

Intersectoral Linkages in Smallholder Farming Systems: The Case of contract sugarcane farming in the Mumias Sugarcane growing Zone, Western Kenya.

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By

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in partial fulfilment of the requirements
for the degree of Master of Arts
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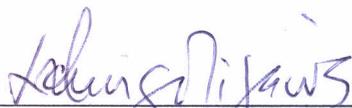
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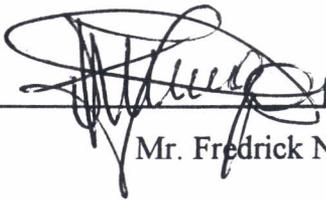
This thesis has been submitted for examination with our approval as University Supervisors.



Prof. Judith Mbula Bahemuka

22/12/99

Date



Mr. Fredrick Ndege

Date

DEDICATION

This thesis is dedicated to papa, Mathew Wanjawa, who sacrificed his life's savings to give me graduate education and to my late Mama, Mary Wanjawa, who believed in me.

ACKNOWLEDGEMENT

It is never done without help and neither was this. I am indebted to several individuals and institutions whose generous support I am much obliged to acknowledge.

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ABSTRACT

This thesis is on the inter-sectoral linkages between the cash crop sector and other farm and non-farm activities. It ~~thesis~~ examines and synthesises evidence on how a relatively successful and veritable cash crop sector may buoy the regional economy and the general quality of life of the participating groups by stimulating growth in other sectors .

Using the microcosm of contract sugarcane farming in the Mumias Sugar - belt, the study evaluates the extent to which relevant sugarcane farming technologies have been adopted for food production and, how the resource base at the household level has been deepened and enlarged through investment of the income accruing from sugarcane farming in other income-generating activities especially, the micro and small enterprise sector. The factors that inform the emerging adoption and investment patterns are investigated.

Two bodies of knowledge namely, modernisation theory and livelihood strategy theories are adopted as the theoretical muscles for the study. In so doing, the process is conceived of as fundamentally informed by the intricate interplay between, on the one hand, the paradigm in whose rubric development efforts are initiated and, on the other hand, household decision making, and how these are brought to bear on each other.

The study is based on a survey of 117 farmers drawn from the Mumias Sugar-belt and on contract with Mumias Sugar company. Data were collected from randomly selected farmers using a structured questionnaire. Focussed group discussions (FGDs) and interviews with key informants were also held. The quantitative, descriptive and statistical methods used in presentation and analysis of data are frequency distributions, percentages, cross tabulations

and correlation and regression analysis.

Examination of study findings confirms the significant interface of sugarcane growing and other farm and non-farm activities. In tandem with the theoretical framework adopted, the offshoot of such interface is shown to be a consequence of the local socio-cultural economic and institutional environment. The quality of farmership (derived from the farmers' socio-economic characteristics), the scale of production at the farm level and the performance of local institutional delivery systems (Extension services and farmer organisations) inter alia emerged as the most critical determinants of adoption and investment behaviour. However, a closer look at the findings reveals that only 42 per cent. of the farmers have adopted the technology of fertiliser use to the extent that they use it for food production while only 24.8 per cent of the farmers invest cane income in other income-generating activities.

Moreover, the study reveals the farmers', and indeed the areas, dependence on cane income. Besides, because this income is consumed directly rather than invested into other income generating activities, this dependency is poised to get even worse.

The study reports diminishing landholding compounded by large household sizes and argues that given the practise of land inheritance via land subdivision, fewer farmers will be in a position to engage in effective sugarcane farming. It is therefore instructive that farmers start preparing for the post sugarcane growing era by investing cane income, and indeed any other income, in income generating activities . In view of the foregoing, the study observes that small farmers in the Mumias sugar-belt will now, more than ever before, depend on off-farm income for an adequate level of living. To focus on programmes specifically for agriculture and to ignore the off-farm sector especially the micro and small enterprise development, as has been the case this far, is not in the best interest of the small farmers. Further, the study

underscores the critical role of the interplay between farmer and household characteristics, local capacity building institutions and scarce factors of production - land, technology, capital, skills and knowledge. In cognisance of this, the study posits that the way forward is for the establishment and cultivation of a vibrant civil society and community based organisations which will serve as the focal base for influencing socio-cultural and economic values and attitudes and, for the dissemination of knowledge and formation of skills and practices necessary to mobilise and maximise the productivity of local resources, and to stimulate enterprenuership.

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CHAPTER ONE

BACKGROUND AND STATEMENT OF RESEARCH PROBLEM

The key to the development of Kenya Africa, lies in the development of its rural sector - home for 70 to 80 percent of the population of the country. It has been widely accepted that Kenya cannot progress with its development without the strengthening of agricultural production. Without increased agricultural production Kenya will remain overly dependent on outside assistance costing it not only valuable financial resources but also its dignity, if not sovereignty (ECA 1989). It is a disquieting fact that the present trend is towards a lower agricultural productivity than in previous decades. This has often been attributed to a high population growth coupled with methods of production that are not always optimal in relation to the potential of the land (Harrison, 1989; ECA, 1988).

In the first decade of independence (1964-74) agriculture contributed 36.6 per cent to the Gross Domestic product (GDP). Between 1974 and 1979 Agriculture's contribution dropped to 33.2 percent and to 29.8 per cent in the ensuing decade 1980-1989. The 1990's have also followed the same trend: in the years 1990-1995 the economy's backbone sector slumped further to contribute only 26.2 per cent of the GDP.

In cognisance of this, researchers and policy makers are in tandem in their advocacy for increased agricultural production through the rapid and widespread adoption of technological innovations that will enable small holder farmers to increase their productivity without having to seek recourse to the destruction of forests or cultivation of marginal lands (ECA, 1989; OAU, 1981: 45). FAO's study "Agriculture Towards 2000" shows that 60 percent of the

anticipated increases in farm production will have to be accounted for by higher productivity (FAO, 1987). Hayami and Rutan (1987) point out that if technical progress is not sufficiently rapid, the increase in labour demand will fail to keep up with the increase in labour supply arising from rapid population growth. This could lead to growing income inequality in rural areas not because of new technology, but because of insufficient progress in technology use.

Furthermore, Mellor and Johnson (1984) observe that rapid growth of the rural labour force in the low-income developing countries not only increases the problem of adequate employment, particularly against the backdrop of a diminishing scope for expanding the land area, but also vitiates the possibility and ability for eliminating poverty by a redistribution of assets and income. Again, they note, high rates of population growth add to a stock of agricultural labour which is already used at very low levels of average and marginal productivity.

Studies on the determinants of labour force productivity indicate that trends like those observed by Mellor and Johnson can only be reversed via recourse to technical advancement which, as Denison (1974) observes, plays an even larger role than capital-deepening. Thus a major avenue through which development efforts may affect productivity is through its impact on technical change that is, the application of new techniques to production.

In this vein, the 1994-96 development plan is apt in its observation that,

The key to increased agricultural production ultimately lies with the nations ability to disseminate relevant information to the farming community to facilitate effective adoption of new production techniques (Dev. Plan, 1993:24).

On its part the World Bank, in the Policy Research Bulletin (1992), notes that,

More than financial capital, more than natural resources, more than cheap labour, knowledge is becoming the key factor of production (World Bank, 1992:6).

Thus, and as has been borne out by recent research, investment in human capital may yield returns equal to or exceeding investments in equipment and infrastructure. In other words, investment in technological material and scientific inputs that is not buoyed by investment in human capital will not bear fruit. Indeed, it is an article of faith in sustainable development that the onus for development be vested in the people themselves by opening up avenues by which they may reach consensus for action and developing the knowledge and skills to use material and technological investments. In rural areas, like those served by the Mumias Sugar Scheme, the daunting challenge is to increase the availability, accessibility and quality of the information, to ensure its dissemination in appropriate ways and to elicit more information from the rural people themselves in order to guide development planning.

Past research suggests that the modern cash crop sector can be instrumental in transferring the necessary knowledge and skills from the cash crop farm to other farm and non-farm activities (Buch-Hansen and Kieler, 1983). This view is supported by Mellor's observations that the development of modern agriculture creates three types of growth linkages, (1) Backward linkages caused by increased demand for intermediate or capital goods; (2) Forward linkages caused by increased supply of agricultural products for agro-processing industry; and (3) Consumption linkages generated by the expenditure of increased income from marketed output (Mellor, 1976).

The issues which are underlined in the foregoing concern intersectoral linkages and whether or not the cash crop sector, in the mould of contract farming, facilitates technology adoption and income investment in other farm and non-farm activities. Such an occurrence is, of

course, an outgrowth of interplay of a multiplicity of other factors e.g. level of education, age income level of contact with extension workers etc. Nonetheless, in the absence of a capital investment culture and institutions to disseminate relevant information, which largely informs adoption behaviour, many potential adopters and investors remain unfulfilled. But, again, without the benefit of empirical evidence at the local level these sentiments largely remain conjectural. Besides, at policy level, lack of such important information makes it difficult for those charged with the onus of formulating and executing rural development programs and policy initiatives to make incisive decisions.

This study aims to fill this lacuna by synthesising evidence on the linkages between the cash crop sector and other farm and non-farm activities and how such a linkage is instrumental in the general development of the area. In particular, the study seeks to evaluate the extent to which relevant sugarcane-based technologies are adopted for food production and cane-based income used as start-up capital for income-generating activities.

STATEMENT OF RESEARCH OBJECTIVES

Overall Objective

The study seeks to capture intra and intersectoral linkages between the cash crop sector and other farm and non-farm activities. The thrust will be towards assessing the adoption of relevant cane technologies and/or investment of cane based income.

Specific Objectives

1. Investigate the extent to which relevant sugarcane-based technologies are adopted by local farmers for food production.
2. Investigate the extent to which sugarcane-derived income is used as start-up capital for investment in income-generating activities. Evidence will also be adduced to show cash flow patterns from sugarcane farming to other sectors of the regional economy.
3. Assess the role of the quality of farmership in influencing technology adoption and income investment patterns.
4. Identify the institutional arrangements through which farmers can gain the knowledge and skills to use available resources and opportunities showing how their performance and operations may impinge on technology adoption and income investment patterns.
5. Show the variation in adoption and investment patterns attributable to scale of production at the farm level.

In regard to the above objectives, the study will attempt to answer the following questions:

1. What are the relevant sugarcane-based farming technologies and how have they been incorporated in food production?
2. What are the levels of cane-based income and to what extent is this income used as start-up capital for income-generating activities?
3. What role does quality of farmership, indicated by the farmers socio-economic and demographic indicators, play in explaining farmers' tendency for technology adoption and income investment.
4. What are the institutional arrangements to gather and disseminate relevant information to the local farming community and through which they can gain the necessary knowledge and skills to use available resources and opportunities, and how do their operations influence technology adoption and income investment patterns.
5. To what extent are technology adoption and income investment factors of the scale of production at the farm level.

Study Justification

As has been alluded to in the statement of the problem, the case for continuing to work on small-scale enterprise development and adoption of agricultural technology is Important. First, more than 40 million Africans are still confronted with the threat of famine and nearly half of the entire Sub-Saharan Africa population suffers from food shortages (Maxwell, 1992). It is projected that on the basis of food production trends, Sub-Saharan Africa would be unable to feed, from domestic sources, almost half of its population by the year 2020 (Third World Development, 1984). Current estimates show that for every four Africans, one depends on food imports and food aid for survival (FAO, 1987). In Kenya it is government

policy and expectation that all the nations food requirements be met from domestic production so as to maintain a position of food self-sufficiency. Yet, Kenya has continuously recorded food shortages; notably in 1961, 1965, 1967, 1980, 1984, 1994 and 1996/97 (GoK, 1966-70; 1979-83; GoK Sessional Paper No. 4 1981 and No. 2 1994). This desperate food situation behoves researchers to illuminate the underlying factors hence this present effort.

Secondly, for many of the limited-resource farmers increasing agricultural production and engaging in income-generating activities represents their best (often only) shot at meeting their food requirements and for earning cash incomes to meet other needs (Gerhart, 1975). Even the landless poor depend on the purchasing power of agricultural producers to find employment either as agricultural workers or in the rapidly expanding rural non-farm sector. Sugarcane farming is only profitable if cultivated on a large scale. There is this tendency for farmers to increase acreage under cane at the expense of other household activities. This is further exacerbated by large household sizes leading to land fragmentation. As such the need to maximise production through adoption of relevant technologies and to invest income in activities that generate further income is not only key but also critical for sugarcane growing areas.

Past studies have reviewed the adoption and investment behaviour in polarised terms (i.e., adoption/non-adoption or investment/non-investment) which relate the adoption only to factors influencing it (Wanjawa, 1993). This study is different in that it illuminates intra-sectoral as well as intersectoral linkages - namely, the extent to which technologies used in cash crop farming are adopted in food crop production and cane-based income invested in income-generating activities. Of course, the factors that inform such behaviour will be highlighted. To take the adoption discussion further, the extent of technology - reflected by,

among others, proportion of land and number of crops under a given technology - will be measured. These concerns are apropos to on-going research and development efforts not only to increase agricultural productivity but also household income and to stimulate and generate overall growth (National Development Plan, 1997-2000, ECA, 1989; OAU, 1981; FAO, 1987; World Bank, 1992).

The approach taken to address, even redress, the concerns highlighted, is the Farming Systems Research and Extension (FSR&E). It is an effective and popular research tool in efforts aimed at achieving increased agricultural production through rapid, and widespread adoption of technological innovations and in capturing the linkages between the farming sector and other sectors (Hyder, 1986) Its choice stems from its efficacy in holistically addressing the problems of limited-resource farmers taking into consideration their priorities and conditions. To this end, it stands in good stead to identify component sub-systems where intervention has the greatest chance of success.

Smallholder farmers constitute the majority of farmers in rural areas (ECA 1989) and it is against this backdrop that the thrust of the study zeroes in on them. Besides, in terms of output share of rural population, generation of employment, poverty alleviation and skill development of farmers, the role of smallholders is critical (Goldschmidt 1979). It is instructive to note also that agriculture provides employment to 73 percent of the labour force and is projected to account for 28 percent of the GDP between 1997-2000 (National Development Plan, 1997-2000).

The Mumias Sugar scheme is rated as the most veritable project in Kenya's sugar industry and indeed Kenya's efforts to spur rural development through industrial project implementation (Walter, 1991). This is reflected in its outstanding performance as the single largest producer

of sugar in Kenya (Glassford, 1984). Mumias' position is likely to remain dominant. Nonetheless; the people of Mumias cannot afford to solely depend on sugarcane growing, at least not given the volatility of the liberal market regime. The far reaching effect of the importation of cheap sugar in early 1996 is a case in point. Besides, with diminishing landholding and burgeoning family size fewer farm families than before will continue growing sugarcane and even for these cane acreage will diminish. It will be instructive to see investment trends so far and whether farmers are laying a background for the post-sugarcane growing era.

If the performance of the Mumias Sugar Scheme, in sugar production is worth notifying, can the same be said of its role in the general development of the area? 1) Can we say that the local people, as a result of sugarcane farming, are placed in a better stead to carry out their other farm and off farm activities? 2) These questions obtain for most, if not all, of Kenya's rural development programmes. Do they go the extra mile to contribute to community capacity building - this is the stuff of which sustainable economic development is made - or are they pedestals for fostering dependency? The Mumias Sugar Scheme provides an excellent test case for viewing this process. Besides, the choice of Mumias is especially crucial coming, as it does, on the footholds of government decision to privatise Mumias Sugar Company, and farmer initiatives to buy shares. As co-owners should their role remain as it is or should they take more charge, and if so, towards what direction? This study will shed some light on these issues. Lastly, these concerns gain currency in the light of government efforts to commission new sugar schemes at Nambale Busia - hardly 20 Km west of Mumias and in neighbouring South Nyanza. What development agenda should they take? Findings from this study could make an informative input in drawing up such an agenda especially insofar as technology adoption, income investment and poverty alleviation in particular, and community capacity building in general are concerned.

DEFINITIONS OF KEY CONCEPTS

In the preceding discussion two concepts - technology and Farming systems have recurred - It is instructive to define them in the light of their utility in the study. Other key concepts such as micro and small enterprises, contract farming and smallholder farming are defined in the literature review.

TECHNOLOGY AND TECHNOLOGY ADOPTION

Technology is a loaded concept that has been defined variously by different people. Mellor and Johnson (1984), for instance, define it broadly as:

... an assortment of tools and operations and techniques which transform the power of human muscles or refine the perception of human senses (Mellor and Johnson, 1984: 18)

Long (1994) defines technology as the equipment utilised to perform work, and technological innovation as any alteration in such equipment.

The foregoing tend to limit technology to equipment or machines, which need not really be the case. Technology, as Seidman and Anang (1992) observe, could more broadly, and acceptably be seen as specialised knowledge - such knowledge may relate to the process of production (as in innovations in how a given commodity is produced) or to products themselves - as in product modification. In either case the focus is on knowledge. Machinery

of whatever shade is drawn in only to the extent that it embodies the knowledge that needs to be utilised. Besides, at the micro level, where the runaway cost of machinery is often prohibitive, what is crucial is the knowledge that the poor and low-income earners can use, given their conditions, to harness basic, often meagre, resources to meet household needs. In taking cognisance of the foregoing, the study will use the concept of technology to refer to a set of knowledge capabilities namely; production, maintenance, entrepreneurship and marketing. As was argued earlier, ideas have to be embodied in either machinery or institutions. To this extent our conceptualisation of technology will include, the institutions that package and transmit them.

Technology is closely tied to technology adoption. Being a central concept it is instructive that its conceptualization and ramifications for the study be clarified. To this end, the study adopts the definition given by Feder et al (1988) of technology adoption as:

...the use of a technology in a longrun equilibrium when one has full information about the technology and its potential (Feder et al 1988:56).

This definition is in tandem with that given by Ahmed (1981) who, in obvious reference to agricultural technology, defines technology adoption as:

the use of a technology to any extent when the farmer is in the know of its utility (Ahmed 1981:34).

What emerges from the foregoing is that an individual can only adopt a technology if the individual is aware of the given technology and its utility and thus in a position to make a

decision on whether or not to use it. Even if the decision is made to use a given technology such utility should be such that it is not sporadic but rather sustained over a period of time - this is what Feder et al (1988) refer to as a long-run equilibrium.

In using the aforementioned concept definition of technology adoption, the study is largely informed by the thinking that: Sugarcane farmers in Mumias have had access to sugarcane growing technologies for a long time, some since 1972 when sugarcane growing was incepted, and have therefore had a chance to evaluate their utility for other sectors, including affordability and, based on such evaluation, made decision on whether or not to use the technologies. If the decision made is to utilise the technologies - for example tractor use, fertiliser application, record keeping, seed procurement and entrepreneurship - what is the extent of such utility. That is, what is the acreage, number of crops or number and size of income-generating activities for which the technologies are utilised? Answers to these questions help the study to document, not only the intersectoral linkages but also and more importantly, the extent of such linkages and its general contribution to the overall economy. Hopefully it does not come across as if the study seeks to give a different, even narrow, semantic view of technology but rather that its interest really is to examine and document the linkage between one dominant sector and other sectors. A linkage which, as earlier pointed out, is largely ideational and institutional rather than mechanical. Indeed, this is done in the belief that an important aspect of any research is the definition of a meaningful and

manageable focus.

FARMING SYSTEMS APPROACH

A system is conceived of as a configuration of units or elements or parts in a unified organised whole with each unit, element or part having consequences for it and for others and in turn, affected by consequences of other parts.

The concept of farming system or agricultural production system is gleaned from this general thinking. A farming system is thus seen as a socio-cultural and economic activity in which the farmer or farm family manages certain resources to produce for household and other needs (Dillon and Anderson, 1984). The farmer's or farm family's objectives include not only production for subsistence and increasingly for sale, but also subsidiary activities of largely a social-cultural and/or psychosocial nature.

The farming systems research and extensions (FSR&E) approach evolved as a result of the need to create close co-operation between technical and social scientists so as to maximise returns for limited resource farmers (Norman, 1980). These farmers, contrary to popular belief, are rational, are natural experimenters and understand the environment in which they operate rather complex interaction among various farming activities (Norman, 1980).

Therefore, the fundamental principle of FSR&E was that farmers could help in identifying the

appropriate path to agricultural development. It is now recognised that limited resource-farmers' participation at all stages relates in one way or the other to the selection, testing and adoption of appropriate technologies. Indeed, as Bahemuka (1993) observes, the main objective of FSR&E is to solicit for agro-social response, not simply to demonstrate a yield response but rather to relate to the farm household members in a learning process of technology generation, adaptation and adoption.

A farming system may involve growing one or more crops, rearing one or more species of animals or mixing to varying degrees the production of commodities with the rearing of animals. A farm may be owned and managed by a single individual or farm family. If a farm family is involved, as is often the case, more than one family member is involved in farm work, and to this extent may tend to be involved more in one commodity than others. The more typical situation is where men are involved in cash crop farming and women in food production. This however, is largely fizzling out. This implies that farming systems approach is of necessity a combination of all the activities the farmer, usually the farm family, engages in to meet household needs based on exploitation of land (Bahemuka, 1989).

As a corollary, decision-making processes may involve several individuals, each with their own objectives in growing different crops in different situations and with different statuses and roles in the community. Besides, some members of the farm family may be involved in

farming only part-time, by which case their farming activities are supplemented with a wide range of other income-generating activities including formal employment or casual employment on other peoples farms or in rural agro-based industries or self-employment in small scale enterprises marketing farm products or consumer goods in an array of other income-generating activities.

Thus (see for instance, Bahemuka, 1993), each of the farm activities can be conceived of as an enterprise. The term system in referring to these activities is preferred because the various activities used by one farmer or farm family are very tightly interrelated, in fact so much so that it is extremely difficult to isolate the costs and profitability of separate enterprises, especially given that:

1. The same plot of land may be used for different enterprises at the same time or in different seasons,
2. The same farmer may give time to several different enterprises in one week or in one day; and
3. Different enterprises produce different inputs for each other often with subtle reciprocity.

As such sharing of resources, as Mbithi and Mbula (1981) observe, keeps farm families close thus strengthening the links between household and community. Given the foregoing,, and against the backdrop of a study that seeks to identify and document the interface of one

dominant sector and others, it is thought that it would be simplistic to merely isolate one enterprise and assume that factors that explain its success and failures are limited within its operations. It is in eschewing such a narrow thesis that a farming systems approach - an approach that takes into consideration the farmers' overall environment, including socio-economic factors, the dynamism of their production system in relation to their conditions and needs, input/output ratios and constraints on increased production - is thought to be in order.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

LITERATURE REVIEW

This Chapter delves into some of the salient issues that inform the study. To this end relevant literature is reviewed under the following topics:

1. Historical and general aspects of Sugar cane growing
2. The Mumias Sugar zone agricultural system and potential for rural development
3. The need for technology adoption and income investment.
4. The micro and Small enterprise development and the farm sector interface

HISTORICAL AND GENERAL ASPECTS OF SUGAR CANE GROWING

Sugar cane, *saccharum officinarum* L., is a family of the grasses. There is strong evidence that it was first domesticated in New Guinea more than 10,000 years ago and from there was taken to Philipins, India and Indonesia. From India it reached the middle east and with the Nab expansion in the 7th and 8th centuries, sugar growing and processing spread in the Mediterranean basin. It was taken to the New World colonies by Columbus on his second voyage in 1493 and it was there that large plantations, that were to provide Europe with sugar

for centuries to come, developed. Large scale sugar growing was introduced in Africa from the mid 19th century onwards. Nonetheless, a modicum of subsistence growing especially along river banks, existed long before this. In Kenya, Coughlin, Odada and Owino (1986) trace the production of commercial sugar farming to 1922 when Miwani Sugar mills was established. Ever since sugarcane growing and processing has gained currency and today there are eight fully fledged sugar factories and three others in the offing. Despite this meteoric rise in number of factories, Kenya is yet to break even in terms of national sugar requirements. It is government policy that this gap between production and requirement be bridged.

Sugar cane production needs tropical and subtropical climates as well as considerable know-how in the field of agriculture and especially crop husbandry. It is propagated by cutting fully grown stalks into pieces consisting of at least four internodes and 3 buds. These pieces are grown in a well prepared seed-bed and from then the plant crop grows. When the plant crop matures, owing to climatological and soil conditions, it is harvested by cutting the stalks just above the ground. The remaining stool will tiller again resulting in the ratoon crop. Depending again on climatological and soil factors, as many as five or six ratoon crops can be grown in succession. Maturing of a ratoon crop may take between 12 and 18 months. With a plant crop and an average, four ratoon crops requiring 22 and 16 months each respectively, the land will have to be re - ploughed every 7 years.

Sugar cane growing is virtually unsurpassed by any other cultivated plant in its ability to transform the energy of sunlight into plant calories. To take full advantage of this ability the factors that inform the growth of sugar cane should however, be optimal. The most important factors are related to climate and the soil. Other conditions granted, an average annual rainfall of 1600 mm is required. For ripening, the building up of the sucrose content in the stalk, a dry season of some 4-5 months is required. During such a dry season the cane can also be transported to the factory without much ado. Prolonged droughts are however detrimental to the crop and significantly reduce yields. An average daily temperature of 28 degrees centigrade is optimal while the growth is checked by temperatures lower than 15degrees centigrade.

Chemical, physical and micro-biological properties are the principle soil factors that control the growth of sugar cane. As can be expected from a member of the grass family sugar cane grows on a wide variety of soils ranging from coastal sands to heavy black river clays. Although the demands made by sugar cane are not high as such, it is unparalleled in its ability to transform the energy of sunlight and this can only be optimal on fertile, well-drained soils with favourable physical characteristics.

It would be conjectural to give general figures for nutrient-removal from the soil by the crop, but suffice to say that a cane crop of 150 tonnes may remove as much as 75 Kgs nitrogen, 50

Kgs phosphates and 50 Kgs calcium from the soil. This high nutrient requirement results in rapid impoverishment of the soil, especially if cane is grown in monoculture as is often the case except for the plant crop when beans and other early-maturing legumes are intercropped. In this regard adequate fertiliser application and adequate water supply become the life line for a profitable crop. Amongst the fertilisers nitrogen takes the prime slot since most soils are lacking in its adequate supply. However, depending on the soil type also phosphorus urea and potassium may have to be supplied.

To obtain good yields the root system of sugar cane has to be well developed and this is only possible if the physical properties of the soil are optimal. The seed-bed should permit rapid infiltration and satisfactory retention of usable rainfall or irrigation water. It should be such that while allowing free root penetration, it resists erosion. The requisite physical soil conditions can only be obtained by an adequate land preparation system consisting of ploughing, sub-soiling, harrowing, ridging and top dressing.

practices such as land preparation, extension services, fertilisers, pesticides, seed cane, harvesting and transportation are centrally controlled and carried out by Mumias Outgrowers Company (MOCO). The process is such that MOCO contracts MSC to provide these services and pays for them directly. When the crop is harvested MOCO surcharges the cost of the services including a 21.5 per cent interest.

Barbara and Hives (1983) trace the origin of contract farming in Africa to the period immediately after a country was declared independent. They attribute this to the fact that prior to independence cash crop production was prohibited and although this anomaly was redressed, upon independence, the required capital for production was lacking. This meant that farmers who were willing to grow these crops were hamstrung by lack of financial capital and thus had to be assisted. The corollary is that contract farming, organised by newly independent states and multi-national agribusiness companies and financed by the World Bank and international lending institutions, ensued.

The organisation of small holder agriculture in some form of contract farming is believed to be one of the most effective means of overcoming stagnation in smallholder productivity which enamours production in developing countries. The rationale given for this is that smallholders overcome by poverty are not in position to invest in such technological inputs - often capital-intensive - as hybrid seeds, machinery, extension, fertiliser and transportation hence fettering the expansion of peasant commodity production (Glover, 1985). Besides, Glover posits, contract farming provides considerable co-ordination for potential rural development since it can facilitate the smallholder participation in the national economy (Glover 1985).

Buch-Hansen and Kieler (*ibid*) credit contract farming with increasing incomes and providing

a higher self-sufficiency in food. They observe further that,

The contract farming system which results in increasing purchasing power has enabled the producers not only to develop the productivity of cash crops but, agro-chemicals, ploughs, hybrid seeds, hiring of tractors and so forth are increasingly being used in subsistence production (Buch-Hansen and Kieler 1983:154).

Although those who take up cudgels for contract farming have an undoubted validity, their observations do not really make contact with the reality on the ground. Indeed, their observations are highly glossed over emphasising, as they do, what ought to rather than what is happening. They hinge their observations on the static premise that technologies are a fixed and given quality and thus naturally gravitate from cash crop to subsistence farming. This is, of course neither tenable nor true. Not surprisingly, proponents of contract farming fail to cite any tangible examples from Africa of contract systems where growth patterns have been cultivated. Nor, especially where growth pattern have been established, do they try to analyse the intervening bases of such growth. Had they done so, a more consistent conclusion would have been that growth relations in contract farming are neither given nor automatic and that advantages attributed to contract farming are, in most part, an ideological gloss and that some of the benefits claimed to accrue to the contract farmer do not necessarily apply in a series of quite common circumstances. Contract farming is assailed for exploitation and low returns to farmers (Glover, 1985). It is costly in mechanisation and administration, costs that are loaded on to the farmers thereby eroding financial gains for smallholders not to mention inefficiency in operations, and that incomes tend to be squeezed as costs of deductible inputs rise and crop prices stagnate (Carter and Dean, 1961). Besides, no one can say for sure that contract farming as practised in the Mumias Sugar Scheme facilitates technology transfer.

Indeed, farmers have been known to sell, at throw-away prices, fertilisers distributed for planting and top-dressing. Their perception is that the fertilisers are given for free not to mention their ignorance of the optimal requirements for the physical and chemical properties of the soil (Wanjawa 1993). Even then, is it not stretching credulity too far to expect contract farming to transfer technology when in essence it is exclusively at the privy of the Mumias Sugar Company. The management of the company decides which areas and, in those areas who to contract including what size of land, what seed cane to use, what fertiliser or other chemicals to apply and when to apply, when to harvest, when to replant and how much to earn. It is patent that in this system the farmer is an appendage useful only to the extent that s/he provides the land for management to work on. Undeniably their relationship is akin to that of a mistress and a handmaid.

Thus, the structure of sugar cane production in Mumias, by precluding farmers from direct contact to and active participation in processes of decision making that go on in the farm enterprise, squanders the opportunity to act as a conduit for technology transfer. In a similar vein it robs the farmer of an opportunity to grow and enhance their quality of farmership as a result of contact with better production techniques. Indeed it is an article of faith in a people centred perspective of development that the beneficiaries of efforts of technology transfer be equal and active participants in the process. Unless and until there is a willingness to surrender some ground in terms of decision making there is no much scope for technology transfer, let alone adoption.

Predhan (1979) could thus be apt in his observation that development projects, however well contrived and dynamic may not automatically generate spread-effects to the peripheral region nor is such a relationship given. Besides, it is not enough to have generators of spread-effects

without transmission lines within the target regions that are strong and open enough to facilitate the spread-effects.

It is the considered view of this study therefore, that in the main the potentials of contract sugarcane farming in Mumias for the overall stimulation of the economy as gauged by intersectoral technology adoption and income investment will remain just that, potentials, unless and until the production system, through its stake-holders namely, Mumias Sugar Company (MSC), Mumias Outgrowers Company (MOCO), and the government of Kenya - put into place institutions and mechanisms that will help in providing and strengthening capacity for growth taking into consideration the conditions and priorities of smallholder farmers. This becomes even more critical in the vein of the current view that the outcome of development programmes will be based less on scientific and material inputs as on the people involved and the institutions to enhance and harness their participation (FAO 1987). The key to increased agricultural production and a stimulated economy, therefore, ultimately lies in the ability of the Sugar Company and other stake holders to disseminate relevant information to the farming community to facilitate effective adoption of new production techniques (GoK development plan 1994-96, World Bank, 1992).

In the same vein, if the quality of information, its gathering and dissemination is prime, so is the quality of its recipient. The dynamic strategy behind peoples participation and community mobilisation is to release their energy and build their confidence to interpret situations, make decisions and choices, and implement them as individuals, groups or as communities. Unfortunately this aspect of human growth has suffered neglect at the altar of profit maximisation emphasised by Mumias Sugar Company. Even when they have come up for mention, issues about people and their participation have been treated as last and least (Seidman and Anang, 1992). Thus, while it is patent that on the macro level the agribusiness

experience in Mumias is a success (Williams 1985, Williams and Karen 1985, Glasford 1984, Waiters, 1987). On the micro and even aggregate level the performance of Mumias, in terms of improving the quality of farmership, alleviating poverty, stimulating economic diversification and building the capacity for growth, has been irascibly dismal. The economic contribution of Mumias Sugar Scheme at the macro level cannot be sustained unless it is buoyed by a better skilled farmership _ better skilled in terms of level of education, level of technology awareness, striving for improved quality of life and capital accumulation through an enhanced investment culture. It is thus pertinent that the smallholder farmer be prepared to shoulder the difficult and unfamiliar responsibilities s/he is encountering now and those that s/he is bound to encounter in the future as adjustments make demands and have direct economic and social responsibility on them. of critical interest is the shrinking landholding seen against the backdrop of a burgeoning family size and inevitably unmet household needs.

TECHNOLOGY ADOPTION STUDIES

Feder et al (1988) adopt a two-tier definition of technology adoption at individual and aggregate level. They define technology adoption at individual level as the degree of use of a new, or relatively new, technology in a long-run equilibrium when the farmer has full information about the new technology and its potential, and adoption at aggregate level, as the use of a specific technology within a given community. A farmer is considered to have adopted technology if s/he uses it to any extent on the farm (Ahmed 1981, Feder et al 1985). The adoption level is the number of technologies used while the rate of adoption is the number of farmers using a given technology as a percentage of survey farmers (Nweke and Akorhe 1983).

Most adoption research thus far has reviewed the adoption decision in polarised terms (adoption/non-adoption) which relate the degree of adoption only to factors affecting it (Njogu 1991, Wanjawa 1993). Yet, for many kinds of innovations the key questions may be related to the intensity of use as measured, for instance, by proportion of land under and duration of use of a given technology. The tilt of this present study is the extent of technology adoption at both the individual farmer's and aggregate levels.

A fundamental factor in low agricultural productivity among smallholder farmers is the lag in shifting from natural resource to a science-based agriculture (Rutan 1973: 5). Everywhere in Kenya and on the continent such natural resource inputs as virgin lands, crop rotation, manure and even family labour are either stretched to breaking limits or virtually depleted (Hunter and Ntiri 1987: 7-10). The future of African agriculture, while it may remain in the hands of smallholder producers, will increasingly have to rely on induced technological changes (FAO, ECA, 1989).

Yet, Cohen and Uphoff (1980) lament, it would seem that it is characteristic of smallholder life to evade, impede or ignore many kinds of economic, technological and social changes which are considered likely to help them. This is unfortunate especially given that the survival of human communities demands a large and critical share of scientific outlook. This is borne out by Chitere and Van Dorne (1985) who show that lack of adoption of farm inputs and practices recommended by extension agents in western Kenya leads to low maize production of less than 3 (90 kilogram) bags per acre against a possible 20-25 bags if proper crop husbandry was maintained.

The twin issues of technology adoption for food production and poverty alleviation through income generation has been a conundrum in development circles and much scholarship and energy has been dedicated to it in attempts to ferret out the underlying factors. These can be dually delineated. At one extreme are those scholars who brandish cultural primitivism and argue that African smallholders are too primitive and backward to accept changing (Achola, 1984). AT the other extreme are fanatical defenders who extol and romanticise about the African smallholders rationality and shrewd acumen in rejecting innovations which are at best unrealistic and at worst exploitative (Vine 1963, Norman 1900, Hunter and Ntiri 1978).

The cultural arrogance and Darwinian underpinnings of the advocates of cultural primitivism among smallholder farmers are well known and have been challenged and equipoise adequately (see for instance, Osei-Kwame and Achola, 1981). Nonetheless the paternalistic and misleading tone of Africa's cultural romanticists is glossed over. Besides, both the unwavering detractors and fanatical defenders of smallholder culture in Africa miss a fundamental point: that not all African indigenous traditions are retrogressive just as not all of them are progressive. Besides, as individuals interact new ways of doing things emerge and older ones are discarded or modified. Nonetheless, it never entails a total overhaul. This study, as did Acholo (1984), urges a synthesis i.e., instead of passive strategy of tailoring technologies to the cultural outlook of smallholders, as if such an outlook were sacrosanct, a more active policy of cultural interaction is advocated for.

Concomitantly, this study advocates for the active participation of the beneficiaries of technology transfer, that is, farmers take part in the decisions governing packaging delivery and management of efforts of technology transfer and that avenues be opened for their full self-realisation (Chitere, 1980). The issue of participation is especially central since it is known that farmers resist measures foist upon them (Shoemaker, 1971). Besides, and as

Chitere (1980) notes, participation permits mobilisation of local resources, many of which remain under-utilised, and thereby contribute to the growth of local capacity. Again, participation checks alienation, which prevents members from identifying with their communities. This concerns about participation of local people find safe haven in the current realisation that investments in people - especially those that open up avenues by which they may reach consensus for action - are the key factors of development (World Bank, 1992). Thus in discussing technology adoption this study will transcend issues of culture, allocating it only cursory attention, and argue that real factors can be identified by evaluating the extent to which local people are incorporated into meaningful decision making processes and, to the extent that this is so, the institutions to harness and leverage local resources and efforts. Even then, technology adoption behaviour is still amenable to farmers overall livelihood strategies and resource base. Therefore whether or not a technology is used or, as often is the case, the extent of such utility, will depend, in large measure, on how the farmer perceives the problem of low productivity. Such perception again, is largely influenced by the quality of farmership i.e. socio-economic realities of the farmer namely - age, level of education, income, landholding and overall world view. These realities often explain the differential strategies towards, and outcomes of, apparently similar structural conditions (Long and Van de Ploeg, 1988) including reasons why the level of adoption is high in some and low in other farmers.

ENTREPRISE DEVELOPMENT AND THE FARM SECTOR INTERFACE

General Perception

A number of literature on the perception of MSE Sector and its role in development have emerged over time since the early eighties when it was realized that many developing

countries in the sub-Saharan Africa and South East Asia were under siege emanating from financial crises and the adjustment policies that followed. These adjustments vitiated the ability of both modern private and public sectors to generate employment and increase incomes to levels which could sustain desirable socio-economic development. Furthermore, this situation initiated a change in direction of thinking and attitudes of policy makers and planners towards the informal sector hitherto considered marginal and destined to disappear.

It is found that the position of

Long (1977) tended to have represented the most prevalent pre-1980's perception on MSE's role in socio-economic development through his assertion that investment in MSE is not necessarily the correct policy for less developed countries even if they are suffering from high unemployment or under employment, since circumstances may be such that their only effective choice may be between capital intensive projects or none at all. Nevertheless the perception which developed in the 1980s was clearly noted by De Soto (1989). He observed that adjustment policies and cessation of investment in the public sector brought an about a turn in attitudes towards MSEs. Thus in the 1980s the literature which emerged following the realization of possible negative effect of structural adjustments on the performance of the modern sectors, on the one hand, and the capacity of MSE's on the other, tended, in general, to concur that MSEs development could be an alternative way of approaching tasks of development in an era of structural development and attendant socio-economic reforms.

However, subsequent literature tended to be more emphatic about the importance MSEs in developing the economy as they articulated the support of perceptions surrounding growth-oriented strategies on MSE. These strategies perceive MSEs as offering the best alternative to economic growth including industrialization of most developing countries. In support of this view Mead (1995) argued that this is because most of such countries have limited resources especially during the recession and on-going structural adjustment programs. This position has been strengthened by critics of large scale industries who have argued that these type of industries do not deliver either as engines of growth or as providers of employment, even though they already receive enormous support through general trade, finance, tax policy and other direct and indirect initiatives (Sebstad et al. 1995) It is against this backdrop that a Number of MSE enthusiasts have expressed a positive position on the desirability of the MSE related investment.

In particular, they have stressed the following attributes:

1. That the MSEs are a seed bed for indigenous entrepreneurship;
2. That they mobilize capital which could not otherwise ;
3. That they are labour intensive employing more labour per unit of capital than large industries;

4. That they enhance indigenous technology and learning of new and appropriate technology;
5. That they contribute to decentralization of industry;
6. That they further competition beyond protective barriers;
7. That they use predominantly local resources and thus have low foreign exchange requirements; and
8. That they cater for the basic needs of the poor and contribute to a more equitable distribution of income and wealth (Sebstad et al. Ibid).

Yet another body of literature focused mainly on the definition of the MSEs. MSEs had been defined variously. But the most consistent definition that has emerged is that given by Fisseha and McPherson (1991). They define MSEs as small, informally organized, non agricultural businesses the majority of which only employ one person being the owner-operator, some include unpaid family workers while others may have one or several hired employees. It has been noted that although no single characteristic distinguishes MSEs from the small enterprise the position derived from the literature tends to suggest that the rule of thumb is that the threshold of ten employees including the owner-operator and family workers should be considered as the upper bound for an MSE (Mayer and Reckefub, 1992).

Perception of the Kenyan MSE Sector

In Kenya, the first study on Micro and Small Enterprises was undertaken by the International Labour Organization. Together with local experts, especially from IDS, University of Nairobi, the mission sought to examine the factors informing the high level of unemployment and general underdevelopment. Their report on Employment Incomes and Equity in Kenya (ILO 1972) has since been hailed as having broken the ground in providing concrete and irreversible justification for the development of the Micro and Small Enterprise Sector. Subsequent publications widely acknowledged the importance of MSEs and ascertained that they were a source of income and employment for poor households in Kenya.

A more enlightening study was the first National baseline survey on MSEs conducted by Parker and Torres (1993). It was then that the magnitude of the MSE sector and its contribution to employment and income generation was quantified. Perhaps the most important aspect of this quantification was the observation that Kenya had over 900,000 MSEs employing nearly 2 million people. This study was used by the government to justify claims and therefore take credit, that the economy was generating hundreds of thousands of new jobs. Most critics, nonetheless, thought that the government claim was exaggerated,

arguing that most of the jobs, including the income generated, were neither durable nor sustainable.

The government's position on the salient role of the MSE sector is articulated in various policy-documents. Kenya's blue print to the year 2000 recognized the sector by declaring that, "indeed a large measure of Kenya's industrialization will be carried by small industries" (GOK, 1986). At this juncture no specific strategies were spelt out except that "given the nature of small enterprise activities, the primary thrust in stimulating their growth must come from Macro-economic policies aimed at the economy as a whole (GOK, Ibid). The suggested policies included

(i) Increased farm productivity and income to stimulate the demand for goods and services provided by the small scale sector (ii) reducing tariffs on raw materials, semi-processed goods and intermediate inputs, especially those used widely by small scale manufacturers and, (iii) constructing investment incentive structures to encourage the substitution of labour for capital, intended to assist small scale activities that are characteristically labour intensive.

However, more specific strategies and programs for the small firms were expounded by the 1989/93 Development Plan (GOK; 1988). These include, (i) developing an award scheme to promote innovation and invention through small and medium scale enterprises (ii) availing

information and knowledge (iii) examining the legal machinery governing small firms, by reviewing by-laws and regulations inhibiting development of one enterprises, and the improved accessibility of suitable financial and marketing infrastructure and (iv) restructuring of supportive public and private sector efforts in training, advising and counseling.

The other important document is the Sessional Paper No. 2 of 1992 on Small Enterprise and Jua Kali development in Kenya. This policy document is the blue print for MSEs development in Kenya. It was based on the work of a special task force established by the government in 1987 to review all policies

with a view to promoting the sector and creating an enabling legal and regulatory enabling legal and regulatory climate by eliminating existing constraints. Entirely, the paper deals with the provision of finance through the Jua Kali Fund in the Ministry of technical Training and Applied Technology for the construction of sheds to accommodate artisan workshops located in rural areas and availing of industrial and commercial land to small enterprises to construct and install their own facilities. These facilities were to be provided on the basis of needs? assessment conducted at District level on the actual and prioritized requirements of infrastructure for MSEs. Other parts of the paper address policy, credit and gender needs.

The Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year

2010 is another important document. With respect to MSEs, it notes that:

Most are service oriented enterprises, the success of which depends upon their having a convenient location relative to their potential consumers?

The policy paper posits that land near commercial centres of Kenya's Secondary towns and cities will continue to be made available to MSEs. Strategies for investment promotion advanced by the policy document include:

1. New serviced industrial parks capable of accommodating 1,000 industries will be established in growth centres to address the limitations imposed by the shortage of industrial and infrastructure.
2. New industrial estates capable of accommodating 50-200 medium scale industries will be constructed in key industrial areas.

In the various National Development plans (1989/93; 1993/97 and 1997/2001) the government acknowledges that the sector offers unmatched potential as a source of new jobs for the expanding labour force and for filling the so-called "missing middle" in Kenya. It also reiterates its commitment to MSEs and identifies various strategies for implementation.

These government proclamations, policies and plans have been criticized variously and justifiably. The most consistent critique, nonetheless, is that by Maitha et al (1997) who

conclude that the frameworks are too general and unimplementable. Besides, these frameworks are hardly followed by budgetary allocations or the institutions to implement thereby rendering them mere rhetoric.

The emerging literature clearly shows the potential of MSEs in the process of development. This study brings together two issues of practical as well as theoretical concern namely; investment in MSEs and the linkages between such investments and the farm sector. The question to ask is: to what extent do cash crops provide a basis for the growth of MSEs? Drawing on the experiences of development processes in sugarcane-growing Mumias, a conceptual framework is offered from which to view the process.

THEORETICAL FRAMEWORK

Two bodies of knowledge namely, modernisation theory and livelihood strategy theories are adopted as the theoretical muscle for the study. In so doing, the study conceives of the process of technology adoption and income investment in Mumias as fundamentally informed by the intricate interplay between on the one hand, the type of developmental efforts initiated and household decision making on the other, and, how these are brought to bear on each other via efforts of technology transfer. If the development efforts are such that they are couched in a paradigm that allows for a critical measure of community capacity building, as projected by whether or not there is a substantive input of local decision making - beyond rhetoric - then chances point to likelihood of a snowball effect of positive changes. If, however, local participation is lacking, or if it is such that it accentuates existing disparities, capacity building is likely to be minimal or skewed resulting in low levels of technology

adoption and in its wake disparities, dependency, stagnation, poverty and underdevelopment.

Modernisation Theory

One of the most infamous legacies of colonialism was racial bigotry. Then, races were conceptualised in terms of various stations of evolutionary development - from primitive Africans, Indians, Asians etc at the bottom to white adults at the top. After the second world war, this took on an economic dimension. Economic development was visualised as a ladder with 'primitive' or 'traditional' pre-capitalist cultural and agricultural systems on the bottom rung and 'mature' urbanised and industrialised capitalist centres of the west at the top.

Upon independence, development programmes were predicated on these modernisation ideas and ideals of an economic development ladder. These ideas were formulated into theories of modernisation which delineated stages in the process by which societies progress from traditional to modern (see for instance Smelser 1963, Moore 1963). These theories vary in detail and the various ideas are widespread, yet they all revolve around the common proposition that the onus rests on the state to intervene and infuse momentum in the process. This is often referred to as the modernisation thesis.

Development policies and programmes stemming from the modernisation thesis are predicated on economic growth. Their aim is to precipitate growth by investing capital into less developed areas thereby urging them up a few rungs and accelerating their climb up the ladder. In this way, modernisation theorists argue, a process is set in train in which the implanted capital creates economic growth in its immediate locality and that economic prosperity with its attendants trickle down to the surrounding areas. It was construed that as capitalism first spread out from the urban centres of the west and then diffused from

industrial centres of new nations to their hinterlands, not only would traditional economic systems change but also traditional or worse backward cultures would become modern.

Economic changes that turn traditional into modern societies - the modernisation of technology, incorporation into market relations, industrialisation and urbanisation - are assumed to produce associated changes in social characteristics (Cohen 1985). Concomitantly they are assumed to develop more uniform political integration and as a consequence, so the ideas run, the rural-urban and regional disparities are reduced to create a national identity and polity (Hechter 1975).

Policies to speed up the integration of rural areas into the capitalist circuit are therefore assumed, by and large, to bring about prosperity and to make them more amenable to the socio-economic, political and technological changes which replace traditional institutions and cultural values with those thought to characterise modern societies. These ideas have come to be called western-centric (Long 1977:27).

Pursuant to the foregoing, various policy initiatives have been instituted whose overall thrust has been to try and modernise rural areas: from rural-access roads, rural electrification, Harambee schools, Nyayo wards to the development of agricultural production. Agricultural production, in particular, has been geared to the development of cash crops to increase export earnings and to bring rural people into the money economy (MacPherson 1982: 37). Writing in a similar vein, Mellor (1976) posits that modernisation in agricultural production provides linkages between the cash crop sector and other farm and non-farm activities. In particular, that cash crop farming technologies, by and large, gravitate to subsistence production (Buch-Hansen and Kieler 1983).

Criticisms of the modernisation theory are many and varied. Nevertheless they can ably be summarised into two main ones. The first is economic, that rural industrialisation projects exacerbate rather than alleviate rural poverty and food scarcity. In particular those disparities of wealth between large and small farmers are actually increased (Holdcroft and Jones 1982: 219). On his part Gaikward (1981) exemplifies how rich farmers cream off the benefits of agricultural and rural development projects.

The second major criticism of the modernisation thesis is that it bolsters existing power holders and further depresses the disadvantaged and vulnerable groups (Preston, 1986). That rural development projects, in the guise of the modernisation thesis, lack a policy of redistribution of productive resources and in this regard do not create or strengthen participatory forms of organisation (Gaikward 1981: 50). Thus the expectation of modernisation theorists that the benefits of development would bring about self-reliance and community capacity building is, in large measure, untenable.

These and other criticisms have formed the bulk of the thesis underpinning the dependency and world system theories ably enunciated by Frank (1969) and Wallerstein (1974) respectively. These two theories form a whole paradigm on development and it is not the intention of the study to delve into that. Suffice it, however, to say that they see underdevelopment as arising, simultaneously, from the same process as does development. To this end they investigate how processes of underdevelopment have been created or instigated.

These criticisms notwithstanding, the imagery of a ladder up which people, communities and whole regions are progressing, stage by stage, towards economic prosperity and cultural

values of a modern society continues to inform rural development in Kenya. In fact Kenyans are so in synch with the modernisation thesis that they rejoice when one of their own ascends to a position of power and authority or when a development project is situated in their locality. To many, this heralds an opportunity for the community to scale the ladder of development through the spill-over effect. But it is not just the ordinary Kenyan, even the World Bank and the International Monetary Fund - through the Structural Adjustment Programmes (SAPs) and a host of other economic and political changes foisted upon developing countries - operate within the precincts of the modernisation thesis.

The overall thrust of this study is in part to investigate the extent to which large scale agrobusiness projects, using the microcosm of the Mumias Sugar Scheme and within the premise of the modernisation thesis, stimulate and facilitate rural development within and between the sectors or, whether, as the criticism goes, exacerbates poverty, dependency, food scarcity and wealth disparities. In so doing it is largely informed by the tenets of the modernisation thesis and their criticisms.

Livelihood Strategy Theories.

Theories of 'livelihood strategy' are derived from earlier theories about 'household economy' and 'household decision-making' from Economics (see for instance, Baum and Schertz 1983, Singh et al 1986) and from Economic Anthropology (Bartlett 1980). Rather than assume that farmers are 'profit-maximisers= these theories focus on welfare-maximisation' and posit multiple household objectives. These include: secure provision of food and essential subsistence goods, cash income for purchase of outside goods and services, savings (resources accumulated to meet future planned needs and/or emergencies), and social security (i.e. secure access to subsistence goods and productive resources including social esteem and

wealth). While seeking to meet these objectives, the farmer also seeks to minimise critical factors (Holden et al 1991).

To achieve these, households select livelihood strategies i.e., strategies through which they seek to meet the livelihood needs. These strategies are made pursuant to availability and accessibility of resources. Both the resources available and the livelihood objectives do change (often in predictable patterns) over the life cycle of the household. Again, despite high variability in the specific activities of each household the basic strategies pursued by households with more or less similar resources, at similar stages in the life cycle tend to be similar. In investigating household response to subsistence, technological, market or policy incentives for land and resource management it is usually possible to identify groups of households with similar responses (Scherr 1985).

Technology adoption and income investment strategies are in turn determined by farmers' overall livelihood strategies and resource base (Rocheleau 1987). Farmers may be keen to adopt or invest in technology as savings if they have no superior strategy for savings, while they may reject adopting or investing in technology for cash incomes if they already have a successful strategy for earning income from off-farm labour or crops. Farmers with many family members of working age may be little interested in labour saving technology, while those with limited household labour may place a higher premium on technologies that cut down on labour. Farmers with small pieces of land may be keen to adopt technologies or other strategies that maximise production while those with large tracts may not be so keen. Livelihood strategies need not always be a response to socio-economic conditions at any point in time. They could also be informed by historical changes in socio-economic conditions (particularly increased population density, high cost of living and changes in

market forces in general) which lead to changes in relative input and output ratios, and therefore the types of strategies and specific options considered by farmers. If technology adoption stems from such pressures it is referred to as induced innovation (see for instance, Boserup 1965; Binswanger and Ruttan 1978; Ruthenberg 1980). Various long-term pressures may induce farmers to intensify technology adoption or engage income-generating activities. According to Lihanda (1985) these pressures include: declining access to arable land, increasing demand for food products, declining incomes, increasing population density and declining farm sizes.

Intensification historically proceeds from local innovation both technical and institutional, as well as by extensive borrowing and adoption of innovations from other areas. As the value of products or services rises, farmers are willing to consider increasingly costly means of acquiring them, but they still will tend to seek the least costly solution. In more extensive farming systems, farmers will tend to adopt new practices only where expected returns are much higher than inputs, while in very intensive systems, farmers may value more marginal improvements, or high input/output ratios. Still, strategies would be expected to change with changes in relative value of inputs, alternative technological outputs, input or output substitutes, labour and land productivity and household assets.

Taking cognisance of the foregoing, this study lends itself amenable to the position that farmers do make rational decisions which are sometimes independent of external forces. These decisions are often representative of the farmers position and aspirations. Consequently, what farmers grow, how they grow and the specific use to which such produce is put is an outgrowth of both objective and subjective reality. To this extent technology adoption and income investment are both objective and subjective realities. Therefore a sociological analysis of technology adoption, as Long (1984) observes, requires:

a concern for ways in which different social actors interpret and manage new elements in their lifeworlds, an analysis of how particular groups create space for themselves in order to carry out their 'projects' an attempt to show how these interactional and interpretive processes can influence (and are in turn influenced by) the broader structural context (Long, 1984:21).

Again, focusing on the farmers livelihood strategy entails:

A study of conceptual and ideological frameworks that orientate their behaviour and strategies and the sets of relationships that structure their lives. These relationships often explain the differential strategies towards, and outcomes of, apparently similar structural conditions (Long, 1988:231).

Farm enterprise management is thus conceptualised as a form of social behaviour in the context of family and community relations, more than a set of financial or economic decisions. If this be so, the following areas are key: decisions about production in relation to available resources, how farmers balance opportunities against constraint how they respond to low productivity and how they make their living to support themselves and kin. Analysing the above behaviour in its sociological context requires that we explain why producers follow certain specifications on some occasions but not others, why some farmers take advantage of prevailing opportunities and not others, and why some farmers succeed where others fail; behaviour that transforms technology adoption and income investment into a process rather than an event.

RESEARCH HYPOTHESES

In an attempt to ascertain the veracity of the issues raised to address the stated objectives, the following hypotheses were selected to guide the study thus forming the predicate of an investigative and evaluative study in which data were largely quantitative.

1. The technology adoption and income investment behaviour is partly explained by the quality of farmership, measured by socio-economic and demographic indicators of the farmer and his/her household resource base.
2. The scale of production at the farm level influences farmers' technology adoption and income investment behaviour.
3. Sugarcane-derived income is not the main source of start-up capital for establishing income-generating activities.
4. There is a pro rata relationship between length of period of sugarcane growing and a farmer's technology adoption and income investment behaviour.
5. The nature of extension contact between the farmer and the extension agent determines adoption behaviour.
6. The low levels of technology adoption and income investment are for most part due to inadequate institutional arrangements at the local level through which farmers can gain the knowledge and skills to use available resources.

CHAPTER THREE

SURVEY METHODOLOGY

The following chapter outlines the research design for the study. This is predicated on the view that successful research revolves around careful planning, execution and interpretation of scientific phenomena. In this regard, modes of sample selection have been devised and methods and instruments of measurement of observed phenomena constructed. The thrust of my discussion will focus on:

1. Description of study area.
2. Study population, unit of analysis and Conceptualization of data
3. Sampling design
4. Methods of data collection
5. Data preparation and analysis.

The Study Area

Location

The study focussed on the Mumias Sugar Zone, an area defined by longitudes 60-90 and latitudes 30-50 N. It comprises of all those farms within the area above whose radius extends 32 kilometres away from the Mumias Sugar Factory. Although the sugarcane processing plant is situated at Mumias township in Mumias-Butere District the sugar zone stretches into parts of Bungoma, Kakamega and Busia Districts.

Population

Although no census has been carried out specifically for the sugar zone, records at the Mumias Sugar Company estimate the population at 550,000 with a density of 286 people per square kilometre and approximately 60,000 households (Rakama, 1994).

Temperatures and Rainfall

Temperatures vary from an annual minimum of 15-18 degrees centigrade and a maximum of 26-32 degrees centigrade. The Mumias Sugar Zone is well endowed with reliable moderate rainfall distributed throughout the year. Nonetheless, one can discern that it follows a seasonal pattern of long and short rains. Long rains fall between February and July with maximum rain falling in April-May. Short rains fall in August and September. A prolonged dry spell is experienced during the December-February period.

Rainfall patterns influence crop growing in the area. Following the two rain seasons there are two crop-growing seasons in a year. The main planting season is between February-March with the advent of long rains and may stretch into April. The other planting season is August-September with the onset of short rains.

Soil Types, Farming Activities and Sugarcane Growing

The soils in the area tend to follow the ecological zones and three main types of soils emerge: The deep-dark loams in the East, South and parts of central; the dark-red clays in the North; and the dark-brown sandy in the West (Kakamega Socio-cultural Profile, 1990). Generally, the soils are of moderate chemical composition although they are generally deficient in nutrients, especially phosphates and nitrates, making fertiliser use a priority for both sugarcane and food production. The fertility of the soil range from low to high nonetheless, high rainfall and lush vegetation supports the general opinion that the area is of moderate and high agricultural potential.

Farming is the main economic activity and about 88 percent of the area are under cultivation and livestock holding (Mumias Sugar Company Report 1995). The communities in the area are engaged in mixed farming, growing crops as well as keeping livestock. The food crops grown include maize, millet, potatoes, cassava, bananas, beans, groundnuts and vegetables. Most farmers keep local breeds of cattle, goats, sheep and poultry. Lately however, an increasing number is moving into dairy and poultry farming using exotic breeds.

A lot has been discussed in Chapter Three as regards sugarcane growing generally and in the Mumias Zone. Suffice, however, to point out that it is the only cash crop grown in the area and covers over 60 percent of agricultural land. The sugar processing factory, Mumias Sugar

Company, situated in Mumias division is the most veritable sugar processing company in the country and produces over 50 percent of sugar produced locally. Most people in the area are neither formally employed nor engaged in other forms of income generation. Sugarcane growing is thus the main source of income and is considered the lifeline of the area.

Study Population

The study covers smallholder farmers on contract with Mumias Sugar Company. Information is sought from the farmers who run the farm enterprise, i.e. those in whose name the contract is drawn and who therefore control and direct the expenditure of sugarcane earned income.

Units of Analysis

Unit of analysis is the entity about whom or which information is gathered (Singleton et al, 1993:526 and Schutt, 1996:593). This study has three units of analysis namely,

1. Individual farmers interviewed during the survey period.
2. The households from which individual farmers come.
3. The institutions available to aid technology transfer and income investment.

The study sought the acquisition of two types of data - actual and attitudinal. Actual Data refers to aspects that are amenable to direct observation, measurement and evaluation. A case in point is sugarcane-derived income and patterns of its expenditure. Attitudinal data, on the

other hand, does not lend itself to either easy observation or measurement and thus requires delicate probing to ferret out peoples 'real felt' as opposed to 'conventional' feelings and perceptions. Indeed, this latter view is encapsulated in the words of interpretive sociologist W.I. Thomas that, "If men construct phenomena as real then it is real in its consequences."

Sampling Design

There are approximately 44,000 farmers on contract with Mumias Sugar Company divided into four zones namely, Eastern, Western, Southern and Northern. To capture the zonal variations in the Mumias Sugar belt and the overall representativeness of the study's sample, to retain factors of accuracy and precision, and to reduce the costs of creating a reliable sampling frame, I adopted a multi-stage sampling method. This is a modification of the simple random sampling, where there are several stages of sampling and the units chosen at every stage are of a different kind (Jolliffe, 1986:15). Having done that, probability and non-probability sampling techniques are combined to draw the targeted sample of contract farmers from the various zones.

Contingent on limited resources - time, finances, personnel - and due to other vagaries of research design and administration, the study focuses on only three of the four zones. Using purposive sampling - a form of sampling in which investigators rely on their informed judgement to select units that are typical of the study population (Singleton, 1993:160) - and

having identified sources of variation and commonality, Eastern, Western and Northern Zones are selected for the survey. Eastern is selected because it is the cradle of out-grower sugarcane growing in Mumias and which best reflects its past, present and future growth patterns. Western and Northern zones are selected because compared to Eastern their farmers have larger landholding and it was important to see if size of landholding impinges on technology adoption and income investment. Besides, unlike Eastern and Southern zone which are situated entirely in Kakamega District, Western and Northern zones stretch into Bungoma and Busia Districts respectively. It was thought expedient to capture and document this variation. In addition, Northern was especially selected because it is the latest to be drawn into sugarcane growing following the expansion in the 1980s and it was important to investigate the impact of length of sugarcane farming on the key variables of technology adoption and income investment. On its part, Southern zone was left out because its characteristics oscillate between those of Eastern and those of Western and Northern and its exclusion was thus not going to add to the corpus of knowledge and therefore not injurious to the outcome of the study.

The penultimate stage of sampling entailed drawing a sample of sub-locations from the three zones. Each zone is divided into two sections, i.e. I and II, which are further divided into sub-locations each under a supervisor. For this study I focus on six sub-locations in every zone divided equally between the two sections. Although neither the zones nor the sections

have an equal number of sub-locations, the decision to select an equal number of sub-locations is vindicated by the fact that where a zone has fewer sub-locations it more than covers for it in terms of hectare and/or number of farmers. The inverse is also correct. The sub-locations to be surveyed were selected purposively based on proximity to the sugar factory or the zonal office, whichever was appropriate, and on production figures. At the end of the day the selected sub-locations were a fine mix of (1). Those close to and far from the administrative centres and/or processing plant and (2) those with high production figures as well as those with medium or low production. The following 18 sub-locations were selected:

1. Eastern Zone I : Mung'ang'a, Lubinu and Malaha
2. Eastern Zone II: Budonga, Makunga and Esumeiya
3. Western Zone I : Buchifi, Musanda and Lureko
4. Western Zone II: Esikoma, Elukongo and Mayoni
5. Northern Zone I : Buyofu, West Mateka and Khasoko
6. Northern Zone II: Khalaba, Matungu and Kholera

This area sampling was thought to be instructive premised on the simple assumption that people live somewhere, if areas are sampled then everyone has more or less an equal opportunity to be drawn into the sample (Prewit, 1971:30).

Stage,three of the sampling design involved obtaining a sampling frame of sugarcane farmers in each of the selected sub-locations. Lists of contracted sugarcane farmers were obtained

at the Out-grower Division Services (ODS) field offices located in each sub zone - Shianda and Isongo for Eastern, Bukaya and Etete for Western and Bulimbo and Khasoko for Northern.

Having obtained lists of farmers in every sub-location and in order to ensure a randomised selection every nth entry for each sub-location was selected for the interview as shown in table 1. Initially, the survey targeted 126 farmers - 42 each from the three zones - and although this number was sampled 8 farmers defaulted and thus only 117 farmers were interviewed thereby cutting down the sample size.

Table 1: Sampling Distribution of farmers by zone and sub location

Zone	Sub-location	No. of out-growers	Sampling Interval	Number Sampled (N=126)	Number Interviewed (N=117)
Eastern I	Mun'gan'ga	686	98	7	5
	Lubinu	1548	221	7	6
	Malaba	880	125	7	7
Easter II	Budonga	1080	154	7	7
	Makunga	980	140	7	6
	Esumeiya	1842	283	7	7
Western I	Buchifi	1097	156	7	7
	Musanda	616	88	7	7
	Lureko	986	140	7	6
Western II	Esikoma	16*	2	7	6
	Elukongo	1649	235	7	6
	Mayoni	1343	191	7	7
Northern I	Khalaba	1815	259	7	6
	Matungu	1136	162	7	7
	Kholera	1020	145	7	6
Northern II	Buyofu	948	135	7	7
	Khasoko	823	117	7	7
	W/Mateka	1378	196	7	6

Source: Computed from Survey Data, 1997

NOTES:

- * The soils are very sandy and so only a few farmers have been contracted. Despite the small number, an equal number of respondents was sampled to give it equal coverage with other better endowed areas and to show how such adversities may affect the key variables of the study.

In sum, by adopting area sampling the study was able to whittle down the costs - financial and time - of data collection. Indeed as Singleton et al (1993:254) aptly observe:

clustering concentrates interviews within fewer and smaller geographic areas thereby spreading the travel over several cases and saving on the costs of any one interview. [...] besides, clusters reduce costs by allowing lists to be drawn only for selected areas rather than for the entire population (Singleton, 1993: 254).

Data Collection Techniques

The data required was collected using primary and secondary methods. The primary method, employing an interview schedule, involved the collection of broad sets of data via a structured questionnaire consisting of closed and open ended questions (a copy of which is appended) administered by the researcher himself each interview lasted approximately one hour. Prior to the survey the questionnaire was tested after which some modifications were made based on additional information from the farmers and the out-growers and the out-growers Division

services (ODS) of the Mumias Sugar Company. The questions sought to bring out farmers' socio-economic characteristics, contract farming practices, knowledge and utility of existing technologies, production and income generation figures, availability and access to institutions that gather and disseminate relevant information, household needs and strategies for meeting them, food crop productivity, income generation and investment patterns and overall linkages between sugarcane farming and other farm or non farm, socio-economic activities. Using this approach data is generated that makes it possible to identify and quantify patterns of behaviour and therefrom to infer processes at work at individual as well as aggregate levels.

To supplement survey data, the study employs ethnographic techniques to collect qualitative data, which are used to inform quantitative analyses. Ethnography is predicated on the assumption that the researcher has had an elaborate stay in the field so as to understand and appreciate the real felt needs and views of the people involved. To this end, I held focussed group discussions drawing participation from various members of the community. In each sub-location I held discussions with 6-8 farmers each from a different field. Having compiled a list of questions prior to the discussion, I posed to the group with each member being given an opportunity to respond. The responses were put down in a notebook. The issues discussed inter alia, include contract sugarcane farming practices, operations and services offered by Mumias Outgrowers Company, limitations and future of sugarcane farming, food

production and the need for diversification, expenditure of sugarcane earned income and development of an income investment culture. From this discussions it was patent that local people have a wealth of information, which needs to be illuminated and packaged so as to inform development processes.

In addition, the study benefited from information, views and ideas of key informants. These were selected from among Mumias Outgrowers Company (MOCO), Outgrowers Division Services (ODS) and Mumias Sugar Company (MSC) employees. From MOCO discussions were held with the Deputy General Manager and farmers' representatives (Directors); in ODS consultations were made with the Assistant Agricultural Manager, Area Managers, Zonal Superintendents and Supervisors. At MSC I talked to the Head of the Human Resource Department, office of the Deputy General Manager, Finance, and the production department. Among local leaders I held discussions with the Area District Officer and the Chairman of Mumias Town Council and the Divisional Agricultural Extension Officer.

The study also used direct observation. As I moved around the zones, a day was set aside to visit various sub-locations and attend farmers' meetings. Even as I traversed the sugar zone I could not help noticing that school children chewed sugarcane in the morning, for lunch and in the evening which was a pointer to food poverty in the households. Besides, the scene of men, both young and old, loitering at market centres was inescapable which was later

confirmed to be due to high levels of unemployment and/or failure to begin income-generating activities. During visits to households to administer questionnaires, efforts were made to discern information and other picturesque relevant to the study. Through this technique I was able to assess landholding -cane farms compared to food crop farms - food crops grown and their quality, types of houses and households, income-generating activities, market development and other infrastructural facilities available such as the road network, rural electrification, schools, health centres and generally other indicators of a cash crop encroachment on a hitherto rural set-up. Needless to say these went a long way to qualify data generated quantitatively.

Primary sources aside, data was collected from secondary sources. This involved visiting key places such as Mumias Outgrowers Company, Mumias Sugar Company and Mumias Town Council, perusing Annual Reports of the Kenya Sugar Authority and reviewing available literature from these, dissertations and other relevant discussion papers. From all these, relevant information was obtained which has enormously influenced the outcome of the study.

Data Preparation and Analysis

In this study, data entry, processing and analysis was by use of a computer programme - the scientific package for social scientists (SPSS). In this regard, both descriptive and inferential statistical methods were used.

Descriptive Statistics

Descriptive statistics are defined by De Vaus (1986:105) as a way of categorising variables by summarising patterns in the responses of respondents in the sample. In Chapter 5 I use frequency distributions, percentages and averages to condense raw data into forms which supply useful information efficiently. Based on these descriptions, patterns of relationships are identified and variations captured. Some of the data is presented in tables.

Inferential Statistics

Inferential statistics on the other hand supply the researcher with the tools to draw conclusions and make decisions about populations based on sample findings. In chapter 6 I use cross-tabulations, measures of association, chi-square and regression analysis.

Cross-tabulations

These are joint frequency distributions of cases according to two or more classificatory variables. In such cases samples on two or more separate dimensions are simultaneously tabulated such that they illuminate the inter-relationship between the respondent's score on two or more dimensions. Frequency distributions generated from cross-tabulations are summarised and further explained by use of Regression analysis.

Regression Analysis

Regression analysis is a statistical procedure used to predict the exact value of one variable based on an extrapolation of another variable. In this way it makes it possible for the determination of the changes in one variable (dependent) attributable to changes in another variable (independent). For this study two closely related techniques of regression analysis, multiple and stepwise regression, are used.

Multiple regression, an extension of the bivariate correlation coefficient to multivariate analysis, is a general statistical technique that measures the relationship between a dependent variable and a set of independent variables.

On the other hand, stepwise regression, similar as it is to multiple regression, goes a step further to allow for the figuring out of the one variable that best explains the dependent variable.

The two test statistics are only appropriate when the variables are measured at or above the interval scale. In this regard, the study makes use of dummy variables where applicable.

OPERATIONAL DEFINITIONS OF VARIABLES

INDEPENDENT VARIABLES

Quality of farmership

This is not a common term. It has been coined in this study to capture the socio-economic and demographic indicators at the farmer and household levels. The quality of farmership is projected by a farmer's score in the above indicators. This is seen as influencing decision making processes and, therefore, indicative of adoption and investment behaviour.

Scale of production

Scale of production is in this study conceptualised as size of cane landholding and, flowing from this, income generated from cane. It is assumed that a farmer with a larger plot of cane and therefore higher income has a more than average chance of adopting relevant cane-based technologies and investing cane-based income.

Sugarcane-derived income

This refers to all income accruing to the farmer as a result of selling the sugarcane crop and other sugarcane-based crops, such as Soya beans, to the Mumias Sugar Company. The assumption is that farmers who generate higher income from cane are more likely to invest it in income-generating activities

Length of period of sugarcane growing

This refers to the span of time between when the farmer was first contracted as a sugarcane farmer and when the survey was carried out. The underpinning view is that the longer the period of growing the more the likelihood that the farmer has adopted relevant technologies and invested cane income.

Extension contact

This refers to the nature of relationship between the extension agency/agent and the farmer. The underlying assumption is that the level of extension contact impacts on technology adoption and income investment behaviour.

Institutional arrangements

Implies an agency or agencies at the local level among whose objective is the tapping of relevant information and knowledge and disseminating the same to the farming community so that not only do they make informed adoption and investment decisions but also that, having made such decisions, they have the skills to be effective.

DEPENDENT VARIABLES

Technology adoption behaviour

A farmer is considered to have adopted technology if s/he uses it to any extent on the farm. for this study the technology in question is fertiliser application.

Income investment behaviour

A farmer is considered to have invested income if s/he has used the income earned, or part of it, to start an activity that generates further income either directly to the farmer or to a member of the household. For this study the income to be invested is sugarcane-earned.

Conclusion

This chapter has explained in detail the sampling design and other procedures used to select the research sites and, in these sites, the respondents. The study area has been described and the study population, units of analysis and the nature of data sought illuminated. An illustration of the sampling design has also been made including methods of data collection preparation and analysis as well as operationalisation of independent and dependent variables.

CHAPTER FOUR

DATA PRESENTATION AND DESCRIPTIVE ANALYSIS

Data Presentation and Description

This chapter presents and discusses the salient issues that underpin technology adoption and income investment patterns for small-scale enterprise development in the Mumias Sugarcane growing zone. Data is presented, described and discussed in the following areas:

- I Socio-Economic and demographic characteristics of the farmers
- II Contract Sugarcane farming practices and services
- III Cane leasing patterns and cash crop-based Dependency
- IV Cane production, cane-based income and Expenditure and, Household needs and Strategies
- V Adoption patterns of sugarcane-based technologies for food production
- VI Institutions for capacity building, information gathering and dissemination and, Extension services
- VII Investment of cane-based income and small scale enterprise development

This chapter is predicated on this broad question: Along what patterns has contract sugarcane farming interacted with the regional economy and has it stimulated other sectors of that economy especially as regards technology adoption and income investment for food production and enterprise development respectively. Data are presented that identify these patterns and that capture underlying variations. The patterns brought out and the factors that inform them are statistically tested in chapter 5.

I Socio-Economic and Demographic Profile of Farmers

(i) Age and Gender

The farmers ages were distributed among five categories of < 30 yrs (1.7 per cent); 30-49 yrs (39.3 per cent); 50-69 yrs (44.4 per cent) and >70 yrs and over (14.5 percent). Of the total number of Survey farmers 107 (91.5 per cent) were male compared to 10 females (8.5 percent). The age and gender profiles reveal that cash crop farming is still the dormain of men and even among men by the older ones (aged 50 and above). This is an offshoot of dynamics of land ownership in the area where, being a paternalistic society, only male children inherit land. It is instructive to note that 90 per cent of the women farmers were widowed. At another level, however, it reflects the shrinking land holding as a result of which many farm families cannot set aside enough land to be contracted individually and so they pool

together often under their father given the patriarchal land allocation system. Although there is little corroborative evidence, Women are said to be more innovative than men are and, among men, younger ones (below age 50) are more innovative than older ones (aged 50 and above). The fact that old men frequently control sugarcane farming has negative implications for technology adoption and income investment patterns in the area.

(ii) Level of Education, Employment Status and Household Size

Table 2 shows the distribution of the school years completed by the survey farmers. 12 percent had no formal education whatsoever while 82.9 per cent had upto primary education. Only 4.2 percent had a post-secondary level of education. Generally, the farming community in the Mumias Sugar Zone consists of people with primary formal education.

Table 2: Farmers> Distribution by Level of Education

Level	Frequency	Valid %	Cumulative %
None	14	12.0	12.0
4	32	27.4	39.3
7/8/9*	51	43.6	82.9
Fourth	15	12.8	95.7
College	5	4.2	100.0
TOTAL	117	100.0	

Source: Computed from survey data

- * Represents the changes in system of primary Education in Kenya. Before independence it took 9 years, after independence 7 years and with the introduction of 8-4-4, 8 years.

Analysis of the farmers household sizes reveal that households in the Mumias sugarcane growing area range between 6 and 20 people. Of particular interest is that more than 52 per cent had a household size of 10 people and more compared to the national average of 5.6 people. As we shall see in chapter 6, household sizes impact on household decision making and strategy to meet household needs.

Table 3: Distribution of farmers by household size

Size	Frequency	Valid %	Cumulative %
6-7	34	28.6	28.6
8-9	22	19	47.6
10+	61	52.4	100
Total	117	100	

As regards formal employment, the study reveals that farmers in the Mumias sugarcane-growing zone suffer from acute incidences of unemployment. Only 7.7 percent of the survey

farmers were fully employed while 15.4 percent and 7.7 per cent are self employed and retired respectively. For the majority of them, 70.1 per cent, the only claim to employment status is subsistence farming and casual work. Viewed in relation to the large household sizes reported this has serious ramifications for the quality of life in the household and generally on the development process in the area.

Period of sugarcane growing, cane acreage and overall land holding

Table 4: distribution of farmers by period of cane growing

Period	Frequency	Valid %	Cumulative %
24 years	58	49.6	49.6
15 years	46	39.3	88.9
6 years	13	11.1	100
Total	117	100	

The study reveals that 49.6 per cent of the survey farmers began sugarcane growing in the 1970s while 39.3 per cent began in the 1980s. A paltry 11.1 per cent began in the 1990s. This shows that the majority of the farmers, 88.9 per cent, have been growing sugarcane for at least 15 years now - long enough a period for the cash crop to have established linkages with other sectors of the economy. The fact that such linkages are neither pronounced nor strong must be seen as a pointer to the reality that the cash crop sector's stimulation of the regional economy is not given, nor is the view that with time this will take place tenable.

Indeed as predhan (1979) aptly observes it is not enough to have generators of spread-effects without transmission lines within the target regions that are strong and open enough to facilitate the spread effects.

Table 5 shows the distribution of farmers by size of cane acreage and reveals that most farmers, 66.7 per cent, have less than 2.5 acres while only 8.5 per cent can lay claim to 5 acres and more.

Table 5: Distribution of farmers by size of cane acreage

Acreage	Frequency	Valid %	Cumulative %
1 - 2.4	78	66.7	66.7
2.5 B 4	29	24.8	91.5
5+	10	8.5	100.0
Total	117	100.0	

Source: Computed from survey data, 1997

Comparisons with overall landholding reveal that 78.4 per cent of the survey farmers have more than half of their land under sugarcane cultivation. Seen against the large households sizes reported and the length of time it takes to harvest sugarcane, which is frequently

between 24 and 30 months, this has implications for household food needs and may be the over-riding factor in the high incidence of food poverty reported in the area.

II Contract Farming Practices and Services

Contract farming is organised such that certain services are centrally controlled and delivered. For the Mumias sugar zone these services include land survey and preparation, provision of seed cane, fertilisers and pesticides, harvesting and, transportation. Those who take up cudgels for contract farming opine that it helps to draw into the mainstream of the economy the poor who may not, on their own, afford the high cost of inputs. This may as well be so, nonetheless, the study reveals that it is at the cost of human capacity building. Contract farming as carried out in the Mumias sugarcane zone tends to cut out farmers from key decision making areas that affect farm operations. With this is also lost the opportunity for the farmers to develop and build on their own capacity for growth as a result of participating in capacity enhancing practices. As a result most farmers have been reduced to the level of spectators of the cane growing enterprise. The fact that 59 percent did not know the cane variety in their farm, or that only 37.6 percent know the types and utilities of fertilisers in use or that 69.2 per cent sell fertiliser delivered is a pointer to this sorry state and calls for far reaching changes to involve the farming community in the areas of planning and decision making. However, the inept management styles of the giant out-grower farmers company

(MOCO) which seems to be stalked by corrupt managers does not even begin to provide the mechanisms and direction for this and will therefore have to be addressed before any meaningful changes can be instituted.

Besides, the delivery of the services to the farmers is not to their satisfaction. As table 4 shows over 78 per cent of the survey farmers reported some form of dissatisfaction with the nature of the contract services.

Table 6: Distribution of farmers by level of satisfaction of contract services

Level	Frequency	Valid %	Cumulative %
Very satisfied	5	4.3	4.3
Satisfied	20	17.1	21.4
Dissatisfied	53	45.3	66.7
Very Dissatisfied	39	33.3	100.0
	117	100.0	

Source: Computed from survey data, 1997

Of the dissatisfied lot 59.6 percent and 40.4 percent reported poor service delivery and high cost of contract services respectively as the key areas that need to be addressed urgently. The flip side of the high costs of services is the complaint that sugarcane prices stagnate for far too long, at times even when the price of crushed sugar has more than doubled. This too, will

need to be looked into.

The survey farmers agreed that some avenues in the form of field agencies have been built within the zones to serve farmers. Nonetheless 72.6 per cent reported that other than serving the interests of the Sugar Company, which often imply eroding gains for farmers, and serving as pay out points there may as well be no avenue through which their problems can be addressed and solved to their satisfaction.

III Cane Leasing Patterns and Signs of Cash crop-based Dependency

In the preceding chapter I have underscored the importance of sugarcane farming. Indeed, I have observed that it is considered the lifeline of the people in the area. The survey data, however, shows that this is in fact an understatement. Farmers literally depend on sugarcane farming for all their household needs and because a cane crop may take upto 33 months before it is harvested many farmers (the survey reports 45.3 per cent) lease out their cane to other people. In cane leasing a contracted farmer shifts all the financial and/or material benefits due to him/her on part or all of a given contracted plot of cane at a fee. The reasons for cane leasing oscillate between food and school fees (54.7 per cent), funeral and medical fees (28.2 per cent) and other needs 17.1 per cent.

The implications of cane leasing stretch far and wide. Once a plot is leased the farmer enters a pattern of cane leasing that is not easy to disentangle. It is instructive to note that when leasing cane farmers frequently receive less than 40 percent of what would have been due to them. The survey also reveals that those who lease out their cane are frequently unemployed (subsistence farmers and casual labourers); with little or no level of education at all; with large households and with a large number of secondary school going children. Those who rent the cane plots are often employed or involved in some income-generating activity or other and relatively more educated. To understand cane leasing it must be seen as an up-shoot of lack of other sources of income for the farming community, which is in turn a factor of the failure by the community to develop and cultivate an investment culture. Again it must be seen as failure of sugarcane farming to generate the much talked about spread effects for the majority of farmers. The question that however begs answers and which will be addressed fully in chapter 6, is why the majority of the farming community in the Mumias sugar zone have failed to exploit the providence of and potential for growth provided by sugarcane farming.

IV Cane production, cane-based income and Expenditure Patterns and, Household needs and strategies

The prevalence of sugarcane growing in the Mumias sugar zone cannot be gainsaid. In fact almost every household can lay claim to some plot or other of sugarcane either directly,

indirectly or both. This has been over-stretched to imply that income levels in the area are very high. Indeed people from the neighbouring areas joke that a case full of money broke open somewhere in the precincts of Mumias spreading leaves of Kenya shilling notes all over. All you need to do, the joke continues, is take. This may as well be true of a few enterprising people in the area but for the vast majority this joke is not funny and is at best highly exaggerated. A survey of the farmers as shown by Table 5 reveals that over 71 per cent of them produce upto 20 stacks of cane and receive less than Kenya shillings 100,000 within the period of upto 3 years. This amount of money may only sustain the household for a year.

Table 7: Distribution of Survey farmers by number of stacks and incomes due.

no. of stacks	Frequency n=117	Cumulative %	Income due
1 ? 10	26	22.2	less than 50,000
11 B 20	58	71.8	50,000 - 100,000
21 B 30	16	85.5	100,00 - 150,000
31 B 40	10	94.0	150,000 - 250,000
41+	7	100.0	250,000 +

Source: Computed from survey data, 1997

As observed earlier, household sizes in the area are awfully large (it is frequently 10 people and more per household) and these translate into high levels of household needs. For most (85.5 per cent) this revolves around provision of food, payment of school fees, payment of medical fees and home improvement that is, building of houses - frequently semi-permanent, buying of bicycles and radios, clothing, and at times - though decreasingly now - marriage of a second or third wife and other socio-cultural activities. The study further reveals that only upto 23.1 per cent expend cane-based income on activities that will generate further income. This discussion on expenditure of cane-based income would be incomplete without being

linked to household needs and strategies. The study reveals that for most farmers (98.9 per cent) cane income can only meet upto half of the household needs of the farm family. What intrigues, however, is that despite this realisation, which seems to resonate across the farming divide, little has been done in terms of strategizing for income diversification. For 75 per cent of the survey farmers the only claim to strategies for other income is subsistence production and casual work. Closer scrutiny, however, reveals that this is, in most part, an euphemism for "no other strategy at all" reasons being that for one, casual work opportunities are scarce and, when they are accessed, pay very little. Even then such money does not often reach the household. Besides, and as the succeeding pages will show, food production is very minimal in the area since most land has been put under cane production. Seen against the backdrop of large household sizes coupled with low production capacity due to poor soils, little of substance can honestly be said to be produced on the farms. In fact, most farmers (the study reports 87.2 per cent) depend on the market for their staple food - maize. This, again, should be seen as a pointer to the dependency patterns shaping up in the area of which cane leasing, as observed earlier, is a precursor.

V Adoption Patterns of Sugarcane-based Technologies for food production

In areas where cash crop production thrives, food production is often relegated to second best (FAO, 1987). This pattern is replicated among farmers in the Mumias sugar zone. Driven by motives for tangible income, farmers have put most of their land under cane production and food is produced only marginally. As table 6 shows 41 per cent of the survey farmers grow food in plots that are frequently less than 1 acre. Only 0.9 per cent reported growing food crops in plots that measure four acres and more.

Table 8: Distribution of farmers by acreage of food crops grown

Acreage	Frequency (n=117)	Valid %	Cumulative %
< 1	48	41.0%	41.0
1 - 2	61	52.1	93.1
3 - 4	7	6.0	99.1
> 5	1	0.9	100.0

Source: Computed from survey data, 1997

For an area where over 93 per cent of the farming community grow less than 2 acres of food one would expect production to be maximised. Being a sugarcane-growing zone the most natural thing would be for relevant sugarcane growing technologies to be adopted in food production. This is, however, not the case among sugarcane farmers in the Mumias zone.

Not that their food production is impressive, in fact it is dismal. 68.7 percent produce less than 10 bags of maize or millet depending on what their staple crop is and even for these it frequently averages 5 - 6 bags. This is awfully lean for households that average 10 and more people and require 20 bags and more. The sugarcane-based technologies that are relevant to food production include mechanisation (use of tractors for land preparation) and fertiliser application. Understandably, tractor use has not taken root among the farming community reasons being that for one, tractors are expensive to buy or hire and even if they were accessible, it would be unproductive to plough plots that are frequently less than 1 acre and hardly more than 2 acres. Thus land preparation is dominated by ox-drawn ploughs and weeding by jembes and hoes. What, however, is unfathomable is the lack of enthusiasm that meets fertiliser use. One would have expected fertilisers use to be adopted in droves. Yet, 57.4 per cent of the survey farmer do not apply any form of fertiliser, 8.7 per cent may or may not apply thereby leaving only 35.7 per cent as the group that frequently uses fertilisers. But even for these, only half will apply fertiliser for planting and top dressing while the other half will apply only for planting or top dressing yet maximum rewards demand that fertilisers be applied both for planting and top dressing. The study also reveals that even when they do use fertilisers, farmers frequently apply the wrong fertilisers, at the wrong time and in wrong proportions. It is no wonder therefore that they complain, as focussed group discussions revealed, that production has not increased significantly despite constant fertiliser use.

Further scrutiny shows that socio-economic factors influence whether or not fertiliser will be adopted. The adopters were frequently relatively more educated, employed or in income-generating activities and with relatively larger plots of land. Besides socio-economic factors this may be accounted for by the dearth of relevant knowledge to enable farmers develop skills and know-how to use available technologies. This view is indicated by the fact that only 37.6 per cent of the farmers knew the utility of the various fertilisers in use. As opined earlier this also reflects the lack of institutions and other infrastructure to sustain delivery of relevant information to the farming community. These are areas that must be addressed urgently if the area has to make a head-way in recording improved food self-sufficiency. As it is food poverty is on the increase and its attendants such as malnutrition and retarded growth are beginning to show.

VI Institutions for Capacity Building, information gathering and Dissemination and, Extension services

A majority of Kenyans largely depend on agricultural production either directly as in the case of farm families or indirectly as for the millions of others in urban centres who depend on the market. Increased production therefore has a positive spiral effect for the whole country. Researchers and policy makers are in agreement that rapid and widespread adoption of technology is key (FAO, 1987; ECA, 1989; World Bank, 1992 and GOK, 1996 and 1997). Nonetheless, it is increasingly being realised that innovation is contingent on the availability of and accessibility to institutions that gather and develop the knowledge and skills to use material and technological investments. Analysis of the study findings reveals that this component has not been seriously addressed in the Mumias sugarcane-growing zone. Granted, Mumias Sugar company has stationed staff in the field to run extension services among the farming community and for most part they do a commendable job. Nonetheless, their objectives are interim and limited to sugarcane growing. Little is done in the way of creating linkages between sugarcane growing and other sectors of the economy. Indeed, discussions with Field Assistants revealed that their job description rotates around land preparation, provision of seed cane and planting, fertiliser application and weeding. This activities take place within the first 7 months of a plant crop, because a sugarcane crop lasts

for upto 8 years it is only then that the field assistants return in earnest to educate farmers by which time whatever that was taught has been lost. As a pointer to this 65.4 per cent and 58.7 percent of survey farmers did not know the name of their field assistant or when he last visited respectively. This lack of sustained farmer education must therefore be seen as contributing to the lack of farmer capacity building. For reversals to occur institutions will have to be put in place controlled by the farmers themselves, with the express objective of empowering farmers through increased availability, accessibility and quality of relevant information. This objective may not be in the interim interests of Mumias sugar company and it may not be very enthusiastic about it, the way forward would have to lie at the doorstep of a revitalised farmers organisation, preferably a co-operative society. As it is Mumias Out-growers Company (MOCO) cannot even begin to provide leadership, stalked as it is by mismanagement and institutional flaws. But it is not so much the institutional flaws as it is the delivery system. A new dispensation will require managers with a positive predisposition to work a sense of the future, streamlined programmes and the good of the large community and not just the narrow interests of the system they serve.

VII Investment of cane-based income micro and Small Enterprise Development

Rural Development (RD) has been defined variously. A most captivating one is that which defines RD as the sustained long-term increase in real per family income in the rural area (Newby, 1982). There are, of course, other definitions but this has a thrust that is more relevant to the study. As an up-shoot of this, growth oriented strategies perceive investment in small-scale enterprises as offering the best alternative for increasing real per family income and, therefore, desirable (Parker and Torres, 1993). The study sought to capture such linkages between cane-based income and small scale enterprises for income generation. It reveals that only 23.1 percent of the survey farmers are engaged in income-generating activities. The activities were distributed as shown in table 7.

Table 9: Distribution of farmers by type of income-generating activity

Activity	Frequency (n=117)	Valid %	Cumulative %
No income-generating activity	88	75.2	75.20
Posho mill	3	2.6	77.80
Rental houses/shops	2	1.71	79.51
Hotel/bar	2	1.71	81.22
Carpentry	4	3.42	84.64
Bicycle Repair	4	3.42	88.06
Tailoring	3	2.6	90.66
Transport (Matatu)	1	0.85	91.51
Wholesale	1	0.85	92.36
Retail	4	3.42	95.78
Vending/hawking	5	4.3	100.00

Source: Computed from survey data, 1997

The study shows that the socio-economic profile of a farmer influences the farmers decision making on whether or not to engage in investment for income generation. Consequently the entrepreneurs, as for adopters, were frequently relatively more educated, employed or other source of income, and with relatively bigger landholding (some still had very small pieces).

To capture the linkages between sugarcane-based income and investment patterns, the study sought to establish the source of capital for the income-generating activities. The study reveals that 81.5 per cent of the farmers engaged in income-generating activities sourced their start-up capital from sugarcane farming. This resonates with the underlying view that there are strong linkages between the farm sector-especially cash-crop farming - and small enterprise development for income generation. Nonetheless closer, scrutiny reveals that at present levels the activities are not very strong. As table 8 shows more than half of the activities (51.9 per cent) had a stock value of less than Ksh.30,000 and therefore did not generate significant sums of income. Because most entrepreneurs eat into their profits, and in the absence of accurate record keeping, it is difficult to compute the exact income accruing to the farmer entrepreneur.

Table 10: Distribution of income-generating activities by value of stock

Value of stock (in thousands)	Frequency n=29	Valid %	Cum. %
< 20	10	34.5	34.5
20 - 30	7	24.1	58.6
31 - 50	5	17.2	75.8
51 - 100	4	13.8	89.6
Over 100	3	10.3	100.0

Source: Computed from Survey data, 1997

Again, because of small values of stock the anticipated employment generation is abysmal. Most activities (53.8 per cent) do not generate any forms of employment for second parties while 30.8 per cent and 15.4 percent employed between 1 and 2 and more than 2 people respectively. Nonetheless the potential is there and linkages should be strengthened through other avenues for provision of start-up capital in addition to sugarcane based income. But perhaps the most crucial would be the education of farmers so that they can develop and nurture a culture of investment and capital accumulation. The development and harnessing of management skills, especially record keeping and sound investment practices, will be equally important.

Conclusion

From the outset, It has been explained that the thrust of this chapter revolves around the broad question: Along what patterns has contract sugarcane farming in the Mumias zone interacted with the regional economy especially as regards adoption of relevant cane-based technologies in food production and cane-based income, in income-generating activities? In this regard, data has been provided on the socio-economic and demographic characteristics of the farmers and on contract farming practices and services; Cane leasing has been defined, cane leasing patterns described and shown arguing that they are an indicator of that they are an indicator of cane-based dependency; data has been presented on cane production figures as well as figures of cane-based income and brought out patterns of expenditure and how they interact with household needs and strategies brought out; cane-based technologies relevant to food production have been identified and it has been argued that their adoption is key to improved food self-sufficiency probably at its lowest ebb ever in the area; data has been presented on the patterns of investment of cane-based income in income-generating activities making a case for the need to harness the linkages between the two sectors; lastly, the study has underscored the salient role of institution building arguing that viable institutions will enable individuals, groups and communities to develop and harness the knowledge and skills needed to use technologies and material investments. All along the study tries to keep a thread running through so that the patterns and variations identified are visualised not as

independent entities but as necessarily linked to each other. This is in keeping with the farming systems approach adopted earlier in the study. The foregoing suggest several interesting relationships that will help understand intersectoral linkages in the Mumias sugarcane zone. In the next chapter the study uses measures of correlation, cross tabulation, chi-square and regression analyses to show the extent to which identified factors explain technology adoption and income investment patterns in the Mumias sugarcane growing zone.

CHAPTER FIVE

STATISTICAL ANALYSIS AND INTERPRETATION OF DATA.

The survey data from among contract farmers in the Mumias sugarcane growing zone is guided by two broad concerns. Firstly, to capture the inter-sectoral linkages that underpin development initiatives by understanding the patterns of adoption of cane-based technologies and investment of cane-derived income. The guiding questions are; (i) to what extent are relevant cane-based agricultural technologies adopted for food production? And, (ii) to what extent is cane-derived income used as start-up capital for investment in income-generating activities?

Technology adoption and income investment are, invariably, an outgrowth of a myriad of intervening factors. The study has incorporated socio-economic and demographic factors. These are addressed at two levels: on the one hand the study focuses on the characteristics of the individual farmer - age, level of education and employment status. On the other hand the study brings out household characteristics in terms of household resource base.

Secondly, and flowing from the first concern, to understand the functioning of local farmer institutions with a view to assessing their relevance in building and enhancing the growth

capacity of farmers. The question asked is: what operations and programs have been instituted towards educating the farming community so that they can gain the knowledge and skills to use available resources and to take advantage of existing opportunities.

In the previous chapter, select data on contract sugarcane growing practices related to technology adoption and income investment were presented, described and discussed with recourse to descriptive statistical tools. In this chapter, the study further examines and interprets the data using inferential statistics - correlation and Regression analysis. This is done at two levels. First, using the Pearsons product moment correlation coefficient (denoted by r) the study shows not only the strength but also the direction of the relationship between the study's dependent and independent variables. Secondly, by using the coefficient of determination (denoted by r^2) the study shows the percentage of the variation in the dependent variables (y) attributable to the independent variables (x).

Hypothesis 1: Technology adoption and income investment patterns are determined by the quality of farmership measured by the socio-economic and demographic indicators at the farmer and household levels.

This implies that the extent to which, a contracted sugarcane farmer decides to use cane-

based agricultural technologies for food production or other farm activities, or invests cane-derived income for further income generation is a factor of the farmer's quality of farmership as indicated by socio-economic and demographic characteristics namely, age (QV.65), household size (QV.67), level of education (QV.68) and employment status (QV.70). To investigate the above hypothesis these variables were cross-tabulated with fertiliser use (QV.49) and engagement in an income-generating activity (QV.59).

Table 11a: Impact of Age on Technology Adoption behaviour

Age (in yrs)	Fertiliser use		Row Total
	Yes	No	
< 30	1 (50)	1 (50)	2 (100)
30 ? 50	21 (46.7)	25 (53.3)	46 (100)
51 ? 70	25 (48.1)	27 (51.9)	52 (100)
71+	7 (41.2)	10 (58.8)	17 (100)
Column Total	54 (46.2)	63 (53.8)	117 (100)

Source: computed from survey data, 1997

As Table 9a shows the total number of those who use fertiliser is 54 representing 46.2 per cent. Of the four age categories 50 per cent of those less than 30 years, 46.7 per cent of

those between 30-50, 48.1 per cent of those between 50-70 and 41.2 of those aged 70 and more use fertiliser. Although the age category 50-70 contributes the highest number of adopters 25 (46.5 percent), in terms of proportional distribution this is only 41.2 per cent of the respondents in that age group. Likewise, although the age category "<30" has the least number of adopters 1 (1.9 percent) in terms of proportional distribution this represents 50 percent of the respondents belonging to that age category. What emerges is that age is a positive but weak determinant of the variance in fertiliser use. Indeed the calculated r of 0.1409 attests to this. The reading of r^2 of 0.0198 shows that age explains upto 2.0 per cent of the variance fertiliser use and therefore of technology adoption behaviour.

Table 11b: Impact of age on income investment behaviour

Age in yrs	Engaged in income-generating activity		Row Total
	Yes	No	
>30	0 (00)	2 (100)	2 (100)
30 B 50	16 (30.8)	30 (69.2)	46 (100)
50 B 0	11 (21.2)	41 (78.8)	52 (100)
70 +	2 (11.8)	15 (88.2)	17 (100)
Column Total	29 (24.8)	89 (75.2)	117 (100)

Source: Computed from survey data, 1997

In terms of income investment as measured by engagement in an income-generating activity, the study reveals that 29 respondents (24.8 per cent) are engaged in an income-generating activity. Of those aged less than 30 years none was engaged in any income-generating activity. The rest are distributed as follows: 30 - 50 years (35.6 per cent) 50 - 70 years (22 per cent) and 70 years and above (20 per cent). The age category 30-50 is the more amenable one to income investment contributing 55.2 per cent of the total number of those involved in income-generating activities while the age category >30 is the least amenable with none of its members engaged in income-generating activities. The age categories 30-50 and 50-70, that is those aged 30-69 account for 89.7 per cent of investment oriented farmers. What emerges is that age is a significant determinant of income investment. This view is further buttressed by a calculated r of 0.2957 and the reading of r^2 of 0.0874 meaning that age explains up to 8.7 per cent of the variance in farmer engagement in income-generating activities and therefore of income investment behaviour. This finding corroborates that of Wegulo and Obulinji (1997) that because sugarcane farming is dominated by the elderly, since they are the ones with land title deeds, income investment levels are low.

Table 12a: Impact of Level of Education on Technology Adoption

School years	Fertiliser use		Row Total
	Yes	No	
None	4(28.6)	10(71.4)	14(100)
4	16(50)	16(50)	32(100)
7/8/9	24(47.1)	27(52.9)	51(100)
12	7(46.7)	8(53.3)	15(100)
13+	3(60)	2(40)	5(100)
	54(46.2)	63(53.8)	117(100)
Column Total	54(46.2)	63(53.8)	117(100)

Source: computed from survey data, 1997.

Table 10a illustrates how Technology adoption is impacted on by level of education. A total of 54 respondents representing 46.2 per cent use fertiliser. These are distributed as follows: 28.6 per cent of those that are illiterate, 50 per cent of those with lower primary education; 47.1 per cent of those with upper primary education; 46.7 of those with secondary education and 60 per cent of those with post secondary education. As the foregoing attest, there is a significant relationship between level of education and technology adoption. Although those with post-secondary level of education have the highest percentage of adopters from any one

category, it does not imply that there is a pro rata relationship between education level and technology adoption. What seems to emerge rather is that illiteracy inhibits technology adoption while some form of functional literacy is good enough for technology adoption. These can be seen from the fact that 50 per cent of those with only upto 4 years of education were adopters which is higher than those with up to 12 years of education (46.7 percent). Nonetheless, there is a positive relationship between education level and technology adoption. This is exemplified by the calculated r of 0.2348 and the r^2 reading of 0.055 meaning that the level of education explains up to 5.5 per cent of the variance in technology adoption behaviour.

Table 12b: Impact of education level on income investment

School years	Engaged in income-generating activity		Row Total
	Yes	No	
None	1(7.1)	13(82.9)	14(100)
4	8(18.8)	26(81.2)	32(100)
7/8/9	13(25.5)	38(74.5)	51(100)
12	7(46.7)	8(53.3)	15(100)
13+	2(40)	3(60)	5(100)
Column Total	29(24.8)	88(75.2)	117(100)

Source: computed from survey data, 1997

Likewise, as table 10b shows, the impact of level of education on income investment is such that despite a positive relationship as indicated by a calculated r of 0.3049 it falls short of a Pro rata relationship ? that is, increase in (x) does not always lead to increase in (y). For instance, while those with no education at all have the lowest rate of income investment in income-generating activities (7.1%), those with up to 12 years of education have the highest percentage of investors yet they are not the highest category of education.

Nonetheless, there is a significant relationship between the two as shown by the reading of

r^2 of 0.0929 implying that level of education attainment explains 9.3 per cent of the variance in income investment.

Table 13a: Impact of Employment status on Technology Adoption

Employment status	Fertiliser use		Row Total
	Yes	No	
Formally employed	5(71.4)	3(38.6)	8(100)
Self employed	8(88.9)	1(11.1)	9(100)
Subsistence farmer	33(40.2)	49(55.6)	82(100)
	8(44.4)	10(55.6)	18(100)
Column Total	54(46.2)	63(53.6)	117(100)

Source: Computed from survey data, 1997

Table 11a illustrates how employment status impinges on technology adoption behaviour. A total of 54 respondents representing 46.2 per cent, use fertiliser. These are distributed as follows: 71.4 per cent of those fully employed, 88.9 percent of those self employed; 44.4 per cent of those retired; and 40.2 per cent of subsistence farmers. The category of self employed is the more adoptive one while that of subsistence farmers is the least adoptive, which would suggest that those with steady employment, and therefore steady source of income, are more

likely to use available resources and to take advantage of existing opportunities. The calculated r of 0.2398 confirms this positive relationship. However the reading of r^2 of 0.0575 shows that although the relationship is positive employment status only explains 5.8 per cent of the variance in adoption behaviour.

Table 13b: Impact of employment status on income investment

Employment status	Engaged in income-generating activity		Row Total
	Yes	No	
Fully Employed	2(25)	6(75)	8(100)
Self employed	9(100)	0(0)	9(100)
Retired	4(22.2)	14(77.8)	18(100)
Subsistence farmer	14(17.1)	68(82.9)	82(100)
Column Total	29(24.8)	88(75.2)	117(100)

The impact of employment status on income investment is similar to that on technology adoption. The self employed are still the more income investment oriented employment category with 100 per cent of its members in income-generating activities followed by those fully employed (25 per cent), those retired (22.2 per cent) and subsistence farmers (17.1 per

cent). This suggests a positive relationship between the two variables as confirmed by the calculated r of 0.2046 and exemplified by the reading of r^2 of 0.04186 meaning that employment status explains 4.2 per cent of the variance in income investment behaviour. This view merges into that of Gerhart (1975) who observes that off farm employment may enable a farmer to overcome working capital constraints or make it possible for him to finance fixed investments.

Table 14: Effect of Quality of farmership on Technology Adoption and income investment behaviour.

Quality of farmership	Technology Adoption		Income investment	
	r ²	%	r ²	%
Age	0.0198	2.0	0.0874	8.7
Level of education	0.0551	5.5	0.0929	9.3
Employment status	0.0575	5.8	0.04186	4.2
Total	0.1796	13.3	0.53056	22.2

Table 12 illustrates the combined effect of the quality of farmership (Age, level of education and employment status) on the variance in technology adoption and income investment patterns. No doubt there is a positive and significant relationship between the independent variable and the two dependent variables. Indeed the sum of r² reading of 0.1796 and 0.53056 shows that the quality of farmership explains upto 13.3 per cent 22.2 per cent of technology adoption and income investment behaviour respectively. More particularly it shows that quality of farmership not only explains more of the variance in income investment than technology adoption patterns but that at 22.2 per cent it explains more than half of the variance in income investment behaviour explained by the study's selected variables.

Hypothesis II: The scale of production at the farm level influences the farmers' technology adoption and income investment behaviour.

The scale of production (size of cane acreage and therefore the amount of cane-derived income) is seen as determining and shaping technology adoption and income investment patterns. The underlying premise is that the larger the scale of production and therefore the amount of cane-derived income the more the likelihood that a farmer will adopt relevant technology and invest cane-derived income. To investigate this hypothesis size of cane acreage (QV.5) was cross-tabulated with fertiliser use (QV.59).

Table 15a: The Impact of Scale of Production on Technology Adoption behaviour

Scale of production in acres	Fertiliser use		Row Total
	Yes	No	
1 - 2.4	33(42.3)	45(57.7)	78(100)
2.5 - 5.0	13(44.8)	16(55.2)	29(100)
6+	8(80)	2(20)	10(100)
Column Total	54(46.3)	63(53.8)	117(100)

Source: computed from survey data.

As table 13a shows 46.2 per cent of the survey use fertiliser. In terms of scale of production they are distributed thus: 1 -2.5 acres (42.3 percent), 2.5 - 5 acres (44.8 per cent) and 5 acres

and more (80 per cent). This shows that there is a pro rata relationship between scale of production and adoption behaviour i.e., the larger the scale the more innovative the farmer. Indeed, the calculated r of 0.18896 attests to this. This finding however departs from popular belief that those who produce at a smaller scale of production are more amenable to innovativeness since they have to maximise production. Although there is a positive relationship between the two the reading of r^2 of 0.03570 implies that scale of production at the farm level only explains 3.6 per cent of the variance in adoption behaviour.

Table 15b: The impact of scale of production on income investment behaviour

Scale of production in acres	Engaged in income-generating activity		Row Total
	Yes	No	
1 - 2.4	20(25.6)	58(74.4)	78(100)
2.5 B 5	7(24.1)	22(75.9)	29
6+	2(20)	8(80)	10
Column Total	29(24.8)	88(75.2)	117

Source: Computed from survey data.

As is illustrated in table 13b there is an inverse relationship between scale of production and investment behaviour. In fact, not only does the category of 1 -2.5 acres, the lowest scale of production, contribute the bulk of those engaged in income-generating activities (69 per cent) but also that at 25.6 per cent it is the category with the highest rate of investment. This would seem to suggest that those with a small cane acreage of less than 2.5 acres and therefore a smaller amount of cane-derived income, frequently between 50,000 and 150,000, are more likely to invest this income so as to generate further income to supplement cane income. The inverse would be true for those with a larger cane acreage of 5 acres and more. Nonetheless, the r^2 reading of 0.053 implies that despite this relationship the scale of

production can only explain upto 5.3 per cent of the variance in investment behaviour. It is instructive to note that this is about the same percentage variance scale of production impacts on adoption behaviour.

Hypothesis III: Sugarcane-derived income is not the main source of start-up capital for income-generating activities.

The point of departure that underpins this hypothesis is that, for most part, start-up capital for income-generating activities accrues from sugarcane farming. To investigate this, major source of income (QV.61) was cross-tabulated with whether or not farmers were engaged in an income-generating activity (QV.59). Table 14 illustrates this correlation:

Table 16: Impact of cane-derived income on investment behaviour

Major source of income	Engaged in income-generating activity		Row Total
	Yes	No	
Cane-based	15(18.3)	67(81.7)	82(100)
Other sources	14(40.0)	21(60.0)	35(100)
Column Total	29(24.8)	88(75.2)	117(100)

Source: Computed from survey data, 1997.

The table shows that for over 70 per cent of the respondents, the major source of income is cane-based. This suggests that the dependency on cane farming, and therefore the accruing income, is immense. This strong correlation does not however hold when it comes to investment for further income generation. Although they contribute 51.7 per cent of those engaged in income-generating activities, in terms of proportional distribution per category (rate of investment) only 18.3 per cent of those whose major source of income is cane-based are engaged in income-generating activities. On the other hand those who depend on other sources, other than cane income, contribute 48.3 per cent of the total number of those engaged in income-generating activities which translates to 40 per cent in terms of proportional distribution from that category. What emerges therefore is that

although cane farming is the major source of income in the area cane-based income is not the main source of start-up capital for income-generating activities. In fact those who are best placed to engage in income-generating activities are those who have a steady source of income in addition to cane-based income since they can combine the two sources to run the enterprise. Nonetheless, there is a positive relationship between sources of income per se and investment behaviour as is indicated by a calculated r of 0.2760 and an r^2 reading of 0.0762 meaning that source of income explain upto 7.6 per cent of the variance in investment behaviour.

Hypothesis IV: There is a pro rata relationship between length of period of sugarcane growing and technology adoption and income investment behaviour.

The underlying premise implied is that the longer the length of period for which a farmer has participated as a contract sugarcane farmer the higher the chances that such a farmer has adopted relevant cane-based agricultural technologies and has invested cane-derived income in an income-generating activity. To investigate this hypothesis the year the farmer first grew cane (QV.4) is cross tabulated with fertiliser use (QV.49) and engagement in an income-generating activity (QV.50).

Table 17a: Impact of Length of period of Sugarcane growing on Adoption behaviour.

length of period	Fertiliser use		Row Total
	Yes	No	
25 years	25(44.6)	31(55.4)	56(100)
17 years	21(43.8)	27(56.2)	48(100)
7 years	8(61.5)	5(38.5)	13(100)
	54 (46.2)	63 (53.8)	117(100)

Source, computed from survey data, 1997

Table 14a illustrates the impact of the length of period of sugarcane growing on technology adoption behaviour. It reveals that contrary to what had been expected farmers do not adopt technology based on the length of period for which they have participated in sugarcane growing. What emerges rather, is that those who entered sugarcane growing most recently (7 years ago) have a greater propensity to technology adoption as indicated by their adoption rate of 61.5 per cent compared to 44.6 per cent and 43.8 percent for those who have been growing sugarcane for 25 years and 17 years respectively. This indicates that though there is a positive relationship between the two variables the relationship is such that the length of period of sugarcane growing only remotely influences adoption behaviour. This finding is corroborated by a calculated r of 0.0843 and an r^2 reading of 0.00711 meaning that the length

of period of sugarcane growing explains a mere 0.71 per cent of adoption behaviour.

Table 17b: Impact of length of period of sugarcane growing on investment behaviour.

Length of period	Engaged in income-generating activity		Row Total
	Yes	No	
25 years	11(19.6)	45(80.4)	56(100)
17 years	12(25.0)	36(75.0)	48(100)
7 years	6(42.2)	7(53.8)	13(100)
	29(24.8)	88(75.2)	117(100)

Source: computed from survey data, 1997

The premise underlined in this hypothesis was that those who have been growing sugarcane for a longer time have a more than average chance of engaging in an income-generating activity even if only for the simple reason that they have had a longer time in which to accumulate sugarcane-derived income having already met such basic needs as permanent/semi-permanent house, bicycle, radio and probably through with school fees paying therefore more likely to invest in an income-generating activity. The study findings are, however, contrary to this premise. In fact, what seems to emerge is that just as in technology adoption, those who joined sugarcane growing most recently have a higher propensity for income investment. Indeed the investment rates for individual categories show

that those who have been growing sugarcane for only 7 years have the highest proportion of its members engaged in an income-generating activity (40.2 percent) compared to 25 per cent and 19.6 percent for those who have been growing sugarcane for 17 years and 25 years respectively. This would seem to suggest that there is an inverse relationship such that the fewer the years a farmer has participated in sugarcane growing the greater the likelihood that he will participate in an income-generating activity. This is however not true. In fact the calculated r of 0.1532 and the r^2 reading of 0.0235 shows that where as there is a positive relationship between the two variables it is weak explaining, as it does, only 2.4 per cent of the variance in income investment behaviour.

Hypothesis V: The nature of extension contact between the farmer and extension agent determines adoption behaviour.

This implies that the closer the working relationship between the farmer and extension agent the greater the chance that such a farmer would adopt relevant sugarcane growing technologies for other farm and non farm activities. To investigate this hypothesis the nature of extension contact (QV.41) was cross tabulated with fertiliser use (QV.49) as is illustrated in table 16 below. A total of 54 respondents representing 46.2 per cent use fertiliser. Of these 68.5 percent have a moderate contact 25.9 per cent have close contact and 5.6 per cent

have sporadic contact. Although those with moderate contact contributes the bulk of innovators (68.5 percent) in terms of proportional distribution for each category this represents 51.4 percent of the total number of farmers in that category. Those with close contact report the highest adoption rate of 56 per cent, while at 15 per cent those with sporadic contact have the lowest rate. What emerges is that the finding is true to the spirit embedded in the hypothesis that the closer the farmer - extension agent contact the higher the rate of adoption. Indeed the calculated r of 0.313 attests to not only this positive relationship but also that with an r^2 reading of 0.098 the relationship is significant to the extent that it explains upto 9.8 per cent of the variance in adoption behaviour. This finding concurs favourably with that of Lockhead et al. (1980) who observes that farmer education positively impacts on further operations and their efficiency.

Table 18: Impact of nature of extension contact on Adoption behaviour.

Extension contact	Fertiliser use		Row Total
	Yes	No	
Close	14(56)	11(44)	25(100)
Moderate	37(51.4)	35(48.6)	72(100)
Sporadic	3(15)	17(85)	20(100)
Column Total	54(46.2)	63(53.8)	117(100)

Source: computed from survey data, 1997

Hypothesis VI: The low rates of technology adoption and income investment are due to the inadequacy of local institutional arrangements through which farmers can gain the knowledge and skills to use available resources.

The point of departure for this hypothesis is that adoption and investment behaviour are at the end of the day determined by the performance of institutions at the local level and especially how the target population receives them. In the likely event that such institutions lack adequate programmes that involve farmers and through which they can be empowered to use available resources it is more likely that such farmers would report low levels of technology adoption and income investment. To investigate this hypothesis farmer's level of satisfaction with institutional delivery systems (QV.11) was cross-tabulated with fertiliser use (QV.49) and engagement in an income-generating activity (QV.59)

Table 19a: Impact of level of farmers' satisfaction with institutional delivery systems on adoption behaviour.

Level of satisfaction	Fertiliser Use		Row Total
	Yes	No	
Very satisfied	7(7.8)	2(2.2)	9(10)
Satisfied	25(52.1)	23(47.9)	48(100)
Dissatisfied	22(36.7)	38(63.3)	60(100)
Column Total	54(46.2)	63(53.8)	117(100)

Source: computed from survey data, 1997

The 46.2 per cent respondents who were innovative were distributed along the following levels of satisfaction as illustrated in table 17a above: Very satisfied (13 per cent), satisfied (46.3 per cent) and Dissatisfied (40.7 per cent). Although the satisfaction category "satisfied" has made the largest contribution of those who are innovative, in terms of categorical proportionate distribution this represents 52.1 per cent of the total number of respondents in that category. Likewise, although the satisfaction category "very satisfied" contributes a paltry 13 per cent of the total number of innovators, in terms of categorical proportionate distribution this represents 77.8 per cent of the farmers in that category. The satisfaction

category "Dissatisfied", at 36.7 per cent, posted the lowest adoption rate of the three categories. This goes to show that not only do farmers satisfaction levels correlate positively with adoption behaviour as is borne out by a calculated r of 0.23988, but also that they have a pro rata relationship such that the higher the level of satisfaction the higher the adoption rate. The inverse would also be true. Indeed, the reading of the coefficient of determination (r^2) of 0.457 shows that farmers' satisfaction levels with institutional delivery systems explain upto 4.6 per cent of the variance in adoption behaviour.

Table 19b: Impact of level of farmers= satisfaction with institutional delivery systems on investment behaviour

level of satisfaction	Engaged in income-generating activity		Row Total
	Yes	No	
Very satisfied	2(22.2)	7(77.8)	9(100)
Satisfied	12(25.0)	36(75.0)	48(100)
Dissatisfied	15(25.0)	45(75.0)	60(100)
Column total	29(24.8)	88(75.2)	117(100)

Source: computed from survey data, 1997

In terms of income investment behaviour, as measured by whether or not the farmers are

engaged in income-generating activities, the study shows that of the 24.8 percent who are engaged, 6.9 per cent reported a high level of satisfaction, 41.4 per cent had a moderate satisfaction and 51.7 per cent were dissatisfied with the institutional delivery systems. This would seem to suggest that there is an inverse relationship between satisfaction levels and investment behaviour. However, even a cursory survey of the adoption rates for each category: very satisfied (22.2 per cent), satisfied (25.0 per cent) and dissatisfied (25.0 percent); reveals almost a similar rate for the diverse satisfaction levels which goes to show that satisfaction levels may have little or no effect at all on adoption behaviour. The calculated r of 0.1095 and the r^2 reading of 0.012 confirms that although there is a positive correlation between farmers' levels of satisfaction with institutional delivery systems such a relationship is weak and insignificant explaining, as it does, only 1.2 per cent of the variance in investment behaviour.

Discussion of Research Findings

The preceding pages of this chapter have examined the correlation between the study's dependent and independent variables. With recourse to regression analysis, and using the coefficient of determination (r^2), I have brought out the variance of the dependent variables attributable to the study's explanatory variables. This is summarised in table 18 below:

Table 20: Coefficient of determination (r^2) and percentage variance of explanatory variables as they impact on technology adoption and income investment behaviour among farmers in the Mumias Sugarcane growing zone.

Variable	Adoption behaviour		Investment behaviour	
	r^2	% variance	r^2	% variance
Age	0.0198	2.0	0.0874	8.7
Level of education	0.0551	5.5	0.0929	9.3
Employment status	0.0575	5.8	0.04186	4.2
Scale of production	0.0357	3.6	0.053	5.3
Cane-derived income	*	*	0.0762	7.6
Period of cane growing				2.4
Extension contact	0.0071	0.7	0.0235	*
Institutional Delivery System	0.098	9.8	*	
	0.0457	4.6	0.012	1.2

source: computed from survey data, 1997

* Explanatory variable not investigated for that dependent variable.

As it emerges the combined thrust of the explanatory variables

selected for the study were found to account for upto 32.0 per cent and 39.0 per cent variance of adoption and investment behaviour respectively.

Extension contact, at 9.8 per cent variance, is the strongest determinant of adoption behaviour. However, when the combined effect of quality of farmership age, level of education and employment status (see table 12 and 18) is brought to bear, it explains upto 13.3 per cent making it the single most strongest determinant of adoption behaviour. Extension contact and quality of farmership aside, farmers level of satisfaction with the institutional delivery system and scale of production are the next most important determinants explaining upto 4.6 per cent and 3.6 per cent respectively. The length of period of sugarcane growing is by far the weakest explanatory variable explaining an insignificant 0.7 per cent of the variance in adoption behaviour.

On the other hand, age, level of education and employment status between them, account for upto 22.2 per cent, more than half, of the total variance in investment behaviour attributed to the selected variables. Of the three variables, level of education, at 9.3 per cent, is the strongest followed by age (8.7 per cent) and the least is employment status at 4.2 per cent. It is also instructive to note that age is a stronger determinant of investment behaviour (8.7

per cent) than adoption behaviour (2.0 per cent), level of education is a stronger determinant of investment behaviour (9.3 per cent) than adoption behaviour (5.5 per cent) while employment status is a stronger determinant of adoption behaviour (5.8 per cent) than investment behaviour (4.2 per cent).

Other than quality of farmership, cane-derived income emerged strongly explaining upto 7.6 per cent. Although, of course, there is the hidden influence of income accruing from other sources especially for dual income earners, cane income + salary, which emerged as the most investment oriented income category (see chapter 5). The scale of production explains 5.3 per cent, length of period of cane-growing 2.4 per cent and level of satisfaction with the institutional delivery system, at 1.2 per cent, is the least important determinant of investment behaviour among the selected variables.

Against the foregoing, the quality of farmership (age, level of education and employment status) emerges as the singlemost major determinant of both adoption and investment behaviour. However, at 22.2 per cent quality of farmership is a stronger determinant of investment behaviour than adoption behaviour (13.3 per cent). The differentials notwithstanding, this goes to confirm our major hypothesis that household livelihood strategies whether adoption or investments are, in most part, determined by the quality of farmership

measured by socio-economic indicators at both the farmer and household levels. This is further borne out by the World Bank (1992) which notes that more than financial capital, natural resources and cheap labour, knowledge is becoming the key factor of production. As the study shows the relatively young, the relatively educated and the employed represent a more knowledgeable group and are therefore more poised to take advantage of relevant technologies and to engage in income-generating activities.

As has been illustrated (see table 18) various selected variables explain varying degrees of adoption and investment behaviour. Nonetheless among them the variables explain only 32.0 per cent and 39.0 per cent of the variance in adoption and investment behaviour respectively. This goes to show that there are other factors not explored by the study but which account, in most part, for the variance in adoption and investment behaviour. Further research is necessary to ferret out these other factors.

CHAPTER SIX

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSIONS.

This chapter sets out to accomplish a number of important, if also interrelated, tasks. A selective summary of findings that inform the study are presented (1) cane-based technologies and emerging patterns of their adoption (ii) cane-derived income and emerging patterns of its investment in income-generating activities (iii) the role played, or rather that which should be played, by local institutions to tap from the potential and resources availed by a rural-based industrial project. All along I draw conclusions, make recommendations and suggest likely courses of action. Second, an exploration is made of the theoretical insights on the farm sector - small enterprise development interface. Efforts are made to show how this interface derives from livelihood strategies at the household level. Third, new research issues emerging from the study are suggested.

Cane-based technology and adoption behaviour

There is no question about the importance of relevant technologies in the rural development of Kenya, where factor endowments are so different as to limit the relevance of western agricultural technologies, especially for small farmers (with no more than 2 hectares of land) who comprise the majority of the corpus of rural population. Earlier in the study (chapter 1 and 2) we emphasised the key role of equipping small farmers with knowledge and skills to take advantage and use available resources and opportunities. As an offshoot we sought to find out whether or not sugarcane farmers in Mumias were taking advantage of the existing relevant cane-based technologies to increase food yields. First, our study reveals that although the Mumias area has a more than average agricultural potential, land area for food production per household is frequently about an acre and produces between 5-6 bags of maize per season - way below self-sufficiency levels. Second, that this low food productivity provides fertile ground for the need to use relevant available technologies with a view to maximising production. Nonetheless, only 46.2 per cent of the farmers use fertilisers and even for these only 30.4 per cent apply fertiliser for both planting and top dressing. Besides, even in the unlikely event that farmers apply fertiliser at both levels, the situation is such that they use wrong types of fertilisers, in wrong proportions and at the wrong time. It is no wonder therefore that many adopters (46.5 per cent) complain of low yield fertiliser use notwithstanding. Third, the socio-economic and demographic indicators of age, level of

education and employment status (in this study their effect is combined and referred to as quality of farmership) play a pivotal role in determining adoption behaviour: the relatively younger (between 30-50 years), the relatively educated (5 school years and more) and those with a steady source of income (either employed, engaged in an income-generating activity or both) are more likely not only to take up relevant technologies but are also more amenable to new ideas and to learning and using new skills. Together these factors account for 13.3 per cent of adoption behaviour. This percentage is bound to increase should more socio-economic and demographic factors be brought to bear. Fourth, one issue that stands out in the study, is the conspicuous absence of new and relevant technologies for small farmers outside of high breed seeds (HYVs) and fertiliser use. Since the small farmers' land is limited, even with two-crops of maize and other grains, they will need to engage in other activities: in vegetable growing, dairy farming, poultry keeping, handcrafts etc. relevant technologies are not available for these and other activities as far as the small farmer is concerned. This study suggests the need to mobilise and rationalise available resources to meet the need for new knowledge and new technologies. Such mobilisation and rationalisation should be reflected in national and regional development plans. Again, multiple cropping needs to be emphasised as one way in which land can be augmented by more intensive use during a year, besides reducing food poverty, underemployment and income disparities.

Cane-derived income and investment behaviour

With no significant increases in the total physical area for food production to be expected and, saddled by unemployment and large household sizes, demand for capital, not only to increase yields and promote the multiple-use of existing land but more importantly for investment in income-generating activities, for buying modern inputs, for disseminating information and enhancement of skills, becomes immense. While capital requirements are high, the low levels of per rural family income (averaging 2678/month in the Mumias sugarcane zone) imply low saving capacity and therefore low investment potential. This is amply borne out by the low investment rate of 24.8 per cent. Even then this are activities with largely a very small value of stock (frequently less than Ksh.5,000) and often with few or no employment creation at all for others. While low investment may be engendered on the low investment capacity among the farmers in the area, the study reveals that the real inhibition may not be so much lack of capital as it is lack of an investment culture. Indeed the few income-generating activities reported in the study were among the relatively younger farmers (30-50 yrs) the relatively educated (7 school years and more) and those with a steady source of income (fully employed, self employed or retired with pension). This study suggests that the government through the District Development Committee, local leadership and other institutions and organisations should move expeditiously to institute such programmes and activities as will be necessary to inculcate investment and other relevant skills and knowledge among the farming community. For a start the government could start skill formation classes along the

lines of adult literacy classes. If the farmers were to be equipped with the necessary investment and management skills, and if they were to use these in establishing viable income-generating activities, cane income would provide the best option yet to extricate themselves from the vicious cycle of poverty and move on to increase household incomes and the attendant quality of life and social welfare.

Institutional Building and Delivery Systems

The need for institutional changes to maximise the use of scarce factors to equip small farmers with the knowledge and skills to use available resources cannot be gainsaid. It is difficult for small innumerable farms to do these things individually. To dispense credit and fertiliser, to gather store and disseminate relevant information, to diffuse technology, to market output and to improve infrastructure - roads rural electrification etc - vibrant and veritable organisations and institutions are called for. But, co-operatives thought to be the key institutions are almost failures and where they still exist are almost exclusively at the beck and call of the powerful and mighty and not for those who need them most. The case of Mumias Out-growers Company, more than exemplifies this scenario. This assumes even greater weight especially seen against the backdrop that farmers who are dissatisfied with the institutional delivery system have the lowest rate of technology adoption and income investment.

And when we ask why the Mumias out-growers company has failed, invariably the answer is the disparity in the ownership of land, incomes and skills between the masses of small farmers and the small group of large farmers and in the long history and heritage of this disparity which have bred a culture of dependence, fear and indifference on the one hand and paternalistic dominance on the other. Besides high level corruption and mismanagement, inadequate organisational programmes and activities to equip farmers and staff that have neither enthusiasm for work nor vision for future growth have stalked the organisation. Interference from Mumias Sugar Company and the government as well as tribal and clan politics at the local level have only served to compound the problem.

To stop this slide and to strengthen the small farmers, three courses of action are suggested. One, to form small groups of small farm households which would participate as units in various larger organisations including an umbrella farmers union. These groups formed horizontally by interest may then become the focal points of entry for changing social and economic values, improving knowledge and skills and increasing their bargaining power. Two, based on the new groups of farmers, to reformulate the constitution of Mumias out-growers company including levels of farmer representation and to align its objectives to current farmer development needs. The government and Mumias Sugar Company should divest themselves from the day to day running of MOCO. Three, to revamp the institutional,

management and administrative capacity of MOCO. As I averred earlier (see chapter 5) a new dispensation will require well trained managers and senior officers with a positive predisposition to work, streamlined and innovative programmes, a sense of the future and the good of the large community and not just the parochial interests of the system they serve.

Theoretical Insights in the development concerns of Mumias .

This study brings together two issues of theoretical as well as practical concern in the development process. Namely, investment in small income-generating activities and how such investment copulates with the farm sector. These issues have in the past been neglected at the altar of foreign-sourced, capital intensive and large investments.

True, mono-cash crop farming, as sugarcane farming is in Mumias, could ruin an area by making the farmers dependent on the cash crop at the expense of the development of other sectors especially food production. This makes the cash crop to emerge as a pedestal of dependency rather than an engine of growth. I have discussed the dangers of the emerging patterns of cane-based dependency in Mumias (see chapter 5). A situation that would be further compounded were the soils to become too weak or, as is increasingly the case, land sizes became too small to support profitable sugarcane farming, a likely event given the

burgeoning household sizes and the attendant diminishing landholding.

Nonetheless, this thesis is premised on the theoretical thinking that although dependency in Mumias is engendered on cane farming the same cane farming can be used to turn the situation round. That, small farmers can extricate themselves from the labyrinth of cane-based dependency by being encouraged to invest income from cane in activities that generate further income. Such activities would become engines of indigenous entrepreneurship, would mobilise local capital, would employ more labour per unit of capital than large industries and thereby contribute to more equitable distribution of income and wealth and access to social services and welfare.

The question to be asked, however, is how does one get small farmers to invest their little income for future when they are already overwhelmed by more urgent household needs - food, fees, medical care etc. we do not pretend to provide a panacea for this but insist, nonetheless, that the benefits derived from cane if well managed will be the best, may be only, option in a long time. For a start it would be instructive to organise farmers into small interest groups. Such delineation could be based on household needs, resource base and livelihood strategies. Based on these it would be easy to prioritise group needs and to pool available resources. With good advice, organisational and management skills, farmers should

be able to invest in small viable activities without jeopardising the livelihood of the household. Profits from these activities may accrue to the household as income to meet household needs - purchase consumer goods and services - or be reinvested in the same activities to expand them. With time (10-20 years) sugarcane farming will just be one source and not the source of income.

But, for this to happen, the farmers would have to be empowered, through skill formation, to take charge of their lives. Local community organisations would have to be formed to spearhead these concerns and individuals would have to emerge that can attract funds and other help from outside organisations. Inevitably, and as Mbatia (1997:227) observes, as the state divests itself from directly financing development, there is need to create an enabling environment for the growth of a vibrant civil society.

CONCLUSION

The major impression from the study is that problems of development are complex in rural areas where scarcities of capital, land, appropriate technologies and skills on one hand and the inadequacies of institutions are worse, probably more so than urban areas which are more visible and thus attract more funding either through the government or from other donor organisations.

Amidst such problems the salient sources of the growth of rural output and incomes must come from a favourable interplay of vibrant institutions, both government and civil, and scarce factors of production. As the study illustrates to produce more food more farmers must acquire the knowledge to understand and develop the skills to use relevant technologies. To strengthen and enlarge the household income base farmers must begin to invest the little income they receive from sugarcane in activities that generate further income. To make the best out of them and to minimise the failure rate, farmers will have to be trained in skill formation especially entrepreneurship, decision making, book and record keeping, stock taking, calculation of profits, reinvestment and banking to mention but a few. To make more efficient use of spending for services to farmers, changes in public agencies delivering the inputs and changes in farmer organisations receiving them and among farmers themselves are

necessary and inevitable. Given the scarcities of production factors, the chief sources of growth in the coming decades must be viable institutional innovations and programmes coupled with an energised civil society which will enable the factors to be used more productively. Efforts should thus be directed towards building institutions and strengthening their capacity to mobilise and maximise the productivity of rural resources especially human capital.

Emerging Research Issues

This study sought to bring out technology adoption and income investment patterns and the factors that inform such behaviour. The study's selected explanatory variables could only account for 32.01 percent and 39.0 percent of the variance in adoption and investment behaviour respectively. There is need for further research to ferret out these other factors. For a start it might pay dividends to further illuminate household resource bases and household strategies to meet household needs and how their interplay impacts on household decision making. Besides, in making choices based on these decisions, what are they trying to maximise? Incomes, food, social acceptance or all of the above? Again, do individual households make independent decisions or do they consult neighbours, relatives= friends, local elite, teachers, administrators, politicians, priests etc. Answers to these questions might help understand why farmers would, for instance, plant maize season after season even though

they make losses or continue growing sugarcane even though other activities such as dairy farming or poultry keeping would generate more income? Although Mbithi and Bahemuka (1981) have tackled this issue in ASAL areas, new studies especially, in non-ASAL areas would be instructive and in order.

Historical studies of rural development could also be desirable in order to improve the understanding of the rural poor whether small farmers or others. Their historical origin and evolution in the context of the historical background of local institutions might not only be interesting but would also illuminate the bases of current rural development problems. While at it, it might also be important to explore the stages of rural development that African countries must go through before reaching western levels of development. Once you locate a region based on these stages it might be easier, at least from a theoretical point of view, to identify what development programmes to institute.

Given the centrality of institutions, especially small farmers' organisations, in providing the focal bases of changing social values and increasing knowledge and skills, how does one go about researching a topic that measures the efficacy of such organisations?

Finally, there is a lull in research in rural development issues with emphasis being directed to urban issues and other global concerns - Gender, democratisation etc.-probably because they

are more visible and thus easier to attract funding. Not that such issues are not problematic but rather that there is still need for more research focussing on development concerns in rural areas especially increasing and enlarging bases for generating rural household incomes and food reserves as well as uplifting the general quality of life.

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APPENDIX 1: FARMER QUESTIONNAIRE

Questionnaire No: Date

Name:..... Sex: 1=Male 2=Female

Location:.....Sub-location.....

A CONTRACT SUGARCANE FARMING PRACTICES

1. Are you on contract with Mumias Sugar Co?

1 = Yes 2 = No

If Yes indicate,

Year when contract was drawn

Year when you first planted sugarcane.....

Farm size under sugarcaneacres

2. Do you know the sugarcane type you grow?

1= Yes 2 = No

If yes, select appropriate type

1. C 0945 2. C 0421 3. N 14

4. B 41227 5. CB 38 6. NCO 376

3. The Sugar company undertakes a number of activities: indicate for each of the following whether satisfied or dissatisfied.

1. Ploughing and harrowing

2. Provision of seedcane

3. Acquisition and delivery of fertilisers

8. Please enumerate the activities you undertake from planting to the time the cane crop is harvested.

	<u>Activity</u>	<u>Frequency</u>	<u>Age of Cane</u>
1.
2.
3.
4.
5.
6.

9. Do you use fertiliser for your cane crop?

0 = No 1 = Yes

If Yes, indicate the following

	<u>Type</u>	<u>Cost/50kg</u>	<u>When applied</u>	<u>Why</u>
1.	Urea	_____	_____	_____
2.	Nitrogen	_____	_____	_____
3.	Phosphorus(TSP)	_____	_____	_____
4.	Single Sulphur (SSP)	_____	_____	_____

10. Have you ever bought fertiliser from another farmer?

0 = No 1 = Yes

If Yes, indicate

	<u>Type</u>	<u>Price Paid</u>	<u>Crops Applied to</u>
1.	_____	_____	_____
2.	_____	_____	_____

- 3. _____
- 4. _____

11. Have you ever sold fertiliser?

0 = No 1 = Yes

If yes, indicate

	<u>Type</u>	<u>No. of bags</u>	<u>Price Paid/bag</u>
1.
2.
3.
4.
5.

Why did you sell the fertiliser?

.....

12. Have you ever leased out cane?

1 = No 2 = Yes

If Yes, indicate the amount leased out.

For what purpose did you lease out cane?

- 1. Fees
- 2. Pay hospital bills
- 3. Pay dowry
- 4. Buy food
- 5. Other (explain)

13. When is the last time you harvested cane?

For that harvest indicate:

No of stacks **tonnes** **Approx amount in Ksh**

.....

14. On what is sugarcane earned income spent?

1.

2.

3.

15. Do you earn enough money from sugarcane growing to meet your household needs?

1 = Yes

2 = No

16. If No, how do you make up for the deficit?

1. Off farm employment

2. Small scale income-generating activities

3. Others (explain).....

.....

17. Do you think your sugarcane production is optimal or is there room for improvement?

1. Optimal

2. Room for improvement

If there is room for improvement what is your strategy for increasing production?

.....

.....
18. Have you ever used your sugarcane farm to access credit?

1 = No

2 = Yes

If Yes, indicate

<u>Year</u>	<u>Amount</u>	<u>Source</u>	<u>Project</u>
-------------	---------------	---------------	----------------

19. Would you say that sugarcane farming enables one to acquire new farming skills?

1 = 1

2 = Yes

If Yes, indicate the various skills you have learned.

1.

3.

2.

4.

B. INSTITUTIONAL ARRANGEMENTS AND EXTENSION SERVICES

20. Please indicate your major sources of information about sugarcane farming:

1. Extension agents
2. Books, Magazines and Newsletters
3. Local resource people
4. Fellow farmers
5. Self taught

21. Have you ever participated in:

Year

1. Farmer visits
2. Demonstrations
3. Field/ Farmers days
4. Sugarcane growing seminar

22. Do you use the services of the company extension assistant?

1. Yes
2. No

23. If you do, do you know his name? 1. Yes 2. No

24. Who seeks the other:

1. Farmer
2. Extension Assistant
3. Both

25. How often does he visit the farm:

1. Often
2. Sometimes
3. Once in a while

26. When he visits he talks to you :

1. Individually
2. In a group

27. When is the last time he visited:

1. Within two months ago
2. More than two months ago
3. I don't remember

28. What did you talk about:

- 1..... 2.....
3.....

29. What did you learn on that occasion:

- 1.....
2.....

30. What kind of contact do you have with the extension
assistant:

1. Close
2. Moderate
3. Sporadic
4. None

31. How do you rate the extension services you receive:

1. Satisfactory
2. Dissatisfactory

32. How satisfied are you with the role you play in the
delivery of these services:

1. Very satisfied
2. Satisfied
3. Dissatisfied
4. Very dissatisfied

33. If dissatisfied do you think that involving farmers in
the planning and delivery of services would help:

1. Yes

2. No

34. How exactly would you want the farmers to be involved:

.....
.....
.....
.....

C LINKAGES: FOOD PRODUCTION

35. Other than sugarcane what other crops do you grow?

- Cash Crops:
- 1.
 - 2.
 - 3.

- Food Crops:
- 1.
 - 2.
 - 3.
 - 4.

36. How do you prepare land?

1. Tractor
2. Ox-drawn plough
3. Jembe
4. Others

1. Small piece of land
 2. Low productivity due to poor soil
 3. Bad weather
 4. Others(specify)
-

45. How do you respond to this low productivity?

1. Intensify production
 2. Buy on the market (But maintain maize farm)
 3. Increase acreage
 4. Abandon maize production and depend on the market
 5. Other (explain).....
-

46. If intensification is not an option (in 28 above) why not?.....

.....

47. If you buy on the market (in 28 above) what is the source of funds?

1. Savings from sugarcane farming
 2. Off farm employment
 3. Small scale income-generating activities
 4. Other(explain)
-

D MICRO AND SMALL ENTREPRISE DEVELOPMENT

48. Do you run any income-generating activities (IGA)?

1 = Yes

2 = No

If Yes, indicate:

(a) Activities run:

1.
2.
3.
4.

(b) Source of capital:

1. Savings from sugarcane farming
2. MOCO loan
3. Savings from off-farm employment
4. Other (specify).....

(c) Approximate value of stock:

1. less than 20,000
2. 20,000 - 30,000
3. 30,000 - 50,000
4. 50,000 - 100,000
5. 100,000+

(d) Who manages the IGA?

1. Self
2. Spouse
3. Older children
4. Hired Labour
5. Others.....

(e) Number of employees:

- | | | | |
|----|-----|----|----|
| 1. | 1-2 | 3. | 5+ |
| 2. | 3-5 | | |

E LIVELIHOOD STRATEGIES

49. What are your household needs?

1. Food
2. School fees
3. Home improvement and maintenance
4. Health needs
5. Clothing
6. Investments

50. What are your strategies for meeting these needs (rank in order of importance)

Farming

Off farm employment

Small scale enterprises (IGA)

Others (specify)

51. Do these strategies successfully meet your needs?

0 = No 1 = Yes

If no, what is it you don't meet?

<u>Need</u>	<u>Relevant Strategy</u>
-------------	--------------------------

1.

2.

3.

How do you intend to make up for these?

1.

2.

3.

Which of the following best describes the way you meet your household needs?

1. Largely produce on the farm, sell surplus to meet needs.
2. Full time employment, salary meets other needs.
3. Runs an income-generating activity and profits meet household needs.
4. 1,2,3
5. 1,3
6. 1,2

F. QUALITY OF FARMERSHIP

- | | | | |
|--------|----------|-----------|--------|
| 1. Age | 1. <30 | 3. 40-50 | 5. 60+ |
| | 2. 30-40 | 4. 50 -60 | |

2. Marital Status 1. Married 2. Single 3. Other

3. Family Size 1. <5 2. 5-8
3. 8-10 4. 10+

4. Income per month _____

5. Level of Education 1. None 2. Primary 3. Secondary
4. Post secondary

6. Land ownership 1. <5 acres 2. 5-8
3. 8-10 4. 10+

7. Employment Status 1. Formal 2. Self-employed
3. Casual 4. Farming

No. of adult males _____

Have you divided part of your sugarcane farm among your adult male children 0 = No 1 = Yes

If yes indicate 1. No. of children _____

2. Acreage _____