves as security. While the concern here is for farmers who borrow for productive purposes it is all but impossible to distinguish clearly between loans

for productive and for consumption purposes particularly when dealing with small advances. Credit, even when supplied in kind, has been known to be misused by resale of the goods provided. Galbraith (1952) distinguishes the condition in which credit becomes a strong force for further improvement. He writes,

> "..... when a man with energy and initiative who lacks only the resources for more and more efficient production is enabled by use of credit to eliminate the one block on his path to improvement. This point where credit becomes an instrument of progress comes apparently.....(when) increasing income or increasing well being from the threat of starvation and hunger has given the borrower some measure of independence from his creditor".

Credit will therefore be directly related to output if productively used. Gaitskell (1972) notes that the greatest stimulus at the farm level is the existence of a guaranteed market offering a remunerative price. Favourable prices are extremely important especially when we consider that the farmer is always confronted with a number of uncertainties that lie largely outside his control. As they relate to his production activities these activities are largely attributable to the unpredictability of the quantity of the physical product that will be obtained, to the product price at the moment of sale and to institutional uncertainities. Under field conditions production risk is difficult to separate from price

and institutional risk. Institutional uncertainities include such factors as the timely availability of seed, fertilizer and insecticides; transport for the produce; and the availability and timeliness of the credit. The risk associated with the product price is caused by price fluctuations. Production risk is made up of the risk that climatic conditions may not be favourable and also that the market prices for production inputs and the product itself cannot be predicted with certainity.

Prices of the inputs determine the cost of production of a unit of output. Credit facilities may increase the use of such inputs as fertilizers, improved seed varieties and insectcides but it is the relationship between the cost of production of a unit of output and the market price offered for that unit of output that will determine the profitability of a particular enterprise. The price offered per unit of output must cover the costs of producing that unit. The problem as already pointed out is that, prices for agricultural commodities are in many cases unpredictable. Because of the tremendous risk that the peasant farmers face, they would seldom desire to equate unit factor cost with marginal value product.

The farmer is thus surrounded by too many uncertainities and the profits of this effort are subject to these price uncertainities. This certainly determines the productivity of any credit that the farmer utilizes. This will in turn determine the extent to which loan repayment conditions are fulfilled.

Therefore all factors which contribute to farm income including crop productivity determine the loan repayment performance of the farmer. However, in addition there are always other factors which may also determine the loan repayment performance. These are non-farm income, and the various committments that the farmer might have. Some of these committments can be quite demanding, for example, payment of school fees for the farmers' children. It should therefore be clear that a mechanical positive relationship between loan repayment performance and farm income should not always be expected.

CHAPTER VI

RESULTS OF THE ANALYSIS

The results of the regression model used in this study are presented in the following sections of this chapter. The results are divided roughly into two parts. The first part is a descriptive report discussing the mean, maximum and minimum values for the variables entered into the regression sets for Machakos and Kakamega districts. The second part discusses the three regression equations derived for maize at Kakamega and maize and cotton at Machakos. The results of these equations are discussed taking into consideration the data limitations for this study and the environmental conditions of the study areas.

The results reveal that maize yields and cotton yields for the long rains 1977 season were considerably low especially when they are compared with average yields of the I.A.D.P. model farm plans which are reported in appendices 7, 8 and 9. The independent variables entered into the regression equations explain from about 10 percent to 40 percent of the variation in loan repayment. This seems to indicate that there are other variables left out of the equations which are important in determining repayment performance. Finally, the hypotheses

postulated earlier in chapter I are tested.

Table 6.1 gives the values of the variables considered for the Kakamega sample.

Table 6.1: Properties of the Kakamega Sample Crop - Maize

Properties / Variables	Mean	Minimum Value	Maximum Value	Standard Deviation	Variable in the Model
Loan repayment (% age)	19.9	0(18) [1]	93.1	22.79	Y
Use of purchased inputs (in ration of recommended level)	0.88	0.53	1.00	0.14	X_1
Value of farm assets (KShs.)	49522	7,720	219,000	43127717	X_2
Yield (Kg per ha.)	2354	169	4219	1009.95	X_3
Family Size (adult units)	9.42	3	23	3.94	X_4
Education (years)	2.92	1.00	5.00	0.98	X_5
Maize area (ha)	2.53	0.48	7.24	1.56	X_6
Farm size (ha)	8.52	1.60	38.00	7.24	-
Crop area (ha)	4.02	0.90	13.50	3.08	-

1)

The main Characteristics of the Study Samples

1. The Kakamega Sample:

From the table (6.1) the mean of the maize yields achieved by the farmers at Kakamega was 2354 kg/ha. The expected mean yields as shown in appendix 9 is 4050 kg/ha. This divergence of the actual yields from the expected was big and obviously full repayment of the loans cannot be possible from the proceeds of actual crop yields. The average loan repayment rate was 19.9 percent with 18 farmers having zero repayment. This figure therefore must have pulled the average loan repayment rate down. Full repayment was not encountered and the highest repayment rate was 93.1 percent.

From the same table 6.1 it can be observed that the average area under maize per farm family was 2.53 hectares with a maximum of 7.24 ha. and a minimum of 0.48 hectares. Area under maize comprised quite a big portion of the farm land taking into consideration that the farm sizes are not very big. The mean farm size for the Kakamega sample was 8.52 hectares with 4.02 hectares as the mean area under crops. The average farm family is accordingly quite large, about 9 adult units.

This probably explains why maize takes quite a big section of the farm land since its the main food crop.

Recommended use of purchased inputs for maize at Kakamega on the average seems to have been adhered to. The main purchased inputs were hybrid maize, fertilizer and pesticides. Use of fertilizer and hybrid maize was followed but the farmers were not keen on using pesticides. The average use of purchased inputs was 88 percent of the recommended level. The minimum actual use was 53 percent and the maximum was 100 percent. This shows that all the farmers were quite close to the recommendations. Value of farm assets ranged from KShs. 7,720 to a maximum of KShs. 219,000. Most of it was made up of the value of farm land[3] and since there were big differences among the farm sizes, there is bound to be big differences in the values of farm assets.

6.1.2 The Machakos Sample:

Table (6.2) shows that the average farm

[3] I.A.D.P. valuation of land followed the local market prices of land in estimating the value of land.

size in the Machakos sample was 5.99 hectares, ranging from 1.2 to 37.40 hectares. This means that we have a wide spread as far as farm size is concerned. Of the total farm size the average area under crop is 2.50 hecates, the minimum being 1.20 ha. and the maximum being 8.00.

The status of loan repayment again refers to 1978, one year after the issue of credit. On the average only 20 percent of the total amount payable (principal plus interest) was paid back. The sample revealed that some farmers had nearly paid back with a repayment percentage between 70 percent and 96 percent. However this was only 8 percent of the total sample. On the other hand, nearly 37 per-cent of the sample had made no repayment. This is clear evidence that while full repayment is possible there can be enormous differences in repayment performance with some farmers not bothering to repay even a single cent. The reasons for these enormous differences in repayment performance will be given greater attention in the regression analysis results.

From the same table 6.2 it can be observed that the average maize yield is 600 kg (599.39), ranging from 39.50 kg to 2250 kg.

Table 6.2: Properties of the Machakos Sample Crops - Maize and Cotton

(No. of Observations = 38)

Properties / Variables	Mean	Minimum value	Maximum value	Standard Deviation	Variable in the Model
Loan Repayment in percent	20	0[1]	96	7.07	Y
Value of farm assets Kshs.	82,643	13,292	736,000	113578	X_2
Family size (adult units)	8.33	2.00	16	3.13	X_4
Education No. of Years	1.90	1.00	4.0	0.99	X_5
Farm size	5.99	1.20	32.40	5.70	-
Crop area	2.50	1.20	8.00	1.24	

Table 6.2: cont.

Properties / Variables		Mean	Minimum Value	Maximum Value	Standard Deviation	Variable in the Model
Use of purchased inputs in ration of recommended level	Maize	0.46	0.19	0.80	1.73	X_1
	Cotton	0.88	0.46	1.00	0.14	X_1
Yield in Kg. per ha.	Maize	599.39	39.50	2280	425.44	X_3
	Cotton	565.68	166.60	1050	207.65	X_3
Maize area		0.90	0.1	2.60	0.64	X_6
Cotton area		0.74	0.4	2.40	0.46	X_6

1) Fourteen farmers had 0 repayment

Out of 38 farmers, 52.6 percent had yields below the average for the sample (600 kg). Out of the rest of the farmers (47.4 percent) who had yields above average, only 16.6 percent had yields above 1000 kg. per hectare. For comparison purposes the average yield of maize expected following the I.A.D.P. model farm plans for Mbiuni area was 2250 kg. per hectare. The divergence between the expected and the actual yields is therefore extremely big.

The long rains 1977 season on which this study is based was reasonably wet and these low yields cannot be attributed to drought. The fact that one farmer within the sample managed to harvest 2250 kg. per hectare supports this point. However it was noted that only 6.5 percent of the maize crop was planted by the first week of March which was the correct planting date for Machakos. For comparison purposes the maize at Katumani research station for long rains 1978 averaged 5110 kg. per hectare Rodewald (1978). Total rainfall at Katumani for long rains 1978 was 371 mm which was 10 mm below the average. This comparison reveals that probably the farmer at Machakos has difficulties in

predicting the time of the rainfall and therefore does not plant his crop when the rains first fall. This consequently affects his yields because Rodewald (1978) has shown that the Katumani maize yields reached 6.7 tonnes per ha. if planted around the first of March and decreased by 10-15 percent, for each week's delay in planting beyond the correct planting date.[1] Rainfall cannot always be predicted with certainity. Secondly, usually the ground is too hard to plough and some farmers prefer to wait for the first few days of rain which make the ground softer for ploughing. The rain that falls within the time that the crop is in the field is not therefore enough for the maize crop.

From table 6.2 it can be observed that cotton yields were much better than maize yields especially when compared to I.A.D.P. model farm plan. The average yield of cotton was 565.68 per hectare ranging from 167 kg/ha. to 1080 kg/ha. The average yield per hectare from the model farm plan was 800 kg/ha as shown in appendix 8. The distribution of cotton yields is given below.

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[1] His study therefore showed that the timing of land preparation and planting is extremenly important in crop productivity especially in a marginal area like Machakos. Although a two stage model has not been employed in this study it could show clearly how the timing of land preparation and planting is related to crop productivity and hence loan repayment performance.

Table 6.3: Distribution of Cotton Yields in Mbiuni among the sample farmers.

Cotton Yields kg/ha.	Percentage of farmers	No. of farmers
150 - 450	39.5	15
451 - 600	28.9	11
601 - 800	21.1	8
801 - 1000	7.9	3
Over 1000	2.61	1

Table 6.3 reveals that most farmers had yields below 800 kg/ha. which was the average yield per ha. estimated in the model farm plan of the I.A.D.P. However 10.51 percent of the farmers had yields above 800 kg/ha. In the case of cotton it seems that farmers were much close to the plan estimates than in the case of maize. All the farmers had planted cotton on the correct planting date probably because it is planted in the short rains which are more predictable than the long rains.

Likewise the use of purchased inputs in cotton was closer to the recommended level of the model farm plans than in the case of maize. For cotton, 76.3 percent of the

farmers used between 80 and 100 percent of the recommended value of pesticides as indicated in table 6.4. The mean value for the use of purchased inputs for cotton was also quite high, being 88 percent of the recommended value. In the case of maize the corresponding figure was 46 percent with a maximum of 80 percent and a minimum of 19 percent. Overall the recommendations for cotton seem to have been followed more closely than the ones for maize.

Table 6.4: Distribution of Use of Purchased Inputs for Cotton at Mbiuni.

Use of purchased inputs in percent of recommended use	Percentage of farmers	No. of farmers
80 - 100	76.3	29
60 - 79	18.4	7
40 - 59	5.4	2

6.1.3 Comparison between the Kakamega and the Machakos samples

Mean values of several variables will be used in the comparison of the two samples to give an idea of the broad differences between the two samples as shown on table 6.5. Only variables common to both Kakamega and Machakos samples are compared. Variables related to cotton are not considered since cotton was not being grown at Kakamega.

Table 6.5: Comparison Between Kakamega and Machakos Samples (Maize).

Variable (Means)	Kakamega (Bunyala)	Machakos (Mbiuni)
Loan repayment percent	19.9	20
Use of purchased inputs (ratio)	0.88	0.46
Value of farm assets (K.Shs.)	49522	82643
Yield recorded (kg/ha)	2354	599
Yield expectation in model farm plan calculation (kg/ha)	4050	2250
Rainfall (mm), long rains	994	500
Education (years)	2.92	1.9
Maize area (ha)	2.53	0.90
Crop area (ha)	4.02	2.50
Farm size (ha)	8.52	5.99

From table 6.5 it can be observed that the loan repayment rate is the same in both areas of study. However use of purchased inputs in maize and maize yields are on the average higher at Kakamega than Machakos. Obviously yields are expected to be higher at Kakamega than Machakos because Kakamega is much more suited to maize growing that Machakos. It was noted earlier that for maize, the purhcased inputs used were fertilizers and an improved variety of maize seeds. Fertilizer was the much more expensive of the two. It would therefore seem that farmers at Machakos are not ready to use as much fertilizer as farmers at Kakamega. This is understandable considering the marginality and unrealibility of rainfall at Machakos. Therefore it would seem that the fertilizer recommendation for Machakos should be less than the quantities presently recommended in the I.A.D.P. model farm plans. Farm size, area under crops and under maize are on the average lager at Kakamega than at Machakos.

6.2 Multicollinearity

When the independent variables X_1 and X_2 in a regression equation are collinear or nearly so, it is called the problem of multicollinearity. If this problem exists, the relation

between Y the dependent variables to either X_1 or X_2 cannot be sensibly investigated. Usually the simple correlations for the pairs of independent variables are used to detect the existance of multicollinearity. If the simple correlation coefficient say, between X_1 and X_2 is large the pairwise collinearity is serious. But there is no rule as to how high the simple correlation coefficient ($r_{X_1 X_2}$) should be before the collinearity is said to be serious. Klein (1962) suggests a rule of thumb that multicollinearity is "torelable" if $r_{X_1 X_2} < R$ where R is the square root of multiple determination, R^2.

If multicollinearity is intorelable one solution is to drop the variable or variables with which the other independent variables are collinear. In this study this is the procedure followed using Klein's rule to determine which variables are highly correlated. Tables 6.6, 6.7 and 6.8 give the simple correlation coefficients between the independent variables. Autocorrelation which is usually a problem in time-series data was not taken into account because the data used in this study is cross-sectional.

Table 6.6: Correlation Matrix - Maize (Machakos)

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	1.000								
X_1	-0.138	1.000							
X_2	0.046	0.021	1.000						
X_3	0.220	0.408	-0.088	1.000					
X_4	0.410	-0.099	-0.007	-0.087	1.000				
X_5	-0.084	-0.203	-0.110	-0.078	-0.158	1.000			
X_6	0.194	-0.089	0.319	-0.227	0.231	0.026	1.000		
X_7	0.046	-0.143	0.911	-0.172	0.148	-0.176	0.333	1.000	
X_8	0.069	-0.266	0.311	-0.237	0.033	0.020	0.573	0.287	1.000

Y - Loan repayment in percent

X_1 - Use of purchased inputs (in ratio of recommended levels)

X_2 - Value of farm assests (in K.Shs.)

X_3 - Yield in Kg/ha.

X_4 - Family size (adult units)

X_5 - Education (scores)

X_6 - Maize area (ha)

X_7 - Total Farm size (ha)

X_8 - Total area under crops (ha)

R - 0.567

Out of the eight independent variables X_7 and X_8 were dropped out of the regression due to high collinearity between X_7 and X_6, and X_2 and X_8. All the rest of the independent variables were entered into the regression set although their correlation with Y the dependent variable is not very satisfactory. Exclusion of the two variables from the regression equation did not seriously affect the R^2.

b) Cotton:

Table 6.7: Correlation Matrix - Cotton.

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	1.000								
X_1	0.165	1.000							
X_2	0.056	0.015	1.000						
X_3	-0.164	0.0467	-0.145	1.000					
X_4	0.366	0.247	-0.009	0.117	1.000				
X_5	-0.061	-0.299	-0.095	-0.246	-0.090	1.000			
X_6	0.466	-0.222	0.571	-0.279	0.087	0.017	1.000		
X_7	0.058	-0.018	0.910	-0.174	0.145	-0.143	0.407	1.000	
X_8	0.171	-0.189	0.576	-0.074	0.244	0.024	0.688	0.576	1.000

Y - Loan repayment performance in %

X_1 - Use of purchased inputs (in ratio of recommended levels)

X_2 - Value of farm assets (K.Shs.)

X_3 - Yield (kg/ha)

X_4 - Family size (adult units)

X_5 - Education (scores)

X_6 - Area under cotton (ha)

X_7 - Total farm size (ha)

X_8 - Total area under crops (ha)

$R = 0.642$

Again the two independent variables X_7 and X_8 had to be dropped due to the high correlation between X_2 and X_7, and X_2 and X_8. The other variables were included in the regression analysis as discussed later. The relationship betwwen Y and the independent variables is not very strong but nevertheless it was felt that even at this level regression analysis could contribute to a better explanation of the situation.

Kakamega data - Maize

Table 6.8 contains the correlation coefficients for the sample data from Kakamega. A first glance gives a surprisingly loose

Table 6.8: Correlation Matrix - Kakamega - Maize

	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8
Y	1.000								
X_1	0.119	1.000							
X_2	0.068	0.083	1.000						
X_3	-0.050	0.230	0.224	1.000					
X_4	-0.153	0.007	0.614	-0.026	1.000				
X_5	0.007	0.115	0.195	0.117	0.136	1.000			
X_6	0.114	-0.127	0.393	0.132	0.374	0.106	1.000		
X_7	0.005	-0.026	0.853	0.151	0.691	0.226	0.631	1.000	
X_8	-0.036	-0.065	0.526	0.168	0.496	0.138	0.724	0.779	1.000

Y - Loan repayment in percent

X_1 - Use of purchased inputs (ratio of recommendad levels)

X_2 - Value of farm assets (K.Shs.)

X_3 - Yield (kg/ha)

X_4 - Family size (adult units)

X_5 - Education (scores)

X_6 - Maize area (ha)

X_7 - Total farm size (ha)

X_8 - Total crop area (ha)

R = 0.362

relationships between most of the independent variable and the dependent variable.

Due to the strong relationships between X_2 and X_7 and X_6 and X_8 it was necessary to eliminate X_7 and X_8 before a final regression compilation. Any regression analysis requires cause-effect relationships between the dependent and the independent variables. If this is not given the results are questionable. In this sample the correlation coefficients between the dependent and the independent variables is very loose. Obviously the 18 observations with no repayment at all may pose a problem of interpretation of regression results. Secondly the quality of data from Kakamega may partly be responsible for the poor

relationships between the independent and dependent variables.

6.3 Justification for the Regression Analysis.

The correlation matrices have shown little correlation among the independent variables which is one of the main points to justify correlation analysis. The second requirement is high correlation between the independent variables on one hand and the dependent variables. Unfortunately the Kakamega data showed very low correlations, the Machakos data were better but not satisfactory. Under these circumstances the question arises whether regression analysis will contribute towards a better understanding of the problem.

It should be taken into account that after the discussion on the sample properties, a number of points are already quite clear.

(a) The achieved yields are much lower than the estimated yields in the model calculations. Kakamega farmers achieved only 50 percent of the estimate yields on the average and Machakos farmers only 25%.

(b) The variations in yields are tremendous which justified a regression to check their effect on repayment.

(c) There is probably a strong element of motivation and willingness involved in repayment as has already been postulated by other researchers, which is not included in the regression variables.

Therefore it seems there is justification to carry out the regression analysis as a supplementary analysis which may also contribute to further clarification of the problem. All the three regression equations were tested at the 10 percent level of significant.

6.4 Results of the Regression Equations.

6.4.1 The Machakos Sample for Maize.

$$Y = \underset{(0.002076)}{7.71778} \underset{(0.077712)}{- 0.13338361\ X_1} \underset{(0.000034)}{+ 0.000014\ X_2}$$

$$\underset{(0.015277)}{+ 0.037436\ X_3} \underset{(0.01140)}{+ 0.02808\ X_4} +$$

$$\underset{(0.85479)}{0.912743\ X_5} - \underset{(0.89479)}{2.796358\ X_6}$$

1 - The figures in brackets are standard errors of the beta coefficients above them.

R = 0.567

R^2 = 0.321

Y = Loan repayment in percentages

X_1 - Use of purchased inputs in ratio of recommendations

X_2 - Value of farm assets in K.Shs.

X_3 - Yield of maize in kg. per hectare

X_4 - Family size (adult units)

X_5 - Education in years

X_6 - Maize area in hectares

The R^2 for the above regression equation is 0.321, indicating that the six variables entered into the regression set accounts for 32 percent of the variation in repayment performance. This R^2 is relatively low. In Chapter 6.2 it was shown that the correlation between the independent variables and the dependent variable (repayment) was not very strong and this partly explains the reason for the low R^2. However this observation implies that repayment performance is not only determined by productivity/income but that other factors are involved. In the section of literature review Roberts warned that although loan productivity is certainly

important and partly determines repayment performance, it is illogical to expect a mechanical relationship between productivity/ income and repayment performance as a general explanation.

Farm income may be high but repayment may be low due to high expenditure. Among other kinds of expenditure school fees can be a very limiting factor in repayment. The amount of non-farm income will also determine repayment performance because if the farmer has a high level of non-farm income he is able to pay expenses like school fees with the non-farm income and leave the proceeds from crop yields for repayment of loans. However it was noted before that variables like amount of school fees and non-farm income could not be included in the regression analysis due to the unavailability of such data. Other factors like willingness of the farmers to repay and the level of motivation are factors which do probably influence repayment performance as it was indicated in the literature review.

Unfortunately motivation and willingness to repay are variables that are not quantifiable and can therefore only be estimated by deduction of the explained variation from the total

variation. In chapter 6.1.2 it was shown that most of the farmers (97 percent) failed to achieve the expected maize yields of the I.A.D.P. model farm plans for Machakos. Yet out of these 97 percent a few repaid what probably they could afford to pay. But 14 farmers did not pay back even a single shilling and their repayment performance is zero. This is clear evidence that there is an element of farmer motivation and willingness in repayment besides loan productivity.

Three variables are significantly related to repayment performance:-

i) Yield per hectare is positively related to repayment. This is as was expected from the literature review and proves that productivity is one of the determinants of repayment. However the magnitude is not big.

ii) Family size is positively related to repayment. For comparison, at Kakamega this variable is negatively related to repayment. However these contrasting findings fit the explanation offered by Moscardi (1977) as reported in Chapter 3 on literature review. He states that family size

can influence repayment positively or negatively depending on the situation. Big farm families can increase the food consumption levels of the farm family thus decreasing the amount of food crop that can be marketed to obtain funds for repayment. This case applies to Kakamega. On the other hand big farm families may provide extra labour if labour is scarce to work on the loan financed enterprises thus raising their productivity and thereby income for repayment. This applies to Machakos where most farmers had maize and cotton as loan-financed enterprises and therefore extra labour is handy in cotton which is a labour-intensive crop.

iii) Use of purchased inputs is negatively related to repayment. However it shows that farmers with high adoption rates are not always the same with high repayment performances. The main purchased inputs were fertilizer and improved seed. Alternatively since several other factors affect yield levels, use of increased quantities of fertilizers may not have increased yields significantly,

if the normal crop husbandry practices, for example time of planting and weeding, were not carried out in good time. At Machakos it was noted in Chapter 6.1.2. that most of the maize crop was planted late. However, early planting is associated with several problems which farmers have to cope with. Usually the land is too hard to plough and most farmers prefer to wait for the first few days of rainfall when the land becomes softer for ploughing. Secondly the onset of rains in Machakos cannot always be predicted with certainty and farmers fear that planting too early is risky. If rains fail for the first days after planting early, the farmers might have to plant again on the real onset of rains which incurs more costs. However the magnitude of the effect of all the significant variables discussed is not big as can be observed from the beta coefficients.

Three variables are insignificantly related to loan repayment. These are education, maize areaand value of farm assets. Education and value of farm assets are positively related

to repayment but not significant which means they are not as important as yield, use of purchased inputs and family size. Although it was postulated that that these variables will be related to repayment, their effect was expected to be lower than the more economic variables - yields, use of purchased inputs and family size. Also the fact that a farmer is wealthy does not make him a better repayer as shown by value of farm assets. Maize area is not significant because its the yield per unit area rather than the total area which is of more importance. The variance in the maize area was not big, which is another reason why it is insignificant.

6.4.2 The Machakos Sample for Cotton.

The estimated regression equation is the following:-

$$Y = \underset{(0.239081)}{0.268808} + \underset{(0.257701)}{0.4394360}\ X_1 - \underset{(0.000000027)}{0.00000003}\ X_2$$

$$- \underset{(0.0001577)}{0.0002176}\ X_3 + \underset{(0.0094250)}{0.0176305}\ X_4 +$$

$$\underset{(0.0323300)}{0.0016390}\ X_5 + \underset{(0.0703654)}{0.2284945}\ X_6$$

1) - Values in brackets are standard errors of the beta coefficients above them.

$R = 0.642$

$R^2 = 0.402$

The value of R^2 in this sample is 0.402 which is much higher than in the previous maize case. However this R^2 shows that the variables entered into the regression set explain only 40 percent of the variation in repayment performance. The reasons given on the maize section are the same reasons which apply for cotton, (i) correlation between independent and dependent variable was not very strong, (ii) farmer motivation and willingness accounts for variation in repayment performance although they are not quantifiable, (iii) most of the farmers had very low yields and although yield variance was big all the yields were on the lower level compared to what was expected in the model farm plan. This might have distorted the effect of productivity on repayment performance.

Three variables are significant in case of cotton. These are purchased inputs, family size and area under cotton. Use of

purchased inputs is positively related to repayment performance and significant. The only purchased input in cotton is pesticides. Cotton is an extremely sensitive and pest-prone crop and the level and frequency of pesticide application among other variables directly determines yield levels. The closer the level of application is to the recommended level the higher the yields and therefore the repayment performance.

Family size is positively related to repayment performance and significant. The same interpretation given in 6.3.2 (the section of maize) also applies in the case for cotton. This is particularly applicable where cotton is involved because cotton is a labour-intensive crop. Farmers especially at Machakos where famine is often a hazard will always give priority to working on food crops before they release any labour for cash crops. Therefore bigger farm families have more labour available for cotton than smaller farm families. Area under cotton was significant at the 1 percent level. Thus the farmers with bigger cotton plots are better repayers.

The independent variables in the case of cotton accounted for about 40 percent of the loan repayment variation. The corresponding variables for maize accounted for 32 percent of the variation. Therefor as far as R^2 is concerned, the results for cotton are superior. The significant variables for mazie are use of purchased inputs, yield and family size. For cotton the significant variables are use of purchased inputs, family size and area under cotton. One interesting outcome for maize, was that the use of purhcased inputs, which was mainly fertilizer, was negatively related to loan repaymnet performance. This suggests that the recommendations for maize for purchased inputs need further investigations. May be increased use of fertilizer does not always result in increased maize yields especially at Machakos where rainfall amount is always unpredictabe and low.

The comparison between the cotton enterprise regression results and the maize enterprise regression results was done to indicate the differences between the two in how the independent variables employed in the regression analysis influenced the loan repayment performance. The comparison showed that in the results for cotton the R^2 is much higher than in the case of maize. This indicates that in cotton results, the independent variables explain a bigger percentage of the variation in loan repayment performance than in the case for maize. It was concluded that this difference could be due to the fact that one is purely a cash enterprise while the other is a food as well as a cash enterprise.

6.4.4. The Kakamega Results for Maize

The regression equation for the Kakamega sample is as follows.

$$Y = \underset{(0.34128)}{0.137574} + \underset{(0.38805)}{0.378439}\,X_1 + \underset{(0.0000016)}{0.000002}\,X_2^2 - \underset{(0.000038)}{0.00056}\,X_3 - \underset{(0.011341)}{0.024000}\,X_4 + \underset{(0.99722)}{0.045678}\,X_5 + \underset{(0.033749)}{0.037258}\,X_6$$

1) - Values in brackets are standard errors of the coefficients above them.

$R = 0.362$

$R^2 = 0.1316$

From the above equation it can be observed that out of the six varibales considered in the regression set, only family size is significant. All other variables are insignificant. These results are quite contrary to earlier expectations because, on the basis of the literature review, we expected that the use of purchased inputs, yields, family size and wealth (farm assets) should explain a major part of the variation in repayment performance. That family size is significant and is negatively related to repayment performance, is also contrary to our expectations but compares to one of the explanations

postulated by Moscardi (1977). The explanation is that if a food crop is involved repayment might be worse among bigger families due to higher food consumption. On the other hand data quality which was another limitation in this analysis may have contributed to most of the insignificance of the variables. Thus the combined effect of not having very good data and the fact that there are quite a number of variables, some unquantifiable and some quantifiable that could not be obtained, together have severely affected the results of the regression model.

However after our discussion of correlation coefficients these results for Kakamega are not completely unacceptable. The low relationship between the dependent variable amd most of the independent variables explains clearly the outcome of this regression analysis. In Chapter 6.1 it was noted that 18 farmers out of 38 farmers had zero repayment and most of the other farmers had very low repayment performances. The spread of the dependent variable was therefore not big. This, combined with the fact that maize yields were very low compared with the mean expected in the model

farm plans contributed to this unexpected outcome of the regression analysis.

That the variables related to productivity are not strongly correlated with loan repayment and fail to explain the variation in repayment performance suggests that motivation, and willingness of the farmers as mentioned earlier in section 6.3.1 and 6.3.2 play a big part in determining repayment performance. This could be particularly true for Kakamega where the loan-financed crop was maize. The problem in repayment is more acute in Kakamega due to the fact that maize is a food crop. In Chapter 4.1.1 it was reported that maize marketing in Kakamega is only 20 percent Government controlled. The rest is traded in local marketing centres. The recovery of the loan will therefore depend very much on the willingness of the farmer to repay after selling his maize in the local markets. It was also noted in chapter 6.2 that most of the farmers on the average achieved only 50 percent of the expected yields. Taking into account that any farm family will satisfy its consumption needs before releasing any maize for marketing, the low yields must have increased

the problem.

6.5 Test of Hypothesis

6.5.1. The first hypothesis was that there is no difference between relatively well off farmers and poorer farmers. For this purpose the variable for farm wealth was used. Farm wealth had been earlier defined as value of farm assets. The whole sample of 77 farmers was divided into groups according to the value of their farm assets. The farmers with value of farm assets of K.Shs. 50,000 and over were put into one group and those with below KShs. 50,000 were put into another group. This was the most convenient place to divide the sample. The means of repayment rates of the two groups were calculated and the hypothesis tested by testing whether there is any significant difference between the means of the two groups. The particulars for each group are given below.

$n_1 = 31$, $\bar{X}_1 = 22.475$, $S_1 = 31$

$n_2 = 46$, $\bar{X}_2 = 16.555$. $S_2 = 23.024$

where n_1 - Sample size of the first sample

n_2 - Sample size of the second sample

$\bar{X}_1$ - Average value of the loan repayment rate in percent (first sample).

$\bar{X}_2$ - Average value of loan repayment rate in percent (second sample).

S_1 - Standard deviation for loan repayment in the first sample.

S_2 - Standard deviation for loan repayment in the second sample.

Letting $\bar{X}_1$ and $\bar{X}_2$ stand for the true average loan repayment rates of the two samples of farmers the test required is whether the observed difference between $\bar{X}_1$ and $\bar{X}_2$ is significant at a 95 percent level of confidence. The null hypothesis to be tested and the alternative hypothesis are:-

Null hypothesis $\bar{X}_1 = \bar{X}_2$

Alternative hypothesis $\bar{X}_1 \neq \bar{X}_2$

If the null hypothesis is true then the observed difference between $\bar{X}_1$ and $\bar{X}_2$ is not significant at a 95 percent level of confidence. If the observed difference is significant, then the alternative hypothesis holds. Basing our argument on the sampling distribution of the difference between the two means $(\bar{X}_1 - \bar{X}_2)$ being approximated by the normal curve, the following test criterion was

formulated at an 0.05 level of significance.

For a standard normal distribution Z is the standard normal variable for which $\mu = 0$ and $\sigma = 1$. This variable, Z, is used to form a test criterion by setting a confidence interval. At an 0.05 level of significance, the value of Z is 1.96 and - 1.96. If our calculated Z falls within these limits we are saying that for 95 percent of the time there is no significant difference between the mean of the two groups of farmers in loan repayment. But if the calculated Z falls outside these limits then the probability of a significant difference between the two groups occuring is big and cannot be ignored and this means rejecting the null hypothesis. The formula for calculating Z is usually given as

$$Z = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Substituting the numerical values for our two samples we get;

$$Z = \frac{22.475 - 16.555}{\sqrt{\frac{24.340^2}{31} + \frac{23.074^2}{46}}}$$

$$= 1.069.$$

Since Z is 1.06958 and this value falls between - 1.96 and 1.96 we cannot reject the null hypothesis. In this case the obeserved difference in repayment performance between the two groups of farmers is not significantly different from 0. Therefore there is no significant difference in loan repayment between the two groups of farmers.

6.5.2. The second hypothesis was that the smallholder farmers participating in the I.A.D.P. do not achieve the crop yields estimated in the model farm budgets of I.A.D.P. on which the repayment ability is based. The I.A.D.P. model farm budgets are given in appendix 7 appendix 8 and 9. The following findings will help in testing this hypothesis. A statistical test is not required.

a) Farmers in Kakamega on the average achieved only 50 percent of the estimated maize yield in the model farm plans. In the Kakamega sample only one farmer out of 38 farmers managed to achieve the estimated maize yield of 4050 kg. per hectare.

b) Farmers at Machakos were in a worse situation. On the average they achieved only 25 percent of the model farm plans maize yields. The average cotton yield at Machakos was 75 percent of the estimated yield.

The second hypothesis therefore cannot be rejected.

6.5.3 The third hypothesis stated that production inputs and yield levels which are economic variables had a greater influence on repayment performance than the more socio-economic variables of education and farm wealth. The findings are:-

a) Purchased production inputs were more significant in influencing loan repayment performance in both areas of study.

b) Yield levels were significantly correlated with loan repayment performance.

c) Education and farm wealth were insignificant

and although this does not mean that they do not influence repayment performance, their influence is of a lower degree compared to that of the crop yield and use of purchased inputs.

Therefore the third hypothesis cannot be rejected.

CHAPTER VII

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Summary and Conclusion:

The purpose of this study was to determine the influence of various economic and socio-economic variables on loan repayment performance among the I.A.D.P. small scale farmer loanees. The loan repayment performance in two of the I.A.D.P. survey districts were determined. To determine the influence of the economic and socio-economic factors on repayment performance, the following factors were considered in the analysis: yield levels, use of purchased inputs, farm wealth, family size, education and area under the crop in consideration.

The linear regression model was used to determine the influence of the various factors on repayment performance. It was selected because its results were superior to non-linear relationships. The model was fitted to the available data in which the coefficients of determination were not very high.

The loan repayment rates in Kakamega and Machakos districts were on the average the same, being 19.9 percent and 20 percent respectively.

In both Kakamega and Machakos none of the farmers in the samples had full repayment. In Machakos alone 37 percent of the farmers had zero repayment. Of the 63 percent who had started repayment, 7.89 percent had repayments between 77 percent and 96 percent. The rest (55.11 percent) had repayments between 15 and 45 percent. Repayment performance in Kakamega district was worse; 47.36 percent of the farmers had zero repayment; 13.15 percent had repayments between 50 and 95 percent while 39.49 had repayments between 1 percent and 35 percent.

Crop yields were as discouraging as loan repayment performance. Almost all the farmers failed to achieve the estimated yields of the model farm plans. On the average farmers in Machakos achieved only 25 percent of the estimated I.A.D.P. maize yields per hectare while the corresponding figure for Kakamega was 50 percent. For cotton in Machakos, yields were much closer to those of the I.A.D.P. model plans and averaged 75 percent. Likewise use of purchased inputs did not measure up to the recommended level. For maize the recommended purchased inputs were improved seed, fertilizer, dust and sprays. The data revealed that in both areas of study farmers used

improved seed and fertilizer, but they were not using dust and sprays. Therefore the monetary value calculated for use of purchased inputs for maize refers to improved seed and fertilizer only. On the whole, use of purchased inputs was low in maize compared to the recommended level, particularly at Machakos. At Machakos the average use of purchased inputs compared to the recommended level was only 46 percent. The corresponding figure for Kakamega was 88 percent. For cotton the main purchased inputs were dusts and sprays. Use of these was quite high and the average use was 88 percent of the recommended level. On the whole both yields and the use of purchased inputs in cotton are close to the I.A.D.P. model farm plans. However in the case of maize both yields and use of purchased inputs are far from the I.A.D.P. model farm plan recommendations. Use of purchased inputs for maize in Kakamega however was higher than at Machakos. Likewise the maize yields at Kakamega were closer to the model farm plans than at Machakos.

Although the level of yields and factors related to yield were expected to account for a sizeable proportion of the variation in repayment performance they did not meet

expectations. These variables considered in the regression analysis explained from 10 percent of the variation in repayment for maize at Kakamega to 32 percent for maize at Machakos and 40 percent in the case of cotton at Machakos. It has already been pointed out that yields for both crops especially for maize were particularly very low. Therefore the full effect of productivity on repayment performance and factors contributing to it may not have come out clearly. This coupled with the fact that the data quality may not have been very satisfactory may have contributed to the low value of the coefficients of determiantion. Nevertheless since for all the three equation R^2 was less than 50 percent it would seem that there are other factors not included in the analysis which are important in explaining the variations in loan repayment performance. It was noted earlier that variables like non-farm income and expenditure were not considered. Apart from these there might be unquantifiable factors like motivation and willingness which were not considered. The discovery of such other factors influencing repayment performance would be of greater assistance in the Governments efforts to improve

repayment performances. Factors like farm wealth, crop area and level of formal education seem to have less influence on repayment performance than the more economic factors of yield returns per hectare, use of purchased inputs and family size. From the above observations the following recommendations can be made.

7.2 Recommendations directly from the study.

7.2.1 Taking into account the enormous divergences between achieved crop yields and estimated crop yields, the recommendation is that "model farm plan calculations" should be related as much as possible on possible achievements at the farm level to avoid too high expectations. The study has shown that a few farmers managed to achieve the model plan averages in both cotton and maize but that it was not possible for the majority of farmers to achieve those yields. (see p. 61 and 65 Tables 6.2 and 6.3). Programmes to stimulate the majority of the small farmers have to be based on targets possible for the majority.

7.2.2 Where possible, security crops should be cash crops which are also food crops. This has the advantage of eliminating consumption of income proceeds from the food crop supposed to

repay the loans. (see p. 77). Secondly since the marketing of non-food cash crops is usually fully Government controlled, repayment deductions can easily be made through the sales of the cash crops. However if food crops serve as security crops then careful handling of the marketing facilities should be ensured.

7.2.3 Further investigations on social behavioural patterns and their influence on repayment performance is necessary. At the same time farmers' attitude towards Government loan schemes need investigation. A clear policy for dealing with defaulters should be made, so as to create a feeling of responsibility and obligation among small-scale loan borrowers (see p. 20). However such a policy should only be employed if productivity/income achieved by the farmers is adequate for proper repayment. (see 7.2.1 and 7.2.2).

7.2.4 Crop input recommendations especially for maize at Mbiuni (Machakos) were not followed closely. The big divergence of the actual use from the recommended level calls for research at the farm level to find out why farmers are not ready to employ the recommended quantities of inputs. In Kakamega these divergences were not as big as in Machakos for maize. (see p.67)

tables 6.1 and 6.2). This suggests that a risk element may be involved while taking into account that Machakos as a marginal area is involved with higher farming risks than Kakamega. Use of large quantities of fertilizer especially for a marginal area like Machakos should be further investigated.

Finally level of education and value of farm assets (farm wealth) have no significant influence on repayment performance.

7.2.5 It was observed that pesticide application particularly for maize was not adhered to and that most farmers did not apply any pesticide on their maize. (Tables 6.1 and 6.2). Research is required on pesticide application to find out why farmers are reluctant to use pesticides on maize.

7.2.6 The need for timely planting of maize particularly at Machakos should be stressed to the farmers. Application of fertilizer on a late planted crop will not achieve as high yields as possible with a timely planted crop. Simple crop husbandry practices should be observed if farmers are going to benefit from adoption of new technology. However farmers' experiences and difficulties involved

in early planting including ploughing when the ground is hard should also be taken into account.

7.3 Recommendation not directly from the Study

The interest rate charged on the principal amounts of loan in the I.A.D.P. should be related to possible returns to capital in small farms. Farming is a risky business because there are several factors out of the farmers control which greatly influence crop productivity. Such factors include unfavourable weather factors and the fluctuating nature of prices for most agricultural products. In view of this fact interest rate charged in the loans issued to small scale farmers should be reviewed from time to time and adjusted to the economic situation prevailing in the country.

7.4 Future Research

Further research should focus on the same problem of loan repayment in different I.A.D.P. project areas. This study considered only two districts while there are data from twelve more districts for which the same kind of study can be applied. This may help to compare what is happening in different I.A.D.P. areas as far as loan repayment is concerned.

Research should also be carried out on the use of modern inputs at the farm level. The crop packages designed for the various agricultural projects are far from adequate becasue research on all crops in project

areas has not been carried out. The packages should be tested closely before they are recommended to the farmers. Recommendations on district basis as presently being done by MoA can hardly work since there are tremendous climatic, geological, topographical variations within a district.

Market research for the crops involved in all crop packages should be accomplished before the packages are implemented. This will ensure crops for which a prospective market is not available are not included in the packages. A case in point is the I.A.D.P. project was sunflower. Farmers grew the variety of sunflower which the prospective buyers (East African Industries) were not interested in. The MoA should have known this long before they designed the crop packages.

The management of cooperative unions and societies could be a major factor influencing loan repayment performance. Research on how to improve the operation and efficiency of these bodies should be carried out. This could assist in planning for delivery of inputs and marketing of crop products. These are the main functions being performed by the unions and societies implementing these projects.

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APPENDIX I

ESTIMATED AGRICULTURAL CREDIT PROVIDED IN KENYA - 1972

Source	Small Farmer Borrower		Large Farmer Borrower		Percent
	No.	Amount (K.Shs.)	No.	Amount (K.Shs.)	
1. Agricultural Settlement Fund	34,000	240,000	450	63,000	33
2. Agricultural Finance Corporation	15,000	32,000	2,300	186,000	24
3. Other Goverment Schemes	8,000	15,000	-	-	2
4. Guaranteed Minimum Return	4,500	15,000	2,500	15,000	3
5. Commercial Banks	9,000	50,000	3,000	205,000	28
6. Co-operative Societies CPCS	35,000	4,000	-	-	10
7. Kenya Tea Development Authority	21,000	2,000	-	-	0.1

APPENDIX I CONT.

Source	Small Farmer Borrower No	Small Farmer Borrower Amount (K.Shs.)	Large Farmer Borrower No	Large Farmer Borrower Amount (K.Shs.)	Percent
8. Pyrethrum	10,000	6,000	-	-	0.1
9. Merchant Credit K.F.A. etc.	5,000	20,000	2,200	44,250	9
Machinery	-	-	-	21,200	
10. Other Sources	2,000	300	400	3,450	0.1
TOTAL	200,000	381,000	3,500	538,000	

Source: Von Pischke J.D. Small Farmer Credit in Kenya, A.I.D. Washington, D.C. 1973 p. 8.

APPENDIX I CONT.

Source	Small Farmer Borrower No	Small Farmer Borrower Amount (K.Shs.)	Large Farmer Borrower No	Large Farmer Borrower Amount (K.Shs.)	Percent
8. Pyrethrum	10,000	6,000	-	-	0.1
9. Merchant Credit K.F.A. etc.	5,000	20,000	2,200	44,250	9
Machinery	-	-	-	21,200	
10. Other Sources	2,000	300	400	3,450	0.1
TOTAL	200,000	381,000	3,500	538,000	

Source: Von Pischke J.D. Small Farmer Credit in Kenya, A.I.D. Washington, D.C. 1973 p. 8.

APPENDIX 2

AVERAGE CROP PACKAGE FOR MBUINI LOCATION IN MACHAKOS DISTRICT 1977/78

Name of Crop	Ha.	Credit Requirement			Gross Margin Per Ha. (K.Shs.)	Gross Margin Per Area (K.Shs.)
		In Kind (K.Shs.)	In Cash (K.Shs.)	Total (K.Shs.)		
Sunflower	0.40	195	40	235	1162	465
Cotton	0.40	280	40	320	1236	494
Maize	0.40	213	40	253	1293	517
Beans	0.40	269	-	269	1622	649
Totals	1.60	957	120	1077	-	2125
		- Overhead costs (5% of T.G.M.)				106
		- Net Farm Income				2019
		- Subsistence Requirements				1254
		- Cash Farm Income				765
		- Interest (11%)				118
		- Net Surplus				647

Source: Ministry of Agriculture: I.A.D.P. Work Plan for Phase I, 1977.

APPENDIX 3

AVERAGE CROP PACKAGE PER FARMER IN KAKAMEGA DISTRICT 1977/78

Name of Crop	Ha.	Credit Requirement			Gross Margin Per Ha. (K.Shs.)	Gross Margin Per Area (K.Shs.)
		In Kind (K.Shs.)	In Cash (K.Shs.)	Total (K.Shs.)		
Maize	0.80	828	120	948	2230	1784
Beans	0.20	164	-	164	1292	256
Sunflower	0.40	280	40	320	965	386
Totals	1.40	1272	160	1432	-	2426
		- Overhead costs (5% of T.G.M.)				121
		- Net Farm Income				2305
		- Cash Farm Income				1151
		- Subsistence requirements				1154
		- Interest (11%)				157
		- Net Surplus				994

Source: I.A.D.P. Work Plan for Phase I, 1977

APPENDIX 4

LENDING INSTITUTIONS BY CREDIT TYPE - (1972)

Credit Type	Institutions Providing	Proportion of all Farm Credit (%)
Long	Agricultural Settlement Fund	33
	Agricultural Finance Corporation	6
	Commercial Banks	4
Medium	Agricultural Finance Corporation	18
	Commercial Banks	11
	Government Schemes	2
Short	Commercial Banks	13
	Merchant Suppliers	9
	Guaranteed Minimum Return Scheme	3
	Co-operative Societies	1
	Kenya Tea Development Authority	0.2
	Pyrethrum Board	0.1
	Other Institutions	0.6

Source: Von Pischke J.D. Small Farmer Credit in Kenya, Volume VII, A.I.D. Washington D.C. 1973

APPENDIX 5

MACHAKOS DATA: COTTON AND MAIZE

Farm Code	Loan Repay-ment %	Family Size Adult	Value of Farm Assets	Total Farm Size (Ha.)	Crop Area	Education in Years	Use of Purchased inputs in ratio of re-comme-nded level (Maize)	Use of Purchased inputs in ratio of recomme-nded level (Cotton)	Yield per Ha. (kg) (Maize)	Yield per Ha.(kg) (Cotton)	Maize Area (Ha.)	Cotton Area (Ha.)
1	96	13.00	67630.0	6.60	3.30	1	0.39	1.00	1312.00	785.70	1.20	1.40
2	77	11.00	39690.0	4.40	1.20	1	0.40	1.00	750.00	600.00	0.52	0.60
3	0	7.00	29886.0	3.60	3.10	3	0.44	0.75	1058.00	500.00	0.48	0.80
5	0	10.00	10500.0	7.20	3.10	3	0.32	0.70	165.00	717.50	2.60	0.40
7	20	8.5	49232.0	3.00	2.50	1	0.64	1.00	337.50	1050.00	1.20	0.56
9	77	10.00	77800.0	6.00	3.40	3	0.30	0.84	350.00	433.00	2.40	0.80
10	0	8.00	55740.0	3.40	2.10	2	0.62	1.00	225.00	910.70	1.20	0.80
11	0	9.5	55740.0	5.30	2.40	1	0.34	1.00	848.20	750.00	1.12	0.80
12	20	7.5	41630.0	4.10	1.20	2	0.72	1.00	225.00	700.00	0.12	0.40
13	20	12.0	10300.0	7.00	2.80	1	0.40	0.91	675.00	275.00	0.88	0.80
15	0	6.00	62830.0	5.60	1.30	2	0.30	1.00	787.50	750.00	0.80	0.52
16	0	7.0	57045.0	3.40	2.50	1	0.33	1.00	101.60	375.00	0.84	0.80
17	0	2.0	41108.0	3.40	1.30	2	0.46	0.62	599.39	466.00	0.50	2.40

18	33	9.0	52740.0	4.20	1.60	3	0.54
19	23	2.0	71690.0	5.40	3.20	2	0.48
20	20	6.0	24230.0	4.50	1.60	1	0.45
22	23	11.0	76265.0	8.60	3.20	1	0.67
23	0	8.0	34385.0	3.80	1.20	1	0.60
24	0	6.0	13292.0	8.00	1.20	2	0.20
26	20	15.0	57030.0	5.80	1.70	3	0.40
28	0	14.0	51250.0	12.00	3.30	2	0.30
30	0	5.0	28400.0	2.20	1.60	2	0.80
31	15	11.0	106000.0	7.50	2.50	2	0.74
33	19	8.0	56168.0	3.80	1.60	1	0.50
36	0	4.0	49525.0	5.90	1.80	4	0.20
39	20	6.0	73600.0	37.40	4.80	1	0.40
40	38	7.0	65340.0	4.80	1.60	4	0.19
41	17	8.0	15100.0	42.0	1.50	2	1.80
43	17	10.0	38815.0	4.90	2.40	2	0.41
44	0	5.0	48100.0	4.20	1.70	2	0.41
45	20	8.0	56210	5.80	2.40	1	0.20
47	42	10.00	54250	4.90	2.70	1	0.40
48	0	7.00	67280	5.00	2.50	1	0.80
49	20	8.00	22664	2.10	1.20	1	0.46

1.00	599.30	576.90	0.40	0.80
0.86	900.00	375.00	1.20	0.20
0.64	750.00	350.00	0.60	0.40
0.70	510.00	300.00	1.80	0.80
1.00	673.00	1000.00	0.80	0.80
1.00	37.50	375.00	0.80	0.40
1.00	225.00	500.00	1.00	1.70
1.00	225.00	712.50	0.40	0.80
1.00	1125.00	375.00	0.60	0.80
0.88	600.00	565.68	1.60	0.80
0.88	750.00	565.60	1.40	0.80
0.46	112.50	166.60	0.40	0.92
0.91	256.00	340.90	1.96	1.20
0.88	483.30	565.00	0.60	1.76
1.00	500.00	680.00	0.20	0.40
0.61	310.90	375.00	1.64	0.80
0.98	225.00	750.00	1.60	0.80
0.91	480	750.00	0.20	0.4
0.82	375	571.00	1.60	1.40
1.00	300	961.50	0.20	0.92
1.00	599.39	440.00	0.40	1.00

APPENDIX 5 CONT.

50	33	7.00	57300	2.40	2.00	2	0.46
51	20	7.00	18800	3.40	3.40	2	0.73
52	0	6.00	52400	3.00	3.00	2	0.40
54	20	11.00	12600	3.10	3.10	4	0.46
55	40	16.00	15100	2.80	2.80	1	0.30

1.00	599	300.00	0.30	0.80
0.82	1500	750.00	0.96	0.80
0.64	625.00	500.00	1.40	0.80
0.87	600.00	565.00	0.90	0.14
0.88	583.30	400.00	0.60	0.92

APPENDIX 6

KAKAMEGA DATA - MAIZE

Farm Code	Loan Repayment %	Family size Adult Unit	Value of Farm Assets (Kshs)	Total Farm Size (Ha.)	Crop Area (Ha.)	Education in Years	Use of Purchased inputs in ratio of recommended level (Maize)	Yield per Ha. (kg) (Maize)	Maize Area (Ha.)
P1	12.01	14	87668.0	12.00	4.00	1	0.799	2086.0	4.40
P2	25.44	6	32310.0	4.00	2.40	3	0.983	3729.0	2.44
P3	0	10	49160.0	8.00	6.20	3	0.453	3150.0	2.40
P4	21.04	15	18270.0	4.80	2.60	3	0.875	423.0	2.40
P5	0	4	16615.0	2.60	1.60	2	0.709	2813.0	1.20
P6	0	8	13450.0	6.40	1.80	3	0.421	225.0	1.60
P7	0	13	94770.0	20.40	6.00	3	0.670	2250.0	1.92
P8	29.48	12	14150.0	3.20	2.80	2	0.999	1884.0	2.00
P9	53.12	7	71366.0	4.00	2.00	3	0.806	1125.0	1.60
P11	0	14	42872.0	7.20	5.00	4	0.444	2533.0	1.80
P15	0	8	14485.0	3.60	1.90	3	0.466	3000.0	1.56
P16	11.40	8	14700.0	2.80	0.90	1	0.762	1859.0	0.90
P17	70.46	5	62470.00	15.00	7.20	2	0.100	2779.0	6.80
P20	27.31	9	162000.0	16.80	1.30	4	0.533	4219.0	1.28

APPENDIX 6

KAKAMEGA DATA - MAIZE

Farm Code	Loan Repayment %	Family size Adult Unit	Value of Farm Assets (Kshs)	Total Farm Size (Ha.)	Crop Area (Ha.)	Education in Years	Use of Purchased inputs in ratio of recommended level (Maize)	Yield per Ha. (kg) (Maize)	Maize Area (Ha.)
P1	12.01	14	87668.0	12.00	4.00	1	0.799	2086.0	4.40
P2	25.44	6	32310.0	4.00	2.40	3	0.983	3729.0	2.44
P3	0	10	49160.0	8.00	6.20	3	0.453	3150.0	2.40
P4	21.04	15	18270.0	4.80	2.60	3	0.875	423.0	2.40
P5	0	4	16615.0	2.60	1.60	2	0.709	2813.0	1.20
P6	0	8	13450.0	6.40	1.80	3	0.421	225.0	1.60
P7	0	13	94770.0	20.40	6.00	3	0.670	2250.0	1.92
P8	29.48	12	14150.0	3.20	2.80	2	0.999	1884.0	2.00
P9	53.12	7	71366.0	4.00	2.00	3	0.806	1125.0	1.60
P11	0	14	42872.0	7.20	5.00	4	0.444	2533.0	1.80
P15	0	8	14485.0	3.60	1.90	3	0.466	3000.0	1.56
P16	11.40	8	14700.0	2.80	0.90	1	0.762	1859.0	0.90
P17	70.46	5	62470.00	15.00	7.20	2	0.100	2779.0	6.80
P20	27.31	9	162000.0	16.80	1.30	4	0.533	4219.0	1.28

P21	0	5	85452.0	3.60
P22	93.14	8	30135.0	5.20
P23	0	12	17020.0	4.10
P24	0	7	10670.0	2.20
P25	21.86	7	39940.0	6.00
P27	0	12	88490.0	22.40
P28	29.16	13	84022.0	18.80
P29	16.52	23	220000.0	38.00
P30	0	11	62395.0	16.00
P31	89.42	4	39054.0	5.60
P32	0	12	85257.0	9.60
P33	0	7	31395.0	5.50
P34	3.46	11	32715.0	5.20
P37	18.64	3	7720.0	1.60
P38	0	15	49016	6.00
P39	0	9	32794.0	2.40
P40	31.10	9	7864.0	5.20
P41	26.50	11	37872.0	9.60
P43	12.15	5	44811.0	11.60

6 CONT.

2.60	3	0.376	3214.0	2.20
2.30	3	0.918	2250.0	1.60
4.00	3	0.999	3750.0	0.48
1.40	4	0.999	694.0	1.40
3.00	2	0.412	2011.0	1.80
12.80	4	0.568	2520.0	7.24
10.40	4	0.206	2250.0	6.80
13.50	3	0.823	2352.0	4.40
8.40	3	0.775	2250.0	4.40
4.20	3	0.630	3750.0	1.12
3.20	3	0.630	2354.4	2.72
3.60	4	0.631	2354.4	2.51
3.40	3	0.630	3375.0	2.80
1.20	1	0.999	750.0	1.20
1.60	3	0.504	1012.0	1.28
2.00	3	0.742	3375.0	1.20
1.30	2	0.599	2144.0	1.30
6.20	3	0.412	2977.0	5.20
6.60	5	0.521	2750.0	3.60

APPENDIX 6 CONT.

P44	0	9	30780.0	4.40	1.90	1	0.390	2179.0	1.84
P45	64.60	6	46104.0	5.20	1.60	5	0.609	169.0	0.80
P47	0	7	32399.0	8.40	2.80	3	0.269	2700.0	1.20
P49	0	7	17505.0	8.80	5.60	3	0.705	2721.0	2.80
P50	22.32	9	26820.0	6.40	4.40	2	0.674	2250.0	3.20

APPENDIX 7 CONT.

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ output items Shs.	(3) Description of Inputs to be financed by credit	(4) Credit Requirements Shs.
4. Seed	Katumani 25 kg. @ 3/20	80	As (1)	80
5. Fertilizer	20-20-0 125 kg. @ 1/70	213	As (1)	213
6. Dust and Spray	Dipterex 5 kgs. @ 6/=	30	As (1)	39
	Red Triangle 3 kgs. @ 3/=	9		
7. Harvesting:	25 bags @ 5/=	125	-	-
Transport				
Gunnies	25 bags @ 3/=	75	-	-
8. Others (specify)	-	-	-	-
9. Sub Total Variable costs (excl. Hired Labour)	-	732	-	532

APPENDIX 7

I.A.D.P. MODEL ENTERPRISE BUDGET

Planting Year: 1977 District: Machakos Crop: Maize Agro-Economic Zone: Cotton Zone Recommended Planting Time: March 77
Input/output Data per 1 Hectare Data Refer to: one Crop/year

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ output items (K.Shs.)	(3) Description of Inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
A. Output				
1. Yield (a) (90 kgs. bags)	25 bags @ 85/-	2,125	-	-
(b)	-	-	-	-
2. Gross Output	4050 kg.	2,125	-	-
B. Variable Costs				
3. Land Preparation (excl. Hired Labour)	Inploughing @ 200	200	As (1)	200

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ output items (K.Shs.)	(3) Description of Inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
10. Hired Labour (a) Land Preparation (b) Planting (c) Weeding (d) Harvesting	20 MD @ 5/-	100	As (1)	100
Sub Total Hired Labour	-	100	-	100
11. Total Variable Costs	-	832	-	632
12. Gross Margin per Ha.	-	1,293	-	-

Source: Ministry of Agriculture, Integrated Agricultural Development Programme Work Plan 1977/78.

APPENDIX 8

I.A.D.P. MODEL ENTERPRISE BUDGET

Planting Year 1977 District: Machakos Crop: Cotton Agro-Economic Zone: Cotton Zone Recommended Planting Time: October 1977
Input/Output Data per 1 Hectare Data Refer to:
1 Crop/Year

Items	(1) Description of items: Quantities and Price	(2) Values Input/ Output items (K.Shs.)	(3) Description of inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
A. Output				
1. Yield (a) AR 80%	640 kgs. @ 3/20	2,048	-	-
(b) BR 20%	160 kgs. @ 1/55	248	-	-
2. Gross Output	800 kgs.	2,296	-	-
B. Variable Costs				
3. Land Preparation	Inxploughing @ 200/-	200	As (1)	200

Items	(1) Description of items: Quantities and Price	(2) Value Input/ output items (K.Shs.)	(3) Description of inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
4. Seed	22 kgs. BPA	free	-	-
5. Fertilizer	-	-	-	-
6. Dust and Spray	2.5 cartons DDT/	500	As (1)	500
7. Harvesting: Transport Gunnies	 20 bags @ 5/- 20 bags @ 3/-	 100 60	 - -	 - -
8. Others (Specify)	-	-	-	-
9. Sub Total Variable costs (excl. Hired Labour)		860	-	700

APPENDIX 8 CONT.

Items	(1) Description of items: Quantities and Price	(2) Value Input/ output items (K.Shs.)	(3) Description of inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
10. Hired Labour (a) Land Preparation (b) Planting (c) Weeding (d) Harvesting	40 MD @ 5/-	200	20 MD @ 5/-	100
Sub Total Hired Labour	-	200	-	-
11. Total Variable	-	1,060	-	800
12. Gross Margin Per Ha.	-	1,236	-	-

Source: Department of Agriculture, Integrated Agricultura Department Programme Work Plan 1977/78.

APPENDIX 8 CONT.

Items	(1) Description of items: Quantities and Price	(2) Value Input/ output items (K.Shs.)	(3) Description of inputs to be financed by credit	(4) Credit Requirements (K.Shs.)
10. Hired Labour (a) Land Preparation (b) Planting (c) Weeding (d) Harvesting	40 MD @ 5/-	200	20 MD @ 5/-	100
Sub Total Hired Labour	-	200	-	-
11. Total Variable	-	1,060	-	800
12. Gross Margin Per Ha.	-	1,236	-	-

Source: Department of Agriculture, Integrated Agricultura Department Programme Work Plan 1977/78.

APPENDIX 8 CONT.

Items	(1) *Description* of items: Quantities and Price	(2) *Value Input/* output items (K.Shs.)	(3) *Description* of inputs to be financed by credit	(4) *Credit* Requirements (K.Shs.)
10. Hired Labour (a) Land Preparation (b) Planting (c) Weeding (d) Harvesting	40 MD @ 5/-	200	20 MD @ 5/-	100
Sub Total Hired Labour	-	200	-	-
11. Total Variable	-	1,060	-	800
12. Gross Margin Per Ha.	-	1,236	-	-

Source: Department of Agriculture, Integrated Agricultura Department Programme Work Plan 1977/78.

APPENDIX 9

I.A.D.P. MODEL ENTERPRISE BUDGET

Planting Year 1977 District: Kakamega Crop: Maize Agro-Economic Zone: All Zones Recommended Planting Time: 15/2-30/4/78
Input/Output Data per 1 Hectare Data Refer to:
One Crop/Year

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ Output items (K.Shs.)	(3) Description of inputs/ to be financed by credit	(4) Credit Requirements (K.Shs.)
A. Output				
1. Yield (90 kgs. bags)	45 bags @ 85/-	3,825/-	- -	- -
2. Gross Output		3,825/-	-	-
3. Land Preparation (excl. Hired Labour	ploughing/ harrowing	350/-	As (1)	350/-

APPENDIX 9 CONT.

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ Output items (K.Shs.)	(3) Description of inputs/ to be financed by credit	(4) Credit Requirements (K.Shs.)
4. Seed	H. Maize 25 kg @ 3/20	80/-	As (1)	80/-
5. Fertilizer T 5P	125 kgs. @2/20 250 kgs. @1/20	275/- 300/-	As (1)	575/-
6. Dust and Spray	7 kgs. Dipterex @ 5/-	30/-	As (1)	30/-
7. Harvesting Transp. Gunnies	45 bags @ 5/- 45 bags @ 3/-	225/- 135/-	- -	- -
8. Other (Specify)	-	-	-	-
9. Sub Total V.L. (excl. Hired Labour	-	1,395/-	-	1,035/-

APPENDIX 9 CONT.

Items	(1) Description of items: Quantities and Prices	(2) Values Input/ Output items (K.Shs.)	(3) Description of inputs/ to be financed by credit	(4) Credit Requirements (K.Shs.)
10. Hired Labour a) Land Preparation b) Planting c) Weeding d) Harvesting	40 MD @ 5/-	200/-	30 MD @ 5/-	150/-
Sub Total Hired Labour	-	200/-	-	150/-
11. Total Variable costs	-	1,595/-	-	1,185/-
12. Gross Margin per Ha.	-	2,230/-	-	-

Source: Department of Agriculture, Integrated Agricultural Development Programme Work Plan 1977/78.

APPENDIX 10

Regression Coefficients and Their Respective T-Values for the Three Regression Equations Derived for Machakos and Kakamega.

	C	Value of purchased Inputs	Value of farm assets	Yield	Family size	Education	Crop Area	R^2
Machakos Maize	7.71778	-0.1333836	+0.00004	+0.037436	0.02808	+0.912743	2.796358	
t-values	0.37	1.72*	0.42	1.80*	2.45**	0.18	0.33	0.321
Machakos Cotton	0.268808	+0.439436	-0.000003	-0.0002176	+0.017630	+0.0016390	+0.2284945	0.402
t-values	1.15	1.85**	1.3	1.87**	1.38	0.05	3.25**	
Kakamega Maize	0.137574	+0.378539	+0.00018	-0.0000501	-0.024000	0.045678	0.07258	0.1316
t-values	0.45	0.14	0.01	0.51	1.59*	0.01	0.64	

* - Significant at 10 percent level

** - Significant at 5 percent level

***- Significant at 1 percent level