TITLE: DAIRY CATTLE HUSBANDRY AMONG WOMEN

FARMERS IN VIHIGA DISTRICT: PROSPECTS AND

CONSTRAINTS

BY

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Ph. D Thesis submitted to the University of Nairobi in Partial Fulfillment for the Degree of Doctor of Philosophy in Sociology
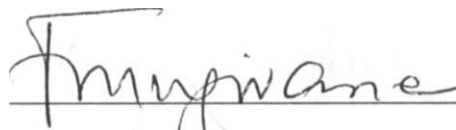
JULY 1999

DECLARATION

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

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DAIRY CATTLE HUSBANDRY AMONG WOMEN FARMERS IN VIHIGA DISTRICT: PROSPECTS AND CONSTRAINTS

MUGIVANE, FRED INUANI, Ph.D.

UNIVERSITY OF NAIROBI

ABSTRACT

The purpose of this study was to examine the role of women in livestock production, and in particular dairy production, as a complimentary, income-generating activity which significantly contributes to the overall productivity and food security. The specific objectives were to document the development of dairy farming systems in Vihiga District; identify the socio-economic characteristics of women small-holder farmers in the existing dairy production system; determine the cost-effectiveness of zero-grazing systems as far as the improvement of dairy production in the district is concerned and identify the performance indicators of the zero-grazing systems in the district. It was hypothesized that the findings from this study could have implications for decision and policy makers targeting women dairy fanners from a socio-economic perspective.

Low food crop production in the study area is due to overcultivated and exhausted soils. Despite land scarcity in the densely populated area, dairy cattle are given less emphasis because traditional livestocks are a form of life insurance for farmers. A technological gap is perceived to exist between men and women farmers. The women farmers operate

under greater constraints than men. They have less access to information, technology, land, inputs and credit yet they have primary responsibility for the home and child care.

Voluntary farm organization, technological adoption, environmental and gender perspectives have been identified in this study as theoretical frameworks to women's role in agricultural activities. A socio-economic model has been conceived to show variables that affect women's role in farm productivity.

Data were obtained from randomly selected small-scale dairy holders, mostly women in dairy zero-grazing production in Vihiga District of western Kenya. A master list of women groups in zero-grazing was accessed from the Ministry of Agriculture Livestock and Marketing, district livestock office at Vihiga and 18 women groups were randomly selected from the list. A systematic (sequential) random sampling procedure was then used to select the potential respondents numbering 105.

A descriptive analysis of the data collected on zero-grazing production systems among women in the district addressed socio-economic indicators of the farmers in the dairy production. Although zero-grazing was found to be profitable and cost-effective for the woman farmer to engage in, feed, labour and veterinary service costs were found to be major constraints in the system.

The data obtained from the respondents were further subjected to associations, multiple regression and path analytical techniques in order to ascertain the influence of explanatory

variables in the empirical models and variations in productivity as measured in net farm income and number of grade cows owned by respondents.

Results indicated that women groups were the main sources for obtaining grade cattle. Majority of the respondents were in the 30-to-50 years age category. Children's and hired labour was found to be an important factor. Farm sizes were significantly associated with A grade cows and participation of the woman as a manager.

Respondents practiced agro-forestry and there was statistically significant association between zero-grazing and purposes of practising agro-forestry. ThisAvas also explained by the finding that area under fodder had the strongest effect on a number of grade cows owned by respondents. The findings also showed explanatory variables (income, children, labour cost, age) accounted for substantial proportion of the variation in dairy income. An interesting finding was that formal education had little impact on grade cows ownership and respondents above middle age were found to have positive and direct effect on productivity.

An important finding from these results is that women groups to which the respondents belonged were the most frequent source of awareness and therefore adoption of zero-grazing dairy systems. The organization of women into target groups, such as zero-grazing women groups, bring with them the benefits of economies of scale in the costs and provision of extension services by many agents. It is recommended that:

(0   Women groups be strengthened so as to be involved in food security and

        agricultural income-generating activities such as zero-grazing;

(ii)   The high costs associated with labour, feeds, veterinary services be addressed as major constraints affecting adoption of zero-grazing; and

(iii)   That both young and older women farmers be encouraged to adopt and manage small-holder farm technologies.

The association's analysis showed that zero-grazing operation relied more on the presence of the children on the farm. However, it was observed that the respondent's level of education was not significantly associated with zero-grazing operations.

Multiple regression results showed positive relationship between socio-economic characteristics of the respondents and productivity. Age as a social variable was found to have a strong influence on income as older farmers tended to have higher gross incomes per year compared to younger farmers. Consistent with the *ciprior* expectations was the finding that households with large family size tended to have lower gross income per year from zero-grazing operations compared to households with smaller family size.

The path analysis findings supported the results of the above quantitative analysis. The model showed that respondents who were above middle age had positive and direct effect on productivity. Education of the respondent (woman) was found to have a negative and direct effect on annual gross income and owning grade cows had negative impact on income. These results were unexpected and interesting.

On the basis of the above results, a viable approach to increase household food security and income is to adopt improved land-saving technologies such as zero-grazing. An understanding of the farmers' socio-economic characteristics, experiences and farming practices is essential before the new technology is made available to the farmer.

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BIOGRAPHICAL SKETCH

The author attended Kidinye primary School, Chavakali High School and Friends School Kamusinga. He obtained a BSc. in Management Science and Agro-Business in 1983, Public Administration and Social work (MPA) in 1985 at Kentucky State University, USA. H e graduated with a Master of Science in Agriculture (MSc.) from Tennessee State University in 1987. He attended graduate course work in Sociology at Mississippi State University from 1987 to 1989. He has taught at Mbale High School, Vihiga High School, Jomo Kenyatta University of Agriculture and Technology and is now a Lecturer in Rural Sociology at the University of Nairobi, department of Agricultural Economics. He was registered in the University of Nairobi for a Ph.D. Programme in Sociology in 1996.

DEDICATION

To my family, with special dedication to my late Father, Mr. Jonathan Inuani

(Forester)and my late mother Mrs. Tereza Munaga Inuani.

ACKNOWLEDGMENTS

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ABBREVIATIONS

KCC	Kenya Co-operative Creameries
ADC	Agricultural Development Corporation
KARI	Kenya Agricultural Research Institute
SRDP	Special Rural Development Programme
IDS	Institute of Development Studies
NCWK	National Council of Women of Kenya
NCPB	National Cereals and Produce Board
FAO	Food and Agricultural Organization
AI	Artificial Insemination
ILCA	International Livestock centre for Africa
NGO	Non-Governmental Organization
MALDM	Ministry of Agriculture, Livestock Development and Marketing
DLPO	District Livestock Production Office
UNDP	United Nations Development Programme
FIN1DA	Finish International Development Agency
V.E.S.T.	Vihiga, Emuhaya, Sabatia and Tiriki
NDDP	National Dairy Development Project
UNEP	United Nations Environmental Programme
KEFRI	Kenya Forestry Research Institute

CHAPTER 1

INTRODUCTION

BACKGROUND **INFORMATION**

The overall thrust of Kenya's National Agricultural Policy is threefold; first, to achieve internal self-sufficiency, second to maintain adequate levels of strategic reserves and third, to generate surplus produce for the export market (Republic of Kenya, 1986). This in turn is expected to provide an enabling environment for agriculture towards attainment of employment opportunities, income generation, foreign exchange earnings, rural/urban development balance, food security and overall growth. Ultimately, the objective of meeting an ever increasing demand for food production, stemming from a rapidly expanding population and rising per capita income remains paramount.

Approximately 80 per cent of Kenya's population is rural and majority (52 per cent) of that population is composed of girls and women (Aspaas, 1991). The United Nations Development Programme (1988) estimated that one-half of developing countries' rural women get supplemental income from small-scale enterprises, and African countries appear to be no exception. In Kenya, small-scale enterprises may be the highest employer of women outside the agricultural sector (Republic of Kenya, 1986). The government has expressed a general onsensus that women are equal to men in entrepreneurial capabilities, irrespective of the size of

the undertaking, but it recognized a number of special constraints that limit women's potential to thrive in small-scale businesses. Among these are limited access to credit, legal constraints, inappropriate design of women's Entrepreneurship programmes and cultural barriers (Spaas, 1991).

The purpose of this study was to examine the role of women in livestock production, and in particular dairy production, as a complementary, income-generating activity which significantly contributes to the overall productivity and food security. The decrease in foreign exchange reserves, the high population growth rate, the need to improve nutritional standards, and the wish to diversify and intensify agricultural production are now inducing the Kenya Government to define livestock policies in order to favour dairy production in the rural areas (Stotz, 1983).

Historically, small scale dairy farming dates back to the 1950s when restrictions on Africans to grow cash crops and practice large scale farming were removed by the colonial government. Ogot (1974) stated that grade dairy cattle farming was started in Kenya by European colonial settlers and like many other agricultural enterprises, it remained exclusively in the hands of white settlers and became dominated by colonial policies formulated to benefit the white settler farmers at the expense of the African farmers.

According to Stotz (1983) exotic breeds of dairy cattle were discouraged in African areas but in 1955, some upgraded exotic breeds were introduced to African farmers accompanied with

appropriate veterinary services.

At independence in 1963, Kenyans in agricultural activities were either placed on settler schemes, previous tribal reserves or acquired large scale mixed farms through companies, cooperatives or as individuals. Milk production at that time was on a quota system to KCC which was the main marketing outlet. The quota and contract systems were abolished in 1970 and this led to expansion of membership in K.C.C. Other areas of expansion for the milk market included the government sponsored school milk project introduced in 1979, and the sub-division of previous company and cooperative firms in the 1970s and 1980s.

The dairy industry in Kenya has thus changed from a predominantly settler/large scale mixed enterprise to a situation where 80 percent of the milk comes from small-scale farms of less than 4 ha. (Ministry of Livestock Development, 1989). The dairy industry can be classified into large, medium and small-scale. Leading districts in the large scale sector include Nakuru, Uasin Gishu, Nandi, Trans-Nzoia, Kericho and Kilifi. This sub-sector is characterized by large holdings of over 200 hectares owned either by individuals or by state corporations such as the Agricultural Development Corporation (ADC) and research stations such as Kenya Agricultural Research institute (KARI) at Naivasha, Muguga and Kitale. Dairy production under this sector is commercialized, involving control of inputs, specialized management and mechanized operations. Medium-scale production on the other hand is characterized by holdings of 20 to 50 hectares, wned by individuals usually in peri-urban areas. The main characteristics of this sector are the

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on commercialized fodder production, crop residues and agro-industrial products.

According to the Ministry of Livestock Development (1989) small-scale dairy production plays a big role in Kenya today. Under this sector, the needs of the family for milk are met first, local sales to neighbours next, and, any remainder is sold to local co-operatives/associations. Cultivated fodder, especially napier grass is the main feed. Housing is provided for calves under improved management. The cattle population in Kenya comprises approximately 2,962,000 grade dairy and 8,923,000 zebu cattle.

Nell (1992) indicated that Kenya is a well-known example of successful smallholder dairy development. The Kenya Dairy Development Project was started in 1980. The main focus of the U project was on milk production at the farmer level. A zero-grazing package was introduced to farmers. This package included forage - crop production, construction of cattle sheds, adoption ol improved cattle and improved management practices. The project relied on existing organizational structures to supply inputs and market milk (Kenya Farmers Association, Crop Societies and Kenya Co-operative Creameries, KCC).

n 1988, some 2600 smallholder farmers were registered as project participants. A number of armers joined farmers' organizations and around 25 zero-grazing clubs of 10 to 60 members were operational (Nell, 1992).
The
e s rength ot the smallholder dairy farming lie in the existence of a basic infrastructure for
«

marketing, provision of inputs and services and the availability of dairy cattle. The Government policies have been favourable to smallholder dairy development and the development of improved production practices for smallholder dairying which was introduced to the farmers through an intensive system of guidance, demonstration and extension. The small dairy units of approximately 3 cows require limited management. The units supply the farms with manures, milk for domestic consumption or sale in the local peri-urban zone.

By empowering rural communities with techniques in animal husbandry, dairy technology and commercialization, several highly successful enterprises are likely to emerge as independent, commercially viable rural projects. This does not only improve the nutritional status of rural households but also provides income and employment.

I he weaknesses of the smallholder dairy farming are that small family farms have low or no capital. The inputs and especially labour is usually too expensive. This makes the system rely on family labour, especially women's and children's labour. Nevertheless, it offers more promise for sustainable dairy development.
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One of the objectives of grade dairy cattle enterprise is to raise the incomes of rural farm families [h]> introducing grade animals in place of indigenous grade stock. Chftere (1976) found that grade ""y cattle farming is more profitable than the keeping of indigenous cows where land is a scarce resource.

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Chambers (1989) argues that though women are involved in agricultural production, complex social and cultural relationships and norms affect the use and ownership of resources, farming operations and new ideas and technologies are perceived difficult. Within the family, male/female interactions influence innovations, notably with regard to agriculture, that is, many family members may be involved in process of innovation. However, there are constraints associated with adoption of a new technology. The selection and improvement of crop and livestock varieties depend on who makes key decisions in the family. In many communities, if a substantial proportion of the crop or animal produced is to be sold, it is usually the man in the family who decides. Researchers and extensionists may use 'top-down approach' with little farmer participation in the introduction of a new technology. The farmer may reject such a rigid package as it does not meet his/her immediate priorities.

Given the different roles of men and women in farming families, Chambers (1997) stated that there was need for a 'bottom-up' approach which emphasize learning from farmers and giving priority to local choices and ideas. This approach and method can enable the capabilities of poor people, especially women and children to enhance their confidence and capabilities. Olenja (1990) concurs with this view arguing that women are disadvantaged in social and cultural set-up "where men claim to own and control resources." Women, who are estimated to head 20 to 50 per cent of all rural households in Africa, depending upon the area, have been especially active in ooperative labour sharing. Such women's labour sharing and cooperative organizations have ven rise to formation of groups which have enabled women to cope with the absence of men

who may be working in urban areas or who have abandoned their families altogether.
«

In Kenya, nearly all rural women are reported to belong to farm and labour sharing groups which also offer mutual aid in times of need. In recent years, some of these groups have taken on social welfare and income raising activities, often based on one or more agricultural activities,(Rau, 1991).

The formation of such groups among women farmers was motivated by interest in increasing farmer participation in the technology development. Groups can be important in keeping farmers in the foreground and increasing a spread or multiplier effect with relevant improved technologies. Consensus and dissent within a group are highly productive in highlighting farmers' management problems, constraints and different strategies for coping with them.

Chambers, et al (1989) suggested that the more homogenous the group in terms of self-defined interests and perceived problems, the more effective the group process is likely to be. Chambers (1974) argues that if a change strategy succeeds, it implies community development whose effort is needed to help people to realize their needs, had been accomplished.

THi

ˏˢ is the basis of most formal and informal self-help groups founded as strategies for evelopment Chambers (1974) gave four values of self-help groups; to enable the exploitation of KHirces, which would otherwise lie dormant, save government's funds, make use of

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underutilized labour and release pressure on over-extended government agencies.

Dairy smallholder among women groups in Kenya have their origin in self-help group activities. A well-illustrated example of self-help group in Kenya is the *Mabati* (corrugated iron sheets) Women Group (Chambers, 1974).

The *Mabati Women Group* begun by working together to raise funds to put corrugated iron **sheets** (mabati) roofs on their members' houses, they moved on to buy **grade dairy cattle, fencing dips** and demanding services of community development, health, veterinary and home **economics** staff.

Maendeleo Ya Wanamike, an Organization intended to promote development amongst women in rural areas was formed in the 1950s. According to Special Rural Development Programme (S.R.D.P.) report (I D S), this formal organization was preceded and co-existed with local level solidarity groups. Examples of these traditional women's groupings were the *Ngwatio* in Central Province, the *Risanga* among the Luhya, *Saga* among the Luo and *Eitu ma mbai* in Ukambani, *Ikiaama Lolngoria* among Samburu/Maasai, *Ebiombe bia biangina(Ebisangio)* in Kisii *Nakha Ho/mark ha* among the Somali.

Historically, these groups were associated with mutual aid efforts in the spheres of agriculture, **home, community** improvement and welfare. Later groups especially those formed with the

WVP. initiative were built on the foundation provided by such indigenous groups.

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With the emergence of the National Council of Women of Kenya (NCWK) and the gradual politicization of the traditional groups, the women's self-help movement began to decline. Women's clubs and other traditional groupings emerged under "women's groups". These groups that emerged can be categorized into two broad types, the social welfare and the commercial type, where the primary focus is income generation. The number of such groups grew rapidly and in 1972 there were 2805 women groups and the estimate for 1985 was about 15000 groups with 550,000 members (Kabira and Njau, 1985).

In 1991 the Women's Bureau conducted a census which recorded the existence of about 24,000 women's groups. The figure excludes the many groups that still operate informally. The main aim of the census was to mainstream women's group activities, identity their locations and specify major problems that need intervention. Table 1.1 and 1.2 show women's groups and their activities respectively. The reveal that Kenya's women's groups are engaged in development activities right down to the village level.

Table !•!•   **Women's Groups** in **Kenya**

Province	No. of Groups	Membership
Coast	1,357	42,094
Eastern	5,007	201,658
North Eastern	225	186,918
Central	3,783	29,793
Nairobi	568	181,904
Rift Valley	4,568	199,586
Nyanza	5,120	115,815
Western	2,916	
Total	**23,614**	**968,941**

Table 1.2: Prominent Activities of Women's Groups

Province	Agriculture and Livestock	Sales and Service	Handicrafts	Social Welfare	Total
Coast	456	294	118	33	901
Eastern	1,926	520	231	119	2,798
North Eastern	66	111	28	0	205
Central	1,010	448	187 ,	137	1,782
Nairobi	67	92	555	339	1,053
Rift Valley	1,552	520	340	14	2,426
Nyanza	3,533	505	288	48	2,302
Western	1,485	542	213	62	
Total	**10,095**	**3,032**	**1,960**	**752**	**15,839**

Source: Women's Group Census, 1991
*

%

The mode of group formation varied from group to group and place to place. A group could be

initiated as a result of the internal dynamics of an already existing group. In this instance, a group

o women who belong to an agricultural work group may see the need to organize themselves in a

 omewhat more tormal fashion in order to improve their position through income generating

activities **Alternatively,** external mechanisms may come into play where either individuals or organizations stimulate group formation. The rapid growth of the movement was due to assistance in the form of farm inputs and other support provided to women's self-help activities by non-governmental organizations or government (Chitere, 1988). Prah (1991) observes that women's groups have been useful and indeed effective in rural development and change but husbands have in many instances opposed such women's activities. Group members, nevertheless, contribute to the welfare of their families by earning income from their groups' activities.

STATEMENT OF THE PROBLEM

Due to unpredictable weather, food crop production has shown accelerating negative tendencies which will eventually result in a totally impoverished rural population. Despite the 1984 drought in Kenya, the milk sector in the country did not suffer much because most of the milk was provided by the small dairy holders. Although small-scale producers occupy only a small fraction ot the land surface of Kenya, they produce between 75 to 80 per cent of the milk and over 90 per cent of the food crops (Economic Survey, 1988). The drought had greater adverse effects in the pastoralist sector, where many animals are believed to have died. This is evident from the

activities. Alternatively, external mechanisms may come into play where either individuals or organizations stimulate group formation. The rapid growth of the movement was due to assistance in the form of farm inputs and other support provided to women's self-help activities by non-governmental organizations or government (Chitere, 1988). Prah (1991) observes that women's groups have been useful and indeed effective in rural development and change but husbands have in many instances opposed such women's activities. Group members, nevertheless, contribute to the welfare of their families by earning income from their groups' activities.

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estimated milk production of 1.6 billion litres in 1985 out of which 60% was by the smallholder daiiy farmers (Mbogoh, 1987). This emphasises the importance of this sector to the economy of Kenya.

The Ministry of Agriculture and Livestock Development through the National Dairy Development Project (NDDP) identified, registered, recruited and interested small scale dairy holders and those aspiring to adopt the system in Kilifi, Kwale and Taita-Taveta districts (Mullins, 1992). These districts are likely to benefit from zero-grazing systems. Small dairy farming has been encouraged in these areas due to small land holdings, high population density and milk production potential.

Surveys in densely populated Kisii and Kiambu (Hearle and Kinoti, 1984) have also established that intensive dairy units (including zero-grazing units) were suitable for small scale farmers due to their high milk yield, savings in paddocking, pasture establishment and maintenance and disease control.

I he high, estimated at 2.8, population growth rate in Kenya (and with 75% of it in the non-industrial rural areas), the limited land resources and the ever increasing cost of production in dairy units dictate that land fragmentation, however undesirable or uneconomical, intensive dairy' units will soon become the order of the day. These studies have significant implications for ihiga District although they do not emphasize the role of women. Vihiga District has a high Population density and a population of 633,046 out of which 335,669 are poor. It has large household size (5.8) and a large number of poor households (54,926), (Republic of Kenya, 1999-

2015). There is need for participation of women in development of technology that will alleviate household poverty and improve household incomes.

The main crop enterprises in the district include maize, sorghum, beans, sweet potatoes, tea, coffee, sugar cane and assorted horticultural crops (namely, fruits and vegetables). Annual requirements for maize consumption in the district for example in 1992 stood at 72,000 tonnes as compared to a total harvest of 32,000 metric tonnes which left a net deficit of 40,000 tonnes to be catered for by way of imports either through National Cereals and Produce Board (N.C.P.B.) or unscrupulous middlemen. Low food crop production is due to overcultivated and exhausted soils. Zero-grazing would enhance intercropping of food crops with trees, shrubs, grasses and other plants for fodder. The residue from the fodder plants will be incorporated into the soil to supply nutrients and organic materials to increase food productivity.

Grade dairy cattle in Vihiga District are given less emphasis because traditional livestock in the district are a bank and a form of life insurance for the farmers. By selling one traditional animal a farmer is not able to feed the family decently, provide clothing, health, schooling-as well as veterinary fees and cattle feed. Local farmers eat little meat, although milk is a staple of their diet

'1 the animals are sold at a derisory price, people lose their savings. Nonetheless, men leave the
VI"lages to go and sell their cattle several kilometres away. Market places are lined with farmers
their cattle herds, waiting in the dust for buyers all day long. During the rainy season, there is
*ss and watei for the animals. But in the dry season, there is little water or grass for the many

traditional cattle herds which are already malnourished and weak. The net result is that traditional cattle keepers in the district are becoming poorer, and no longer able to manage their herds to make the best use of their potential.

It is not just the feed, one has got to look after the animals' health, and vaccines are expensive and not always available. There is need to support dairy farming in the area, especially zero-grazing where a farmer can look after one or two animals in a unit. Increases in production and income by maximizing milk and calves are premised on intensification of smallholder farming systems through introduction of zero-grazing-based dairy unit. Financial benefits derived from the dairy unit may contribute to the spread of the technology adoption and its sustainability.

A case study of Nyeri peri-urban producers (Staal, et al, 1992), recommended that the ability of Kenya to realise its potential in dairy production will depend on strengthening of markets in urban centers. Vihiga has ready availability and all year round accessibility to important urban centres ot Kisumu and Kakamega between which it is conveniently sandwiched for marketing of zero-grazing produce. The relative importance of urbanization and its association with higher income of urban dwellers plus the relatively high per capita consumption of dairy products in the urban areas are powerful stimulus to greater demand for dairy development in Vihiga.

[n] Vihiga District, however, smallholders have yet to widely incorporate dairying into their systems given the challenge that small-scale farmer is the major producer of milk in y*- Their failure to do so is explained by a number of reasons, including large initial capital

outlays, livestock diseases, lack of explicit government support and, a dearth of technologies appropriate to resource - poor, smallholder farmers, many of whom are women This is in spite of the fact that dairy production would make potential contributions to farm productivity, generating income and employment and thereby reducing food deficits engendered by expanding populations in the district.

According to FAO studies, (FAO, 1987)) untapped new forces for tackling the problem of agricultural production can be realised if food security questions are considered from the perspective of the women who contribute to the maintenance of the society by feeding virtually all the families of Africa. Women are the principal food producers and manage most of the local-level food storage, marketing, distribution and purchase. The productive functions women play and the constraints under which they operate must be examined in order that informed policy-level decisions may be made and concrete plans be implemented to enable women utilize their full productive potential in fighting hunger.

Research is, therefore, needed to help strengthen women's roles in agricultural tasks. Women's pre-eminence in agriculture make them a crucial link in the adoption and adaption of agricultural techniques, and the assimilation of innovative practices into the overall culture of the rural **communities.**

the years, a "technology gap" was perceived to exist between men and women farmers.

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Agricultural innovations in the technological sphere have not been gender sensitive ignoring women needs and tended to either erode women's indigenous knowledge base through elevation of men's knowledge to levels above women's thus preventing them from benefiting from technological development process. The genderisation of the ox-plough where the oxen is a man's tool because it earns money and the belief that "men tend livestock" defeats the logic that adoption of technology by men will reach women and the adoption gap between men and women would be bridged through this approach (Prah, 1991).

This study seeks to examine a range of women's socio-economic activities, particularly those that contribute to zero-grazing as a new approach to increased food production to build a productive base for future agricultural and self-sufficiency in Vihiga district. Women's roles can best be described within the context of the contribution they make to the society. Small-scale activities appeal to overworked but resourceful and determined African women (FAO, 1987). With all the household and agricultural responsibilities women often have, many of these need income-generating opportunities which can be conducted in/or close to home. Evidence compiled by Mullins (1992) relates increased income from intensive dairying with greater dietary diversity and better household nutritional status.

,|aal, et al, 0992) showed that because of land scarcity in Nyeri district of Kenya, dairy uction generally takes the form of zero-grazing. The average size of the household farmland duga has been declining steadily over the last 20 years. With this trend more and more

farmers have come to accept that the only way of improving milk production from their small farms is to adopt grade dairy cows and practice improved animal husbandry standards, which include supplementary feeding of the animals with fodder and concentrates. The government policy is now geared toward the promotion and support of this trend of dairy production under zero-grazing (or stall-feeding) conditions among women small-scale farmers, (Sewe, 1993). The women farmers operate under greater constraints than men, and hence need special help. They have less access to information, technology, land, inputs and credit. Because women have primary responsibility for the home and child care, they also have less available time and mobility. While there is much regional variation, women in rural Kenya are frequently illiterate, engaged in subsistence agriculture and unfamiliar with current technology, and are often perceived by male extension agents as being "non-adopters". Their productivity is thereby drepressed (Schultz, 1988).

Women who form the bulk of rural agricultural labour force are likely to benefit from zero-grazing as an income generating activity. While traditionally contributing substantial amounts of labour to crop activities, smallholder farm women may be less accustomed to working with and managing livestock and particularly with the more demanding exotic breeds, typically lcorporated into intensive crop-livestock production systems. They will be further disadvantaged ""Proving their knowledge and livestock management abilities if extension services are not PCr,y directed according to traditional divisions of labour (Chambers, 1997). However, in ^ice and selective practice, based on informed judgement, social access, opportunity costs,

productive capacity, quantity and quality in agricultural production, women set the pace with ceuards to the adoption and diffusion of technological innovations. Further, much of the informal learning at the village production level takes place through informal interaction between women. While it is acknowledged that socio-economic characteristics can have impact on technology adoption and diffusion, the level and extent to which they will influence women's adoption and diffusion has not been defined. The study focuses on this gap by examining effects ot women's socio-economic characteristics on adoption of zero-grazing production system.

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JUSTIFICATION OF THE RESEARCH

Kenya is faced with challenges of limited scope for expansion of agriculture in the face of rapid population growth which places ever increasing demands on already strained arable land. Accordingly, agricultural production by the rural poor is exceedingly based on small-scale farming. The economic Survey (1988) estimated that there were 3 million smallholders, 80 per cent of whom had a land size of less than 2 hectares. Small-scale agriculture is estimated to contribute 75 per cent of the nation's marketed agricultural products (Republic of Kenya, 1999-2015). in the dairy sub-sector, small-scale producers contribute about 70 per cent of total Production and about 80 per cent of total marketed milk (Mbogoh, 1984).

Co

equently, any strategy aimed at eliminating food shortages, alleviating household poverty and I ro\ ing household incomes must start with an understanding of the prospects and constraints ac,ng the smallholders most of whom are women.

Previous studies carried out on the dairy sub-sector have tended to focus on the economic aspects of daiiy development (Waithaka, 1989; Stotz, 1983) and dairy marketing (Mbogoh, 1984). Little emphasis seems to have been focused on the socio-economic characteristics of women smallholders, their ability to improve household food security and income from the sub-sector. This study provides a concrete picture on the intricacies of actual women participation. Membership in women groups is found to provide a strong socio-economic base in the sub-sector. Further, the research focuses on the experience and performance of women and evaluates the cost-effectiveness of the dairy production system among the women. The findings of the study are of interest to all those interested in improving women's performance in Kenya's dairy industry, namely the policy makers, socio-economic research scientists, dairy groups, Non-governmental Organizations, farmers and consumers. The study, therefore, makes a major contribution to special roles women play in the field of agriculture. Thus, women who work in cooperation facilitate more effective organized farming. Economic success or failure are both ▷asecl on restricting women's abilities (opportunities, fulfillment) to providing security and stability to the family especially the children. Based on this study a female perspective (but not necessarily or exclusively a feminist perspective) that can make a special contribution to research, leaching and women efforts is likely to be postulated.

OBJECTIVES

The main objective of the study was to investigate the underlying socio-economic factors related to women's participation in zero-grazing dairy in Vihiga District of Kenya. Specific objectives were:

a) to document the development of dairy farming systems in Vihiga District

b) to identify the socio-economic characteristics of women small-holder farmers in the existing dairy production system

c) to determine the cost-effectiveness of zero-grazing systems as far as the improvement of dairy production in the district is concerned.

d) to identify performance indicators of the zero-grazing systems in Vihiga District.

Conclusion

In summary this chapter addressed the following issues: Rural women get supplemental income from small scale enterprises. The dairy industry in Kenya has changed from a predominantly settler/large scale mixed enterprise to a situation where 80 per cent of the milk comes from small-scale farms with dairy units of about 3 animals that supply manures, milk for domestic consumption and sale. Although lack of capital and expensive inputs are constraints to grade ty cattle farming, research shows the practice is more profitable than keeping of indigenous cattle.

Studies don • n Coast, Kisii, Nyeri and Kiambu have not stressed the important role played by

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women in livestock husbandry. There is a technological gap between men and women as new technologies by-pass women who produce the bulk of the domestically consumed food in rural Kenya. Women are, therefore, resource poor farmers who operate a diversified system of production in which food security and cash incomes are key. There is a need to integrate the involvement of women in relation to the type of technology being adopted.

Vihiga District with a high population density and small landholdings need to adopt zero-grazing technology through involvement of women farmers in order to alleviate household poverty and improve household cash incomes.

The question this research seeks to answer is what is the respondents' level of know-how and skills in dairy farming and which of their personal characteristics influence the adoption of zero-grazing system, and can good husbandry of the system lead to increased productivity?

CHAPTER 2

LITERATURE REVIEW AND THEORY

This chapter is divided into two major sections. The first section concerns review of theoretical literature on women agricultural activities, constraints and prospects. The second one deals with various theoretical frameworks that emphasize women's organizations, adoption/diffusion of technology, environment and gender from women's perspective.

Review of Literature

Indeed there exists limited literature on the nature, kind and types of roles women farmers play to increase agricultural production. It is generally argued that rural women who form the majority of the African population produce the bulk of the domestically consumed food, care for the health and educational needs of the children and socialize them. It is this very woman whose economic survival has to rely on modern techniques of production if she is to cope with the pressure of Modern society. Agricultural land which is generally limited is becoming inadequate. Given the "crease in population, land shortage is beginning to give rise to a depressive situation where land ˢ sub-divided into small uneconomical plots. This can only result in the fall in agricultural output and ᵗ"creased poverty.

The fall i[1] agricultural output in Africa, and Kenya is no exception, induces most households to search for agricultural alternatives that are profitable and increase productivity. It is this search that by and large accounts for women's role and participation in the adoption of new agricultural technologies. Whereas men's tasks in agriculture are usually considered as of high value, women labour is viewed not as a truly human activity but rather as an activity of nature. It is for this reason that women feminists do not believe that the unequal and exploitative relationship between men and women is caused by social and historical factors.

This section examines the existing literature related to the role of women in agriculture with emphasis on their dairy farming activities since women form the backbone of society, and are the main producers and distributors of food.

Several questions would arise at this point. For instance, what is the strength of dairy farming in Kenya[9] And what contributions do women make towards agriculture and dairy farming in particular?

totz (1985) showed that out of a total cattle herd of about 10.5 million head in Kenya, 18 m, ,,0n were grade dairy animals. These head of cattle were estimated to have produced dhoUt 13 bl,,10n litres of milk in 1982, with 55% of that milk being directly consumed at home, TtSt marketed. Of the marketed production, 75% came from small-scale farmers, ^aithaka (19rq\ estimates that there are more than 600, 000 small holders practicing zero-

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grazing.

The growth of dairy cattle in the country during the 1970s was about 10% per annum, reflecting both the expansion of the existing dairy herds and the introduction of grade dairy cattle in the traditional non-grade-cattle keeping farms (Stotz, 1980). The studies show that milk production from the large scale farms in Kenya has continuously been on the decline, especially since the 1960s, but the decline has more than been compensated by the steadily rising milk production from the small-scale farms.

Women contributions to dairy farming, however, are not stressed and their participation in agriculture remains unrecognized and unremunerated (Schlyter, et al, 1990). Mbogoh et al (1992) argue that, milk production from grade cattle is a difficult operation with a high demand on both land and capital requirements and on management skills. Poor feeding due to lay farming, 'he marked seasonality of pasture and unavailability of A.I. services negatively influence their adoption.

C(luisition of grade cows requires capital, either for the purchase of cows themselves, or in the

 Parading o! the local cattle breeds through animal breeding programmes. Mbogoh, however, fails t
      0 show that women have unequal access to, and control over, all these resources (land,

P b * t) without which, grade cattle management is a difficult operation.   Kamau, (1990)
C0ncurs with tk-
          ir>»s and states that " women face great difficulty in obtaining access to credit,

whether to buy tools for the farm or for down payment. The main forms of collateral for agricultural credit are land title, ownership of cattle or membership of a co-operative". It should also be added here that dairy scheme has been successful because women are predominantly responsible for fetching water and fodder for these animals. During drought women and the animals suffer greatly when wells and streams dry up and there is no pasture for cattle. The productive inputs of women in the country's dairy sector is not documented and as a result, women's issues in dairy development are ill-defined and specific remedies to these problems are still to be found. Their work efforts as Schlyter, et al, (1990) argue are regarded as "unpaid family work," "farm family labour" and so on. This view is supported by women feminists who according to Adamek, et al, (1984) asserts that although women who struggle for their emancipation have rejected biological determinism, they find it very difficult to establish that the unequal, hierarchical, and exploitative relationship between men and women is caused by social and historical factors. Crovitz, et al (1980) argue that women's household and child-care work are seen as an extension of their physiology. All the labour that goes into the production of life, mcluding the labour of giving birth (to a child) raising children and domestic work is not seen as a tru'y human activity, that is, not work or labour, but rather, as an activity of nature, which Produces plants and animals unconsciously, and which has no control over this process.

tyter, et al (1900) would like the concept of labour re-defined as to-day's concept of labour is {UaUy reserved tor activity that produces surplus value and tends to exclude a large proportion ot worngpj' s activities . Lipnian - Blumen (1972) argues that the concept of sexual division of

labour suggests that men and women simply perform different tasks, hiding the fact that men's

nsks are usually considered as of high value compared to women's work. It is for this reason that

Schlyter (1990) wants labour force to be defined as "all persons of either sex who furnish the

supply   la^our   production of economic goods and services." Given the degree of

involvement of women in agricultural production and trade in many Sub-Saharan African

countries, the fact that they work as unpaid family members might be questioned and thus adopt a

general policy that subscribes to "anything a man can do a woman can also do", (Mason, et al..,

1975). Thus as much as men may work in urban areas to support their families at home, womens'

agricultural activities equally contribute positively to maintenance and survival of their families.

The predicted increases in urban populations in Kenya are certain to have social dimensions,

with significant implications for rural populations, food production and farming system evolution,

as well as for agricultural technology development and delivery. Already in wide-spread

evidence, further male migration to cities in search of wage employment will mean an even greater

s,lare °f farm activities being managed and conducted by women.

er   '^ast three decades, a considerable body of literature on gender and agriculture has been

up cov ering a range of focused topics such as the impacts of technical change (1 lassan and

Sal Va, 1994), agricultural and economic development policy (Smale and Heisey, 1994) and

lioi H ^ o T ood s security (Gittinger et al., 1990). By comparison, however, there is only a small

^ dv of literature

on the role of women in livestock production, and this spread rather thinly

geographically (Martins, 1990). This paucity of information is true for Kenya and especially with regard to the role of women in livestock production in crop-livestock farming systems. While there are of course exceptions, such as the work of Chavangi (1983), much of past research on women and livestock production has focused on pastoralists, for example, the Maasai (Bekure et al 1991) whose production systems have different objectives, strategies and organizations to those of intensive crop-livestock farming systems. It is interesting that while the majority of livestock studies have been aimed at crop farmers (Oxby, 1983), it is for this farm type that information regarding social organization and division of labour is most lacking. Nevertheless, the mentioned studies established the important role of women in management of livestock and the significant impacts which changes in livestock systems and technologies had on the women and the well-being of their households. These findings take on additional importance in light of current strategies for intensifying smallholder farming systems through the adoption of zero-grazing.

Can zero-grazing, therefore, open channels for women talents and free competition with Quality ot opportunities to ensure the use of each woman's potential? Staal, et al (1992) suggests

[1] * smallholder dairy development scheme in Kenya has been successful primarily due to the
    ᵛ ᵉˢᵘPPort that it has received from the government. The studies, however, do not show government support has addressed illiteracy, ill-health, lack of services and skills
  "'Pounded by women's unequal access to income and their lack of awareness of land use and Plan_ning StuH'
              Q'es on zero-grazing dairy farming show that the enterprise gives some returns to

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small-scale farmers and there is need to encourage women to adopt it. Stotz, (1980) showed that

dairy farming on small farms gives a fair net return of Kshs. 5000 per acre per month. This is

surpassed by tea and coffee only but one should bear in mind that those two crops are not grown

by as many farmers as those keeping dairy cows. Lately however, there has been a market price

fluctuation in coffee and tea but milk has been steady. This is an added advantage of milk over

the cash crops. Sewe (1993) notes that women in Vihiga district are farming in areas of extreme

environmental degradation, they face considerable problems, and many are responding by taking

on new activities such as zero-grazing. In some cases cash crops are produced at the expense of

food crops. Women farmers are responsible for producing food for their families, and

increasingly they face problems of the degradation and reduced availability of cultivatable land

With the greater emphasis on cash crop production, the cultivation of food crops by women is

done on poor, marginal land. Under such conditions, the women find themselves working harder

to produce from increasingly overworked land, and, unlike the men growing cash crops, they have

limited access to agricultural inputs and farming technologies (Bullock, 1994). The future of

zero-grazing technology is such that in some areas it will remain the only option to increase farm

income (Sewe, 1993).

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ccordmg to Vihiga district's Department Of Livestock and Development Report (1992),

dairy projects in Vihiga District have not given adequate coverage to the production
Component

' Particularly with regard to management, communication, infrastructure and other

systems. Animal improvement for increased milk production in the district through

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the usual artificial insemination (AI) is not widespread. The extensification (privatization) of the ^ I field services which started in parts of the country in 1991 reduced the provision of effective and affordable A.I. service. Additionally, impassable roads contributed to the current strictures in the delivery of A.I. and veterinary services during times of the year when they are in high demand as well as causing arise in the costs of these essential services, thereby eroding profits and the confidence of farmers.

Mbogoh (1984) indicates that milk in Kenya is marketed through both the ofTicial (regulated) and the parallel (unregulated or informal) marketing systems. Staal, et al (1992) argues that while traditional African cash crops suffer from depressed world prices, smallholder dairy offers important income-generating opportunities for smallscale farmers due to unmet and growing demand, mainly around urban centres. These studies have alot of implication for Vihiga District which is predominantly rural with growing urban centres and whose zero-grazing development is still in infancy. The neighbouring Kisumu and Kakamega centres between which Vihiga District is sandwiched and the district's rapid population increase would offer urban and rural market outlets f°ʳ the excess milk. But this does not ensure that women are able to sell the excess milk and ʳ dairy products to these urban markets, let alone get a fair price for them. According to 0(1987), factors that can limit women's access to markets, and their possibilities of expanding Oiarkets, include: "control by male family members over markets or marketing decisions; the °Perationₛ of agents and middlemen; limits on women's mobility; and lack of information, ^ m e n , , skiNs and contacts." The zero-grazing women may resort to joint marketing if their

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sociations and co-operatives become successful.   During the 1980s controls on dairy prices led

to input prices paid by producers to increase at a faster rate than producer prices. This resulted in

disincentive to the intensification of production in the zero-grazing, which relies to a greater

extent on purchased inputs (Sellen et al, 1990).

International Livestock Centre for Africa (ILCA, 1993) evaluated dairy production aspects, such

as marketing, feeds/water, diseases control, credit and infrastructure and concluded that dairy

produce is attractive to farmers with little land for its ability to enhance benefits. Socio-economic,

policy and technical factors constraining smallholder dairy development were identified in the

siudy. These include unfavourable policy and marketing environments, inadequate livestock

disease control, poor nutrition, poor reproductive performance and inefficient dairy processing

and marketing. Waithaka (1989) indicates that the handicaps facing the promotion of smallholder

dairying include customs and traditions (the valuing of large herds for socio-economic prestige),

lack of land titles to facilitate commitment of resources by the women farmers, lack of access to

credit by the farmers, lack of close, sufficient water resources, competition in relation to

osMenefit, with cash crops, poor management of milk collection and delayed payments to

mers, heavier labour investment needed and the tendency of the labour load to shift from the

Ct0 ∧emaᵣe members of the family. This study has a lot of implications for women in the study
area who 'ir ^   A'

' according to Makino (1992) are generally to be found tending cattle, collecting

manure hoc*
ng, and marketing of milk; and they have taken a greater part in the production of
food and commercial crops.

Specific strategies for addressing small-scale enterprises in rural areas were defined in the 1986

Sessional Paper No. 1 (Government of Kenya, 1986). The Government of Kenya seeks to make

the small-scale enterprises sector more self-reliant and actively involved in its own promotion

With a large percentage of potential farming women located in the rural areas, the government is

in need of a clear understanding of women's adaptation to issues of isolation in establishing and

maintaining their small scale income-generating activities (Spaas 1991). Even if the issues of
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isolation were addressed, Barnes (1978) argues that the profitability of those small-scale rural

enterprises may also be affected by the size of markets in which the women participate   This is

because women in rural areas sell in small markets with low populations and few infrastructural

amenities.

Some farmers in the country have called upon the Government to review milk production prices

or else milk would soon become a luxury item affordable only to the rich (Danida, 1991). They

aruue that the Kenya Dairy Board which is supposed to license the marketing of milk and its

products, is championing the interests of Kenya Co-Operative Creameries (KCC). Milk, they say,

[15] a basic food commodity and an enabling environment for farmers, most of whom are women, is

eeded to lecover their production costs and make a little profit. Right now, farmers are

^ting at a loss due to increased costs of cattle feeds and chemicals. Staal et al, (1992) have

indlCa,ed «their studies of zero-grazing and semi-zero-grazing that these activities provide only a

^Portion of the income in many households. The study, however, did not indicate how socio-

economic factors such as farm size, education and family size influence women farmers in adopting zero-grazing.

.\s regards labour, efficiency on small farms is an important concern since accelerated food and general agricultural production can be done easily with increased labour efficiency. There are several factors that may affect the efficiency of labour use on farms. According to Spedding (1979) these include factors within the control of the farmer and the national agricultural policies of the government which may lead to increase or reduction of labour efficiency on the farms. The first factor that may affect the efficiency of labour on farms is the employment of labour in relation to the size of the farm. A Small farm employing more workers than necessary may lead to underemployment. The ideal case is to get just enough labour to be fully employed throughout the year, but this may be difficult to achieve.
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I he second factor that may affect labour efficiency is the proper planning of activities. It is common to divide the farm labour operations and assign specific activities on the basis of gender. Varying skills and abilities of workers are important factors in the division of labour. Some farms may rec_iuire the farm owner to select workers most able to do the work. However, in many cases, ability ot the workers is determined after they have been given a chance and employed. All amie Work sho u'd be shared by all workers.

\ third factor that afYects labour efficiency is the quality of supervision. Supervision by the

farmer is important to get the jobs or tasks completed well. On small farms, the farmer may

supervise some activities herself or work together with hired labour on the job, that itself can lead

to effective supervision because problems that arise are tackled by the farmer and the workers

together. Personal involvement of the farm owner helps to increase efficiency of labour,

especially when they themselves get occasionally involved in some of the routine farm-work..

Theoretical **Framework**

Examination of a number of theories indicate that it is not possible to identify a single theory that

would be associated with women groups in farming activities. There are theories in collectivities,

but the women group perspective is not ephasised. The development of a new technology such as

?ero-grazing in Vihiga District, carries with it the notion that in one way or another people can

serve one or more of their own interests i.e. a desire to help others, to obtain financial gains, to

influence **policy** or to have a good time. Many rural women join groups because they believe they

Can meet enc,s through joint effort which they could not attain as individuals. What follows below

 ^theoietical approaches to voluntary farm organizations as a major perspective and sub-

  "es, namely adoption of technology, environmental   and gender as seen through the confines

   ^omen's role in agricultural activities.

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Voluntary **Farm Organization Perspective**

Although a sizeable literature aimed at classifying and analysing voluntary farm organizations

developed in the 1960s and 70s, little of this literature dealt with voluntary farm organizations in

developing countries and Africa in particular (Puglies, 1986). Many farm organizations have

women's auxiliaries. Slocum, (1962) indicated there were Rural Women of the Farm Bureau and

the Cow Belles associated with Cattlemen's Association. He asserts that organizational structure

of most women's farm voluntary groups was similar to those of other interest groups, and their

affairs were conducted in much the same manner. As attention shifted to the dynamics of farmer-

government relations, extension scientist (Roling, 1988) began to recognize the importance of

agricultural organizations for creating a more stable base on which to build rural development and

for the evolution of civil society and state-society relations.

Cornea, (1987) stated that both Organizations (formal and informal) enhance the capacity for joint

action ot their individual members in achieving the set objectives. Etzion, (1961) refers to an

organization as "a system of consciously co-ordinated activities or forces of two or more

 arsons   Kolb and Brunner (1952) have called attention to the increased emphasis on voluntary

 rganizations. I hey would like to see groups such as farmer organizations given considerable

     rt to get members and other farmers to accept improved farming practices. The key to the
contribution off-

             iarmer organizations to the durability and sustainability of rural development is to

     . ,n   designation "voluntary". The implication of this restraint on the organization's

•oiitrol over the individual is that the organization must compete with others for the individual's scarce resources, including her interests or loyalty and her time.

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Implicit in this perspective is the notion of individual freedom to join a group of her choice - voluntarism, therefore, is crucial to the survival and success of organizations. This is because the group takes collective responsibility for its members interests and every member has a stake in ihe other's success (Chitere, 1994). Furthermore, Chambers (1983) stated that their survival and success means they have defeated the normally effective principle of "attrition interests", usually by inventing new goals. As networks of co-ordinated actions, voluntary' organizations are the following: 'Civic Virtue' (members engage in selfless action to promote the common good and to (ome to the assistance of other less fortunate members of the community); 'shadow state' (serve **as instruments** of state manipulation whereby the state shifts the responsibility and burden of social welfare costs to the private voluntary organizations); 'bulwark against state power' (serve a mechanism for citizens seeking to make exercise of government power more accountable to **toe governed);** 'local growth machine[1] (are involved in capital formation necessary for rural conomic growth); 'economic and communication function' (serve as resource mobilization for development and channels of introducing new technologies in rural communities). This is to l®Wthat at different times and in different contexts voluntary organizations perform multiple functions and
        I   at different individuals participate in the activities of the same organization for ^ ^ reasons (Chitere,   1994).

many voluntary organizations, members can readily exercise initiative and can increase both their involvement in and their influence over the activities and products or benefits (Warner and Rogers, 1971; Rogers, 1968). Nziwa Women's Group (Chitere, 1994), Grange Farm Organization (Slocum, 1962), Kenya Water and Health Organization (KWAHO) and many local women's groups in Machakos District (Thomas - Slayter, 1989) are some of the groups that ended up having a bakery, grade dairy cattle, improved poultry and vegetables.

The zero-grazing women groups in Vihiga District are examples of local voluntary farm organizations that can effectively build capacity, restore productivity and sustainability in rural Kenya The Vihiga Women Groups in the study have elective officers, written constitutions, by-laws and membership requirements. Other voluntary organizations in the District include V.E.S.T. (Vihiga, Emuhaya, Sabatia and Tiriki) for construction of houses, water tanks and brick making.

That the aforementioned are structures of recognized and accepted roles to economic e!opment in the study area reinforces the view that a voluntary farm organization contributes ^{0s,t}vely to increased production and natural resource conservation.

.The format*
^{,0n} voluntary groups in rural Kenya such as cooperatives, peasant associations, ^{asso}ciations, water-user associations or self-help groups indicate the rapidly changing Gnomic o ^{Ur}"ties and constraints affecting relationships within and between households.

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One consequence of these changes is that new patterns of cooperation, reciprocity, and exchange among households are evolving in order to ensure household survival and to promote individual and collective welfare.

These patterns of co-operation, reciprocity, and exchange include farm associations or organizations to which men and women belong in order to enhance access to resources, to public and private goods and services, and to centers of power and decision-making. They have implications not only for the access of individuals and households to resources but also for stratification patterns within communities (Cernea, 1987). The voluntary farm organizations may lead in some instances, to increased equity or democratization and, in others, to increased social stratification. There are also significant implications for various categories of people by ethnicity, age and gender.

Traditionally, access to and control over resources for economic development in Africa has been controlled not only by men but also networks (Cernea, 1987). Patterns of land ownership and control are mediated through social networks.

*ct, involvement in networks can increase access to land and other resources (Slocum,1962)

»n networks helps people protect themselves under conditions of resource scarcity

•PP^ension about survival (Chitere, 1994). Networks and voluntary local organizations

[18] of strengthening the vulnerable. That is, networks as reflected in voluntary farm

rganizations help manage uncertainty and stress in rural households and production systems

man j984). In rural Kenya these uncertainties are growing as ecological systems deteriorate,

and productivity and incomes decline. Evidence suggests that networks and voluntary farm

organizations are increasingly important to female -headed households, whose numbers are

growing around the world (Dankelman, et al:, 1988). Participation in voluntary farm

organizations and networks increases in response to problems caused by loss of access to

common property and productive resources. This is the case with the women in Kathama,

\lachakos District (Development Dialogue, 1987). Acute poverty may force women to combine

efforts as in the case of Vihiga in order to maximize the one significant resource they have,

ramelv their labour. In rural Kenya, Members of local communities wish to increase family and

household welfare, productivity, and income, as well as community viability and well -being. They

also want access to the resources of the center. Rural people, therefore, need village-level

structures with financial means and a capacity to carry out local development activities within the

legal framework established by the government.

The

ero-grazing women groups in Vihiga are aware that if local residents do not undertake

n kinds of tasks, they will remain undone. If they want certain basic improvements in their

[r]onment and in their services, for the most part, they will have to do it themselves. Thus, they

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[Iz]   themselves into voluntary local groups such as farm organizations for community

^J^thened, such voluntary organizations can play a crucial role in mobilizing poor

^ral communities to advance both household and community interests. The Vihiga zero-grazing

 omen groups as voluntary farm organizations can alter options for local productivity.

Technological **Adoption Perspective**

provision of extension services has enabled the small-scale farmers to improve their management

skills, thus making it easy for the farmers to adopt higher levels of cross-bred dairy cows

(Mbogoh, 1987). Three explanations exist about adoptive behaviour: (1) most important cause

of adoption behaviour is willingness to change, to try new ideas. It is a psychological trait that

manifest itself in all behaviour. (2) Farmers' orientation to profit is most important factor. The

primary goal is to increase profit. (3) Adoption of technology is viewed as a consequence of

orientation toward farming and farm life (Leagans, 1981). Sellen et al., (1982) have indicated the

view that the farmer must be aware of the need for the technology, be able to obtain agronomic

and economic information so as to evaluate the potential consequences. Stotz (1980), argues that

   farmer is expected to bear the short-term costs for some ambiguous long-term productivity

   •ntenance   I his may be true with zero-grazing where optimum calving for heifer is not less

    3 years and milk production does not increase substantially until the second or third lactation.

    ^"gh economic insecurity may cause some farmers to discount the long-term benefits of
dairy farm
            l-eagans (1981), argues that personal and socio-economic characteristics of the
larni
        0r will influence the adoption of a technology. Such characteristics include awareness

of the technology, perceived cause of problems, formal education , experience in farming ,
affordability, relevance and suitability.

Rogers and Shoemaker (1971) argue that it is impossible for change agents to stop further
diffusion of an innovation once 10 to 20 percent adoption has been reached in a system and the
adoption leaders have adopted.   Those who have adopted the innovation are vehicles of
technological transfer in the diffusion of agricultural innovations.

This is more so if farmers decided of their own volition to join a group(s) that have expressed
awareness and adopted the technology. Chambers (1997) argues that it is the individual farmer
who must decide to adopt a new technology for his/her own operation and that the village is the
basic work unit for change agencies in developing countries. This view is supported by Solo
(1072) who argued that the village members are the most important reference group for decision-
making about adopting new ideas. There are advantages that accrue from an innovation. Rogers
and Shoemaker (1971) postulated that the relative advantage of an innovation that is positively
related to adoption of the new practice could be economic profitability or the way the new idea
 ®imizes costs. They however, cautioned that "an innovation whose rewards lie in the distant
    ** c aracterized by a lower rate of adoption because change agents find it hard to
^e monstrate th*»   i

          relative advantages of such an innovation to their clients". This means that a

        Pro tab,l,ty ls Positively related to a rapid rate of adoption. Rogers and Shoemaker (1971)
      Po int 0l t that the"
          innovations which are simple are rapidly adopted than those which are complex.

Chitere (1976) concurs with this view by pointing out that grade dairy cattle farming is not a simple practice and entails a great deal of extension education for farmers since most problems in farming revolve around the problem of lack of know-how. Some of the problems of farmers in dairy cattle management lie in the fact that the system entails a whole series of practices, such as, correct milking and milk handling practices, pasture establishment and utilization, each needing particular knowledge and skills. Chitere (1976) further argues that grade dairy cattle farming may be incompatible with the previous practices, such as, establishment of pasture in place of communal grazing or use of AI instead of natural insemination.

The adoption of a technology is a recursive, temporal process in which the operator begins with Liiowledge or belief of a problem or of the technology itself. The age, education, income and tarm size influence this process. At this point the operator evaluates the appropriateness of the technology across different fields; the compatibility to the farm enterprise, labour, availability of the components making up the recommended technology within local support networks, "liability based on case of integrating the technology into the existing operation as well as PPort programs which reduce risk; and the potential relative advantage when taking into eration all the prior conditions. Timely, accurate, and accessible information ^^unication) about the technology and institutional support which includes credit, Knicture, extension services are critical across the process of adoption (Bultena et al., 1984). Co
[n] enables one person to recommend an innovation to another, with the intent of [tdv]ourably influencing. . . .
b ner behaviour. Legans (1981) associates adoption process with numerous

vironmental influences and socio-economic factors such as farm size, formal schooling, income

d family size. However, cash income is cited as the most important of the socio-economic

variables.

Environmental Perspective

Wonvn make considerable contribution in agricultural production and must be involved in

sustainable management of the environment and its degradation (Shiva, 1989). Women in Vihiga

work to produce basic food crops for consumption and sale and their role is therefore crucial to

the sustainable use of the land.

Simple appropriate labour saving technologies that would reduce workload and time include

unproved fuel-saving stoves, fish smokers, improved access to water, zero-grazing, biogas

production, carts to carry water and wood among others. Rural women must control the

technology because they have extensive, indigenous knowledge of their natural environment,

*hicl lias been taught from generation to generation. They know the best trees for fuel wood,

ich plants have medicinal value, where to find water in dry season, best conditions for growing

additional crops, vegetables and how to take care of animals. The point here is that the manifest

t functions of women casts them as managers of the environment. In Vihiga district for

^ ^ ^ p V t a i n trees in the home are protected by women from being cut because they may be

F *ne icinal, family shade or for other specific functions. Women get firewood from trees

g t h a t have fallen and seldom cut a green, growing tree. This is cultural bound

nvironment protection in line with Boskott's (1964), Prali (1991) and Cancian's (I960)

postnlation that the survival of society is dependent on our contributions towards its cultural

environment and social organization. The keeping of large herds of traditional cattle has led to

the animals' intrusion on rivers and ponds. The stresses placed on river water resources by

animals has led to river contamination. Contamination of water is likely to result from disease-

bearing animal waste and this may pose health risks for the many people who are compelled to

drink and wash in untreated water from rivers and ponds. Zero-grazing system require that water

be brought to the animals. It conserves the river systems. Extra animals are kept for social and

cultural demands (marriages, funerals, prestige, cow-dung, as a line by norm violators, as a sign

cf wealth, gift, and named in remembrance of women). This has led to overgrazing and long-term

damage to pasture and soil. There is need to bring out the scientific basis of many women farm

activities common in healthy environmental adaptation practices.

[1] °pulation pressure is a key factor in environmental degradation and Vihiga district is a case in

P°"tt. Land, which is cultivated every year without fallow has been divided and sub-divided into

[118] ler food crop plots, no access to safe water and no opportunities for income generation

£tially for women. Intercropping of food crops with selected grasses, legumes, browse tree,

P^ and fruit trees would improve seasonal distribution of fodder to animals under zero-
i n g T^jg •
' ,ⁿ turn, will increase the women's knowledge of agroforestry practice and cash

explains how women in India took loans for dairy animals and with

^ ension agents assistance they were able to grow fodder crops on small pieces of

land improved milk yield, and stopped feeding the animals on overgrazed land. Other women in
the village took loans to build biogas which uses human and animal excrement. The left-over
slurry is excellent fertilizer and for use in biogas which saves scarce fuel wood.

Gender Perspective

Women's and men's utility functions might be different, which would require a new approach in
development work and research (Haddad, 1993). In recent literature, evidence has been presented
! that households do not constitute a unified economy (Bruce, 1989). Due to a perception that
| traditional development projects were biased towards men, projects and policies targeted
specifically at women and a new academic field, "Women in Development", have emerged. The
underlying assumption of this new approach is that resources entering the household are not
distributed independently of the person who acquires or manages them. In other words, gender
relations often change in response to altering economic circumstances.

Gender is a social construct where roles and relationships are defined. It identifies the social
 elationship between women and men and the way this is socially constructed (Friedmann, 1992).
  omen are perceived in many countries to be responsible for providing food for the household.
  ^•fcng women derive a higher utility than men from providing food to children, an increase in
    B e c o m e [or] production would have a higher effect on food security than a similar increase
for men While I
                    [s] ands apparently assume major responsibility for decisions directly concerning
the farm b
                •» several studies have found substantial evidence of joint decision- making in

„ich matters, particularly where major issues are involved (Slocum, and Brough, 1962). Less is known, however, about the details of the wife's involvement although it has been shown that the wife's farm decision-making role is related to her farm work role, socio-economic characteristics such as income (Wilkening and Bharadwaj, 1968) and farm size (Beers, 1937). Attention to the wife's participation in decisions leading to the acceptance of agricultural innovations is lacking even though the adoption process continues to provide a major theoretical basis for the study of farm decision-making (Lionberger, 1960; Rogers and Shoemaker, 1971). Similarly, the possibility that decision-making patterns, farm production, adoption of new technology are influenced by either the wife's or husband's farm activities have not been pursued. This perspective explores the practice of zero-grazing among dairy smallholders, focusing on the women's performance.

Feminist scholarship rejects the assumption that the household, through patriarchal head maximizes utility for all its members. The household cannot be considered as a unit of analysis because domestic units do not necessarily pool resources (Bruce, 1989). Allocation of resources is a function of who controls the income or other financial resources such as grade cattle. The decree of gender stratification in a society refers to the extent to which women are systematically advantaged in their access to opportunities relative to the men in their society (Chafetz, 1988). Tk
s access to economic resources, political power, material goods and such services as education or
Fra,n'n8 1he economic stratification is the paramount issue because it influences
^^^Bfeofgender stratification within a society. Economic stratification within the household 0re, has important economic repercussions at macro levels within the community

agriculture. These women also undertake multiple activities in the year. Some are self-employed and a **high** number tend to be unpaid labourers on their husbands' or household land. **Nevertheless,** studies done by Deere (1978) reveal the important contribution of women to the generation of household income. The studies show that adult women are principally responsible in commerce and animal care, which generate approximately one third of both the mean net income and the mean monetary income of the household. Similar studies reveal that the near-landless and smallholder female households activities account for only approximately 29 and 22 per cent of mean net income and for approximately 20 and 22 per cent of mean monetary income respectively. Vihiga zero-grazing women groups are among the near-landless and smallholder households.

This justifies feminist reforms on pragmatic grounds, stressing women rights and opportunities. ᴬ ˙˙˙ʰ a perspective emphasizing a household as an individual is however quite deficient in examining causes and welfare consequences of gender differences in agriculture. Studies in gender differentials in farm productivity (Udry, 1995) showed that women who had much smaller °tsthan men achieved much higher values of output per hectare than men The study greatly B|»a t e d heterogeneity existing within African households, where the individuals carry out •ctivities on different plots as well as co-operate in other household welfare activities. Given HpPtion that agricultural technology is varied within and across the two genders, the '-°ntribution $_0$f$_t$| , ᵂ°men to household needs helps emphasize the point that women are found Acting $_{jn}$ ^Pacity of either de facto or de jure household heads (Maase, et al, 1998). In the

Vihiga study the de facto female headed household is of great interest since majority of the vowen (wives) are involved in full-time dairy zero-grazing whereas their husbands are only available part-time. The cases of husbands totally missing (never married, divorced or widow) were very few.

Women's efforts to raise the family's standard of living are by no means negligible. It is for this reason that feminists contend that women's relative contribution to households requires a high degree of access to resources. The gender perspective, therefore, addresses the structures of gender subordination and shows women as full and equal participants with men at all levels of societal life.

Socio-Kconomic Model

A theoretical framework designed for this study is shown in Figure 1 "A socio-economic models tor Women Achievement in Zero Grazing". The model is designed to help researchers/farmers to achieve their objectives through time. The model shows things that women farmers encounter in tyng to reach family goals. Each respondent's farm family has prior condition variables (social economic variables). It is assumed that groups/individuals have certain goals in mind that i hey jj-g rymg^{to} 'each, in this case, increased productivity. Note that they are moving in the

of these goals, some of which are long-term and some of which are short-term   Rogers ^{and} Shoemaker (|07n

r v   ) note that socio-economic variables of adopters influence adoption rates.

Some individuals are likely to adopt innovations faster than others due to individual differences in socio-economic characteristics.

To reach the goals they must get information from extension agents or other sources which will contribute to their behavioral changes that entail adoption of technological practices   The information and technological dimensions are the intervening variables as they take place between the vme the farmers starts toward new goals and the time she reaches those goals. Some of these intervening variables are within the immediate control of the farmer. An example is the technological dimension from an indigenous perspective. Indigenous technologies have existed in the study area for a long time but recently they either have been ignored or different attitudes developed towards them. This calls for behavioral and attitude changes. Perhaps here lies the answer of what may be especially affordable to the farmer. Such indigenous technologies include: use of landraces (seeds) e.g. of crops like fingermillet and sorghum; seed storage technologies; broadcasting as a means of seed planting; selection and preservation of seeds; indigenous land Preparation, use of no till or slush and burn methods, use of famine crops e.g. root crops; use of •ocal livestock breeds by using a designated high quality bull and cow. The same can be done for P^try, sheep, pi_{gs} and goats.

^P membership as a social variable is the most prevalent and influential (Lionberger et al., 1982) Qr$_{0u}$P consists of those who are similar in attitudes, beliefs and behaviour. The Special

•ural **Developemnt** Programme (SRDP) implemented in Kenya in the early 1970s entailed work

•ₜₕ village-based groups in Vihiga and Migori.

The programme identified a group of farmers that were group and individually assisted. It was found that more of the farmers who were approached in groups put larger acreage under new farming techniques and realized higher yields than those who were approached individually. It was also found that the extension workers who worked with groups were motivated to do better work.

All the variables in the model work together in some kind of combination over time before the outcome goals are reached. The goal of increasing productivity involves efforts to change the behaviour of someone involved in agriculture - the woman farmer, extension agents, supplier, fhejnodel focuses on guiding people to adopt a new practice, use necessary inputs, change enterprise or cropping and livestock patterns, keep records, or make some other change.

Nummary Of Literature

women participate in small dairy industry, they have unequal access to productive

^ces. Studies have indicated that smallholder dairy farming gives some returns above input Costs ^
-scale farmers. However, the studies are not gender specific. This study seeks to **address varic**
Us '"dividual characteristics and productive performance of women respondents and

their influence on adoption of zero-grazing as a viable technology for women and an income generating activity.

Studies show that there is a small body of literature on the role of women in livestock production in Kenya. Most literature focuses on pastoralism which is different from intensive crop-livestock farming systems. Although the available literature shows that women are actively involved in the rural economy, it fails to specifically focus on women's role and document their activities in auriculture. In Kenya for example, where agriculture is the mainstay of the economy, women comprise about 48 per cent of total population and form eighty per cent of the total rural agricultural population, yet women's roles, land rights and control are not clarified. Additionally, handicaps facing the promotion of smallholder dairy farmers which include customs and traditions, inputs, cattle husbandry, skills, abilities, supervision, planning and labour are not addressed from women's perspective. This study seeks to address these gaps. Also missing from 'hese studies is the fact that male migration to cities means greater share of farm activities managed and conducted by women. There is need to re-define the concept "labour force" to l0CrU(*e P^{er}sons of either sex. Voluntary farm organizations, adoption of technology, environmental and gender have been identified in this study as theoretical frameworks to women's ^{ro}le?n gncultural activities. Various authors show that voluntary farm organizations contribute *,t,ve|y to increased production.

The technological adoption perspective stresses the need for technology and farmer's awareness. Several authors examine technology as a way of doing a useful thing and means to solving a problem. Through the works of authors, the environmental perspective shows women as people best placed to control technology because they have extensive indigenous knowledge of their rural environment. Survival of society depends on them and they are capable of changing peoples' ittitudes towards environment. Authors on gender and feminism emphasize the fact that women as a sociological category, would continue to need to be distinctively recognized in the general development effort because of the crucial and sensitive roles they have in key areas of African life, culture and society. Furthermore, the order of male social dominance continues to seriously inhibit tne economic emancipation of the female species.

The relationship of gender to the development exercise in as far as culture and technology are concerned form a key conceptual desiderata. That is to say the problem of the role of women in application and development of technology in Africa, is ultimately a problem of gender relations, te gender perspective in this study views women as full and equal participants with men at all 'eve's of societal life.

B™ thco
        rei'cal perspectives in the study, therefore, emphasize team work (voluntary farm
^nizatiom $_n$,.
        i   ecessary for increased agricultural production, adoption of zero-grazing
tech nol$_0$gy $_{as}$
                new telling technique to enhance farm output and increase women income, the
tnviron n»ental and th
                I   tne contribution of women to overall economy. Zero-grazing is encouraged

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as a viable farm technology women should adopt to enhance their well-being and that of their households. The perspectives postulated, therefore, justify the need for this study in dairy cat husbandry by women and how women's role in farm activities may lead to increased farm productivity.

HYPOTHESES

The following were the hypotheses tested in the study:

1 personal characteristics of the respondents are positively related to the adoption of zero-grazing dairy system.

2 The respondent's experience in dairy husbandry determine the enterprise productivity.

3 There is a positive relationship between socio-economic characteristics of the respondents and productivity.

4 Theie is a positive relationship between the practice of agroforestry and adoption of zero-grazing dairy system.

   Access to extension service information is positively related to the adoption of zero-grazing dairy system.

FIGURE 1: A SOCIO-ECONOMIC MODEL FOR WOMEN ACHIEVEMENT IN ZERO

-GRAZING

SOCIAL VARIABLES

FAMILY SIZE
EDUCATION
AGE
MARITAL STATUS
GROUP MEMBERSHIP
WOMEN GROUP DYNAMICS
OCCUPATION

7tv

ECONOMIC VARIABLES

FARM SIZE
LABOUR
DAIRY INPUT COSTS
OWNERSHIP

$_x$I/ **COMMUNICATION VARIABLES**

AGRICULTURAL EXTENSION AGENTS
OTHER SOURCES OF INFORMATION

**INTERVENING
VARIABLES**

TECHNOLOGICAL DIMENSION
(ZERO GRAZING)
(AGROFORESTRY)
ETC

\J

PRODUCTIVITY

^{G}ROUp/!M$_{DIV|DUAL}$ **GOAL(S)**

GRADE COWS
INCOME

CHAPTER 3

METHODOLOGY

This chapter provides a description of the study area, sampling of the study area, sampling method, selection of respondents, data collection and operational definitions. It also highlights analytical techniques used to assess the prospects and constraints facing the respondents. These techniques were associations, multiple regression and path analyses. Inputs and outputs data was collected for January to December 1996 using farm records and designed forms given to the farmers. For example, income used in the analysis was of 1996. The rest of the data was collected over a period of two months in 1997.

Hie Study **Area**

' ^{are}a selected for the study was Vihiga District in Western Province. The district has one of ^{l}he highest population densities in the country, that is, about 1,000 persons per km^2 (CBS, 1994).

has an estimated population of over three-quarters million people. Rapid population growth

$^{15\ exacer}$bated the mutually reinforcing effects of poverty and environmental damage. Rural

the district are environmentally fragile. Because they lack resources and technology, the

•ncreasino

| $^{mber\ ot}$ land-hungry farmers over-exploit the small land parcels which they cultivate

several time

R ^{a} year, putting additional pressures on the already subdivided small holdings. They

^ve resorted

• ° cultivating erosion prone hillsides and a long road sides where soil degradation is

$^{r\ \iota\ N}$ and crop $_{ie,}$ $_{s\ usu}$ally drop sharply after just a few years. The problem is compounded by

the extra local breed of cattle that overgraze thus increasing the likelihood of permanent damage to the land (Vihiga Development Report, 1993).

Vihiga District borders Kakamega District to the north, Nandi District to the east, Kisumu District to the south and Siaya District to the south west. It lies between longitude 34° 30' East and 35° and 0' East and between latitudes 0° 15' North. The equator cuts across the southern tip of the district. The district is 33 km wide from east to west and 19 km from north to south. Its altitude ranges between 1300m and 1500m above the sea level and slopes gently from west to east The southern part of the district is dominated by rugged granitic hills which rise to 1950m above sea level The most notable of these hills are the Buyonga, Bunyore and Nyangori hills. ! he geological formation of the district comprises of Kavirondian and Nyanzian rock systems, which have high potential for exploitation as building stones and ballast. Vihiga   District, strategically located about 15 km North West of Lake Victoria at the entry point to Western Province of Kenya, was carved in 1992 from the larger Kakamega District in the province.

le district occupies an area of 541 Km^2 of which 409 Km^2 is potential agricultural land. The

•hassmall scale farms covering 53,928 hectares. The average farm holding within the district

's about o ' |

ectares. T he district covers a uniform agro-ecological zone of UM 1 (upper midland

""^{n}e)and experie -

nionths$_0$f \| u c | U) ences two rain seasons in the year. One long rain season concentrated in the June and a short rain season from August to October.

According to Chitere (1976) the sahiwal animals initially came into Kakamega District between

1953-54, while the breeds of European origin were brought in the district between 1956-57.

Then Vihiga District was part of the larger Kakamega District until 1992. As late as 1973,

Kakamega District had 78,000 native cattle as against 5,286 grade dairy cattle (Chitere, 1976).

Vihiga District Development Plan (1997-2001) shows that dairy cattle increased from 6001 in

1992 to 8681 in 1995 whereas the dominant zebu cattle increased from 80490 in 1992 to 93545 in

1995. Milk production recorded a remarkable increase in production from 9.67 million litres in

1992 to 18.83 million litres in 1995. This can be attributed to adoption of zero-grazing and

improved animal husbandry. However, milk yields on smallholder farms in the District are still

low averaging 1900 kg per lactation or five litres per cow per day (District Development Plan,

1997-2000). Feeds, labour and management are cited as the major constraints in the households.

to Kakamega District, the number of women's groups grew from 10 with 240 members in 1965 to

[12] groups with 40920 members in 1986 (Chitere, 1994). The S R.D P. Occasional Paper No.

^(IDS, i075) indicated there were 43 women's groups in Vihiga/Hamisi areas with a

-vwipot 1312. The
groups were registered with the Department of Social Service, had
ftnmittee officials and a written constitution. The groups undertook many activities from
^tual aid • • •
' «es to large income generating activities and collective projects like keeping of

B^tle (Chitere, 1994). The current women's group movement, like the Vihiga
on*n Gr
[1]w o have adopted zero-grazing as an income generating activity are a

continiiation of the multi-purpose groups begun in 1950s.

Although no empirical studies have been carried out on women in dairy zero-grazing in Vihiga District various Non-Governmental Organizations (NGOs) such as the "Heifer Project" and -Africa 2000 Network" under the umbrella of U.N.D P, " Farming System Kenya Ltd." have been involved in the district. These organizations have worked in collaboration with the Ministry of Agriculture Livestock Development and Marketing. They have recognized the need for raising the level of milk production and cash income earnings of the small-scale milk producers. They have offered advice on technical matters like organising field days and assisting in providing of heifers io women farmers to foster dairy zero-grazing development in the area (Vihiga Development Report, 1993). This points to the great potential that exists for dairy zero-grazing development in Vihiga district.
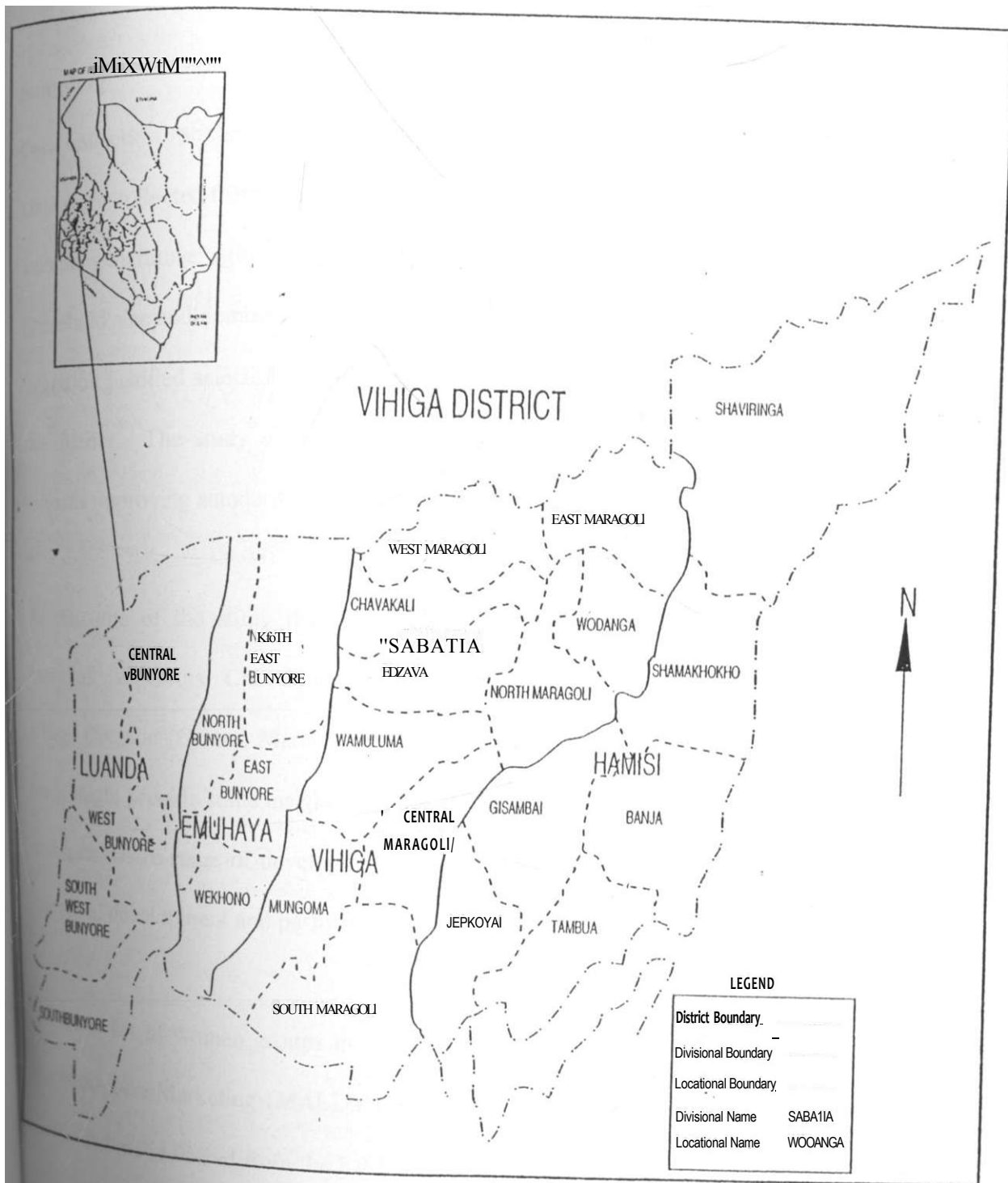
Sampling

Data collect[011] for   purpose of this study targeted women dairy farmers in VihigaDj^t. Data were collected from Vihiga and Sabatia divisions of the district. The divisions lacksm^fit income generating agric ultural activities.   Further, the high population density, tke^e household size and number of poor households and the small landholdings which have kdi m - migration justified selection of the areas. To date, dairy farming is a minor economic adiv^ in the district   The study of zero-grazing dairy systems would make an important comrL^n towards improving standards of living in the selected area.

•'t the time of the study there were 7 locations in Sabatia Division (East Maragoli, u^t Maragoli, Wodanga, Chavakali, Edzava, North Maragoli and Wamuluma) and 3 locally jn Vihiga Division (Central Maragoli, Mungoma and South Maragoli)(Fig. 2). It was feltl^e study might provide some insights into possible effects adoption of zero-grazing might han^e locations where stage of development in dairy industry is in its infancy.   The study focu^ ^n ^option, development and performance of zero-grazing technology in Vihiga District.

master list of women groups in zero-grazing was accessed from the Ministry of Agkve • ^ ^ a n d Marketing (MALDM), district livestock office at Vihiga and 18 women^s ʷᵃ°n'ly selected from the list (Table 3.1). The 18 women groups were selected fi^e ^ of 28 ,

P   ᶜʳᵘˢᵗer sampling method. Administrative divisions in the district wereu^^r f [8roup]s   Within each cluster a simple random sampling of groups was done^g

L   p_aper on which the names of each group was written and deposited in a box.   After

• no them thoroughly, 11 slips were drawn from Vihiga division and seven slips from Sabatia
IdlXlHg

division   A higher proportion of groups selected was drawn from Vihiga than Sabatia division

because the development of zero-grazing units was more established in Vihiga compared to

Sabatia division. Eighteen (18) women groups was a good sample size to provide a basis for

making inferences in the study area.

A sequential (systematic) random sampling procedure was used to select the potential respondents

numbering 105. By Sequential random sampling meant picking a number between '0' and ' 10' at

random by tossing a coin to decide on the starling point (say heads is number 2, tails number 1).

'nen include the identified respondent in the elements to be selected for the study.   In this

sampling, the tail was our stalling point, that is number 1, thereafter a constant l our (4) of

potential respondents was skipped before selecting the next element for the study.   Thus the

pattern from the list was respondent numbers 1, 6, 11, 16, 21. . . . . .'n' until the sample size was

*ined. By tossing the coin to decide on the starting point and skipping a constant number of

lential respondents, the sequential random sampling method was justified in this study.

H p s ^ mope members than others. In order to guarantee representation a proportion of

VVas Usec* across the board to select respondents from each of the 18 women groups.

dements in this study were individual farmers. The smaller the number of members

.,grouP the r. v

ewer the number of respondents selected for the study and vice versa.

-lips of P^{a}P$^{er\ on}$ ^{names} ^{eac}∧ g^{rou}P ^{wa}s written and deposited in a box. After

mixing them thoroughly, 11 slips were drawn from Vihiga division and seven slips from Sabatia

division. A higher proportion of groups selected was drawn from Vihiga than Sabatia division

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^{4e}ntial respondents, the sequential random sampling method was justified in this study.

*> p$_{erceri(}$ pPshad more members than others. In order to guarantee representation a proportion of

The saiy, groused across the board to select respondents from each of the 18 women groups.

ents in this study were individual farmers. The smaller the number of members

^{1,8rou}P the fewer tl

^{WCl} me number ot respondents selected for the study and vice versa.

Respondents from the sampling frame were therefore selected at a pre-determined sampling interval.

From each division of the District the administrative locations were selected. The master list of women in zero-grazing was used as the sampling frame on which selection of the dairy farmers was based These women had expressed awareness of zero-grazing by registering in groups with the Ministry of Agriculture, Livestock Development and Marketing as members of zero-grazing group The unit of analysis (the woman small dairy holder) was randomly selected from each group, having been identified for study as a member of women in zero-grazing.

Hence, the sample was heavily biased towards group members who had shown awareness of zero-izing by registering as such. A total of 105 small scale women dairy farmers were selected in the area of study.

[e] There were women who are not members of groups but practice zero-grazing system. *Wkjt* women are endowed with other sources of income, mostly from non-farming activities. they have adopted zero-grazing without resorting to partnership to raise necessary inputs for ^O-o [n]8 When such a farmer wants A.l. services, marketing inputs, etc., she pays for it or out be,[n]8 a member of a group. These types of farmers have resources to acquire ^'nials on th ;
. meir own without help or joining women groups. To them, zero-grazing has r * * * a status symbo! offering some form of decency and class to the operator. She considers

zero-grazing from a privileged strata view point. The benefits of zero-grazing are not just a profit of a few shillings from milk sales but include high status symbols such as biogas for cooking and light fertilizer from manure and other forms of modernity These zero-grazing non-group members look beyond the ultimate objectives of the group members. They observe efficiency of utilization of the limited resources. Efficiency affords them higher standards of living, prestige, decency and class. They supply high quality of milk to their own households and view milk and the animals as highly commercialized products from the enterprise.

In contrast group members such as those in this study, view the grade cow with its benefits such a; household milk consumption and sale, animal and skin sales for immediate cash flow as an end in itself. The women in the study are likely to be short of resources (the have nots) looking to eke a living out of these partnerships. Most of them are subsistence farmers. They have no other alternatives to employ themselves away from crop farming. Zero-grazing provides an extra Pupation to absorb unused resources such as labour and other farm crop bi-products and land, °P residues from neighbours and land for fodder which is unsuitable for crops. Some of these P> members hire land for fodder or grow fodder for sale These group members have more ' esthan diflerences in resource endowment amongst themselves.

^lwo sets of
omen farmers were in the focus during sample selection. One group had
can a
K^ompiish little on their own and need to be in groups. The group members had
*** groups to atT_{0r}
, ^zero-grazing. This group was the focus of the study.

At the time of the study, the following women groups, Table 3.1 (sampling frame of women .roups) were listed as registered with the District Livestock Production Office (DLPO).

Table 3.1: **Master List and Sampled Zero-Grazing Dairy Women Groups In Vihiga District, 1997**

Division	Location	Group Name	No. of Members	No. Sampled
VIHIGA	S. Maragoli	Kedeta	57	12
	S. Maragoli	Kisienya	54	11
	Mungoma	Savaro	98	20
	S. Maragoli	Kitewa	4	1
	Mungoma	Vikolwa	5	1
	C. Maragoli	Luduguyiu	8	2
	S. Maragoli	Umoja	5	1
	S. Maragoli	Ikumba	4	1
	S. Maragoli	Mbumbere	5	1
	S. Maragoli	Vihiga	8	2
	C. Maragoli	Avendelezi	5	1
	C. Maragoli	Visa Self-Help	5	0
	Mungoma	Mahanga	35	0
	Mungoma	Munameza	18	0
	S. Maragoli	Kivali	12	0
	Mungoma	Madzuu	40	0
	Mungoma	lramba	8	0
	Mungoma	Esavalu	28	0
	S. Maragoli	Igakara	8	0
SABATIA	Wodanga	Vokoli	18	4
	Wodanga	Gavudia	10	2
	N. Maragoli	Chanderema	82	17
	W. Maragoli	J F W. Group	88	18
	Chavakali	Mirembe	20	4
	E. Maragoli	Busali	5	1
	Wodanga	Mambai	28	6
	E. Maragoli	Nziwa	24	0
—_	Edzava	Ilwunza/Mukingi	80	0
UOTAL			759	105

ere research objective is to represent the universe (of individuals, roles, or sub-
s^) or to Ftoyze selected portions of this universe, it is appropriate to draw unbiased sample

within each target population (Zelditch, 1959). This sample will be representative and sufficient for the target population. The response rate was exceptionally good as all the returned answered questionnaires (study instruments) were usable giving a response rate of 100%. The study sample closely represented the population of women involved in zero-grazing in smallholder dairy farms.

Data Collection

The study was carried out in two stages: A formal survey and administration of a set of questionnaires carried out in 1997 and data on inputs and outputs collected in 1996 through farm i records delivered to the farmers.

Formal Survey

iht survey contained a more in-depth and extensive data collection on women dairy zero-grazing activities. All the women selected in each group were visited and interviewed.

Data was obtained on small dairy holders, most of whom were women in dairy zero-grazing in % District ot Western Kenya. The majority of women in this study organized themselves into ^ small groups, which they called "women zero-grazing groups." The groups had formally the members were registered and had a bank account. In addition, they had a ^ of off,cers to govern co-operation with regard to obtaining and use of animals and for ation fWork (planting napier grass, construction of a zero-grazing unit, regular water probers. An overview of the goals of these groups, and of their other structural

;|einents showed them as formal small farm group structure in a concrete situation. The goals of the group members were—to improve their income, make the daily routine as well as the dairy ork easier, get things done at the proper time, relieve their fellow women members some of their heavy tasks and achieve optimum output which they could not undertake or achieve without collaboration. Further, obtaining a cow ,calf, heifer, milk, dairy farming experience among other benefits might have created momentum for group membership.

A Stmctured (close-ended) questionnaire was the main data collection instrument. The questionnaire was personally administered and addressed small-scale women farmers' concerns and/or opinions on adoptions of zero-grazing technology as a deviation from other systems of fory production and its economic impact on the women farmers. Data was collected on animal housing, environment, feed, production, marketing, management, Al, treatment and water.

>ocio-economic and demographic factors (household income, farm size, education, age of •^pondent, years of farming, family size , farm-work, group membership, dairy earnings etc.) another component around which questions were developed

hput-o«tput Data

&ata

Wk consumed, milk, animal, hides and manure sales; labour, feeds and veterinary costs collected f

Hemi̇ents   [1] January to December, 1996 using farm records and forms given to the "come used in the analysis of this study was therefore of 1996. The rest of the

data was collected in June and July of 1997. It was assumed that previous year income would determine number of grade cows owned by respondent and other farm characteristics.

Operational **Definitions**

Dependent **Variables: Yi, Y_2, Y_3... Y,,**

Endogenous (Dependent) Variables included:

\ «rti<?n of zero-graziim dairy system: Adoption is the actual acceptance and use of a technology. It is therefore the output or what farmers do after awareness, interest, evaluation and trial of a technology. This was measured in terms of: practice of zero-grazing, access to technology (zero-grazing). The categories include the number of mature grade dairy animals per household, hectarage of fodder, area under food crops, hired labour expenses. Source of dairy animal may also influence adoption.

Productivity: The efficiency measures of this variable included milk output both sold and
»
wwumed in the household, annual overall returns from small dairy enterprises, grade cows
I owned

Careful management of the dairy animals which include the following: Keeping farm
records hg
established fodder/napier grass, has built a zero-grazing unit or not. Decision-making
an'ndicator of husbandry,
^^fifer^ Ref
ers to planting of trees for purposes of enhancing livestock and crop production
l ^ b y t h e
^option of various practices by respondents e.g. pasture mixed with trees.
In ""ervening variable

^dependent Variables: X_1 X_2 X_3... X_n

Exogenous (independent) variables included:

Socio-economic characteristics:

(1) Forr"3* schooling: highest levels of formal schooling completed, measured in number of years.

lb) Experience in dairy farming: number of years as a dairy farmer,

(c) *ZmiSize* number of hectares owned in 1997 (Fodder, food crop).

id) Family Size: number of persons in the household

ie) Age of the respondent: measured in years

(0 Membership in a women zero-grazing Group: The unit of analysis is the woman registered as member of zero-grazing group in operation,

(g) Marital Status: married, single, divorced, widowed, separated.

^M a fews to extension service information: Was measured by access to various sources of

information to the farmer (textbooks, contact with experts, extension agents,

administrators, intern students attachment, media, agricultural shows and visits)

e woman small-scale dairy holding was taken to be that with limited land size, 2 hectares or
L
Ve a dairY herd of cows and has put up a zero-grazing unit. She may or may not have

^opted the

zero-grazing practice, but has demonstrated her awareness of zero-grazing by

n8 as a member of a dairy zero-grazing group.

Data Analysis

In trying to determine associations between variables, Russell, et al (1993) recommends that P-vahics be used. The authors argue this approach is based on the fact that the Rvalue does not necessarily force an investigator to make a decision about the null hypothesis, hence its growing popularity. To determine the association between dependent variable and independent variable an investigator reports the values of test statistics from which readers can draw their own conclusions. However, it may require some effort on the investigators' pail to convert reported test statistics into meaningful numbers. Results of tests, for example, between an agricultural technology and personal characteristics of a farmer can easily be reported using P-values. This is more so if variables are categorical. Cross-tabulation analyses using chi-square (x^2) are then used to determine the associations between variables. The P-value (or marginal significance level) is the probability, if the test statistic really were distributed as it would be under the null hypothesis, ^{ot} ^serving a test statistic no less extreme than the one actually observed. If it is less than a, 'hen we would reject at the a level. The test statistics themselves contain no more information tan the P-values. For example, instead of reporting test statistics of 3 .51 and 5.43, the

^{es}tigator would use the fact that these are supposed to have come from a chi-square
^rib t'
°n under the null hypothesis and report Pvalues of, say, .0610 and .0198 respectively,
p., |
^{ueste}" us that for the chi-square distribution, numbers as large as or larger than 3.51
^ ^ F ^ b y chance about 6.1% of the time, while numbers as large or larger than 5.43 would
^ chance just under 2% of the time.

In the **associations** between farm sizes and the number of grade bulls, if we obtain a P-value of,

    000001, we will almost certainly want to reject the null. But if we obtain a P-value of, say,
say, •

04 or even .004, we are not obliged to reject it. It has been traditional to choose a significant

level of $^=$ percent, 5 percent, 2 percent, or 1 percent. The higher the significance level we

use for testing a hypothesis, the higher the probability of rejecting a null hypothesis when it is

irue If $^{a=}$ -01 ^{ar,}d   P-value reported is .0001, we reject the null and make conclusion. That

is we will reject the null hypothesis if the probability value (P-value) is less than a, the

significance level of the test. The choice of level of significance depends on trade off between the

costs of each of two kinds of errors: Type 1 and Type II. If the cost of Type I error (incorrectly

rejecting the null hypothesis) is relatively high, we want to avoid making this kind of error, so we

choose a small value of oc. On the other hand, if a Type II error (incorrectly accepting the null

hypothesis) is relatively more expensive, we are more willing to make a Type I error, and we

choose a high value of a (Russell, et al, 1993). According to Levin (1987), a P-value is not the

probability that the null hypothesis is correct. By itself it cannot let us deduce this probability. P-

    have been used in this study in an attempt to provide an answer to the question, "How

$^{ike,y\prime s\,t,le\,r}$esult we have observed?" Thus the reported Pvalues help us weigh all relevant

    decide whether to accept or reject the null hypothesis without being bound by a pre-

^significance level.

   $^{\circ*}$8razi

    & enterprise income was assessed by three different measures: gross output of milk

    ^{nsum}Ption, animal sales and hides and skins sales, gross margin and profit. Zero-

grazing enterprise income studies heavily relied on farm records kept   Where the farmer did not
keep proper records of transactions on the farm, the reliability of the study depended on the
emory of the farmer and the researcher's skill in eliciting the data. Brown (1979), gives the
following ways of determining enterprise income. The gross output of zero-grazing enterprise,
for example, was calculated by multiplying the total volume of the final marketable production by
is average farm gate price. Final production normally excludes intermediate products. The total
volume of the production can be calculated by aggregating the total amount of produce consumed
I in the home, sold, fed to labour, or given a way. The farm gate represents the point of first sale.
J   I he farm gate price is a weighted average that accounts for the variation of prices according to
the grade of produce, the time of sale, and the market outlet. It is used to value both marketable
produce and by-products that are not sold but consumed in the home, fed to labour, given away,
or used as feed.

^ e l a r m management analysis, gross output is often expressed in relation to either the quantity
rvalueof some critical input. Ratios commonly used are gross output per acre or gross output
shilling oi total cost, labour or fertilizer. When expressed in such terms, gross output
Provides a nr r •

preliminary basis for comparing the relative efficiency of an enterprise with that of
T r e a s o n the farm.
^output isde-:

P*ved by subtracting the value of purchased inputs from the gross output of the

R ^ ' n g to Anaman (1988), this measure of enterprise income is particularly

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keep pr°P^er records   transactions on the farm, the reliability of the study depended on the

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Shilliny 01 lo tal cost, labour or fertilizer. When expressed in such terms, gross output

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p r i s e s on the farm.

°utput is der

F^ved by subtracting the value of purchased inputs from the gross output of the
^Prise   \

E   ' n g t o A n a m a n (1988), this measure of enterprise income is particularly

nificant for livestock enterprise whose purchased feed can be substituted for home grown feed.

The net output therefore provides a better measure for comparing the use of land devoted to

livestock production than the gross output.

The enterprise gross margin is obtained by subtracting the variable costs from the gross output of

the enterprise. Variable costs for items, such as feed, fertilizer, spray materials, and casual labour,

can be controlled to some extent, and are not incurred when there is no production. Fixed costs,

for items such as insurance, regular labour are incurred whether or not there is production,

[he gross-margin was calculated using the following formula:

GM = TP - VC

Where GM refers to the dairy enterprise gross margin

TP is the total monetary dairy production (milk and other sales)

VC are the variable costs associated with hired labour, veterinary services and livestock feeds

-nerally labour costs would concern both family and hired labour. Family labour was excluded

the calculations since it was considered as a contribution of the family to the farm

Auction

FProfit is obtained by subtracting the estimated total cost of production for the

^rprise fr$_{()ni}$ •

$^{l \ s}$ gross output. For purposes of this study, costs can be roughly divided into

P $^{e \ S \ ' \ 'a}$k$^{our'}$ veterinary costs, and feed. The total cost of labour can be estimated

•imply by adding the imputed cost of family labour to the actual cost of hired labour. The cost of

veterinary services constitutes the variable cost which are easily identified (treatment, spray, A.I,

,t cetera) The cost of feeds was derived by estimating how much was spent on fodder,

concentrates etc.

Spedding (1979) argues that the enterprise profit partially reflects the benefit accruing to the farm

family. The farm also provides the family with employment. His argument is relevant to small

farms in Vihiga, especially those operated by women dairy smallholders where the family

contributes the bulk of the labour.

\nderson (1977) argues that the level of education, ability, and occupation are important tools

needed by the farmer to analyze decision-making under risk and uncertainty at the farm

Production level. Jasso and Rossi (1974) did study perceptions of equitable distribution of

ncome among rural men and women in agricultural production in the USA. They found that an

^ual distribution of income would be considered unjust and that sex was a significant variable

assessing income difference with males more likely to be judged as underpaid. Trianon and

WM(1975) studied the educational attainment and occupational status for men and women.

f >niniry toth '
        weir expectations, they found that the process for educational achievement was very
*^ilir for

        a es anc l females as far as effect of parental influence was concerned This was

    '^GdftSb
            e,n g a function of the level of education considered. McKee McClendon (1976)
    ^Satedthei .
        I-   tors o l achievement in men and women Comparing background variables

$_c$h as educational attainment between men and women, he found that the status attainment pfocess was quite similar for both. One of the most widely known model's of status achievement ,'tlvit $_0$ f Otis Duncan (Alwin and Hauser, 1981). Socio-economic along with family background sassumed to determine achievement. Family background, education, and occupation all •ontribute to level of income. Socio-economic background was measured by father's years of education, occupational status, and the respondent's number of siblings. This study examined background variables such as education, childrens' and parents' education and age in order to determine whether they affect womens' reaction to zero-grazing. The study helped identify constraints and opportunities for the women in zero-grazing. The various tools of analysis described and the socio-economic models addressed were used to understand the main characteristics of this farming system. To test the assumed positive relationships between socio-economic characteristics of the respondents and zero-grazing productivity, a multiple regression model was applied to estimate the relationship. Productivity was measured by annual gross 'come from the zero-grazing operations and the number of mature grade cows owned by the ^{res}Pondent.

^{he} theoretical model specification was thus,

^{ali0n1} $Yi = f(X2, \overline{X?\qquad} X12) + e$

^juat'

,^{0n} " 'NCOME was the dependent variable (Yi) which was explained by the
d

variables shown below. The number of mature grade cows owned by the respondent

f $^{\wedge}$ ^{1} ^{m} variable in this equation and was represented by X2. This was because the

^grazing allowed the possibility of keeping and sustaining a number of grade cows which gave

nlilk and therefore generated income.

Equation 2: $Y_2 =$ $X_4 \ldots \ldots X_{12}) + e$

In Equation 2, V2, the number of mature grade cows owned was the dependent variable explained

by independent variables shown below. INCOME, symbolized by Xi was an independent variable

m this equation because income generated from zero-grazing is reinvested in purchasing more

grade cows as productive assets for future income. The two variables INCOME and Number of

Mature Grade Cows (GRDCOWS) were therefore used interchangeably in the respective models

(Table 5.9c). *
    «

Mowevei, this system of simultaneous equation are likely to yield biased and inconsistent

•Mimated   A Two-Stage Least Squares (2SLS) method of estimation was applied to give better

estimates of the parameters and thus avoid simultaneous-Equation bias.

        Total feed cost as input in the zero-grazing operation - Ksh.

X4
        Level of formal education of the respondent in years

X,
        Number of children in the household (family size)

X*
        Area of land grown with food crops measured in acres.

X?
        Total labour costs as input in zero-grazing operation - Ksh.

X,
        Total veterinary costs as animal health care input - Ksh.

x»
        Aiea ol land grown with fodder for the zero-grazing operation

        Measured in acres.

        Chronological age of the respondent in years.

XH   Total farm size in acres.

X12   =   Level of formal education of the husband of the respondent in

years.

The *aprior* expectation of signs of the parameters were as follows.

The parameters fit for variable Xi was expected to have a positive sign. This is because socio-economic characteristics of the respondent are expected to positively influence productivity as measured by annual overall returns from dairy farming.

I lie parameter ft 2 for variable X2 was expected to have a positive sign because the socio-economic characteristics of the respondent directly determine the number of grade cows in zero-izing operation.

parameter ft3 for variable **X3** was expected to have a positive sign. This is because the more fmer invests on feeds, the higher the productivity as estimated in annual average returns or P**r©f grade cows owned.

parameter fi r
F""   or variable X4 was similarly expected to have a positive sign This can be
®*ptained by ^
      Postulation that responds with higher levels of formal education are more
ffcSPOns₁Ve tOch

      P^nge (Adoption of husbandry practices) thus increased productivity measured in
   aver age ret 1
      s and number of grade cows owned.

The parameter As for variable X_5 was expected to have a negative sign. This is because households with larger family size are expected to invest less in zero-grazing operations due to competition with subsistence needs of the family. Thus expected decrease in productivity reflected in low average returns and fewer number of grade cows.

The parameter   for variable X_6 was expected to have a positive sign. This is because of the fact that respondents with land under food crops are more likely to increase farm productivity as surplus crops and crop residues and income from food crop sales can be used for provision of animal feeds in the zero-grazing operations.

ihe parameter **67** for variable **X_7** was expected to have a positive sign. The basis for this ^pectation was that respondents who spend more 011 labour are expected to have higher productivity which translates into higher average annual returns.

FP®rameter fj. for variable Xs was expected to have a positive sign This is because)nden.$ wno spend more on veterinary services are expected to have a higher productivity F* in increased income which can be used to increase the number of grade cows owned.

wameter   r
    [9] >or variable X<; was expected to be positive, since respondents with land under
    ^Bhroent are more likely to increase productivity as estimated by annual average
    Sand number of
        E   giacle cows in the zero-grazing operation

The parameter flio for variable X_{10} was expected to have a negative sign with the assumption that lder **respondents** are expected to be less responsive towards change (i.e. adoption of zero-grazing enterprises) thus low productivity as measured in annual average returns and number of actual mature grade cows owned.

The parameter fru for variable X_n was expected to have a positive sign as this is based on economic criterion of economies of size, that is, as farm size decreases productivity diminishes as retlected in lower annual incomes and adoption of grade cows owned.

The parameter &12 for the variable X_{12} was expected to be positive due to the proposition that respondents with better educated spouses were more likely to be influenced towards change (i.e. Option of zero-grazing enterprise), thus increasing productivity as estimated by increased annual average returns and increase in the number of mature grade cows.

Ibices 2,3,4 and 5 present the statistical and econometric tests showing how results from the ""P^cal data tallied or deviated from the above *aprior* expectations.

^ncan Model o r e •
fc • ^UCI ur ^ocio-economic Achievement, (Duncan, 1975), the terms Path Analysis, and Structural equation models have been used to refer to different and
Prized approaches to the analysis of causal relations among variables. In recent Wever m
authors seem to prefer the use of "structural equation models" as a generic

Iixrthe various approaches to the analysis of causality. Reviews of structural equation term[101]

tjels_wj|| be found in Alwin and Hauser (1981). Major recent contributions in this field were

H L b y Otis Duncan in his popular model commonly referred to by social scientists as "Duncan

Structural Model Of Socio-Economic Achievement" which can be used to describe the effects of

lexogenous variables (e.g. education, farming experience, family size, age and farm size) on

endogenous variables (e.g. dairy production system, animal ownership, milk output and income),

lie model specifies a recursive effect where direct and indirect effects on the endogenous

enables can be noted (Alwin and Hauser, 1981). The model provides a method for analyzing

quantitative data which yields empirical estimates of the effects of variables in an hypothesized

aisal system. The causal flow of influences between variables in the model is unidirectional. In

the structural equation the variables on the left-hand side of the equality sign are dependent on

   to the right.

      and dependent variables associated with technological change were identified and

   ,[n]the Duncan Structural Model of Socioeconomic achievement to describe the effects of

      [4] variables on endogenous variables. A multiple regression equation is often used to

      ^•ons posed in the following way: I low large of an influence does variable X have on

         held constant? Such questions are often investigated by social scientists with

,[0]n»ofr_eiire •
                ssion analysis. Multiple regression and related procedures have been
'ated i_{nt0}.

            causal modelling framework (Alwin and Hauser, 1981) A set of structural

         often esti
            I   ted through hierarchical regression procedures, represents the presumed

ausal effect of variables which intervene between a fully independent variable and a dependent

variable The standardized regression coefficient represents a marginal change in a dependent

able given a unit change in the independent variable. Thus, standardized coefficients were

yseful in comparing within the same equation the relative effectiveness of one variable to another

on a given endogenous variable. An overall measure of how well a set of independent variables

determines (or "explains") differences among sample members in a dependent variable (e.g. zero-

»razing income) is the coefficient of determination symbolized as II The accuracy of the

$$2 \qquad\qquad *$$

prediction equation was reflected by R . Duncan's model of socioeconomic achievement is useful

n illustrating and facilitating causal explanations of gender economic achievement Differences or

similarities which may contribute to attainment among dairy production systems as measured by

•actors such as income were noted. Attempt was made to isolate the critical variables that

appeared to offer further insight into the inter-relationships among some of the key variables of

the study with the view to isolating areas that call for further research and/or community action

plan

ius,'fication of Use of Duncan's Structural Model

Duncan'c

structural model addresses the major goal of scientific research, that is, to establish

kwsthat enable us to predict and explain specific phenomena. The Vihiga study is socio-

Pft data derived from a field survey. The results of the study can therefore be viewed

^present .

'n of the scientific method for validating sociological facts and cause - and - effect

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jjyild a science of social phenomena. Duncan's structural model makes assumptions about which •s the "cause" and which is the "effect" when you look at the relationship between two variables.

In the Vihiga study, the Duncan's structural model of socio-economic achievement was used to describe the effects of two exogenous variables on two endogenous variables. The independent variable is the causal factor that produces the effect or dependent variable. The model therefore helps you think through the reasons that led you to your choice and see what follows when you make such assumptions for every pair of variables in your analysis. The model was run successively in oider to compare its performance on respondents with different socio-economic characteristics. Although previous causal models were not tested on women, the Duncan's causal model in this study is tested on women only.

Conclusion

The area selected for the study was Vihiga District in Western province. The average farm holding within the district is about 0.6 hectares. Great potential exists for dairy zero-grazing development in the area. Data for the prospects and constraints facing women dairy farmers were collected from Vihiga and Sabatia divisions of the district. The divisions have high population density, large household size, many poor households, small landholdings and lack sufficient income generating agricultural activities. Eighteen women groups were selected from the list of 28 using cluster sampling method and systematic random sampling procedure used to select 105 respondents. The sample was biased towards group members who had shown awareness of zero-grazing by registering as such.

I input-output data including costs and income used in the analysis were collected for January to December 1996, while the rest of the data was collected in June and July of 1997. Variables analysed include adoption of zero-grazing dairy systems, productivity, husbandry, agroforestry, penence, farm size, family size, age, group membership, marital status and extension service information.

tabulation analyses using chi-square (x^2) were used to determine the associations between Enables Th resulting p-values were used to decide whether to accept or reject the null thesis iK

ne use of multiple regression model to test the assumed positive relationships Socio '

economic characteristics of the respondents and zero-grazing productivity is also analysis was used to describe the effects of exogenous variables on endogenous

CHAPTER 4

DESCRIPTIVE ANALYSIS

Introduction

This section provides information on the Vihiga District's Agriculture and Livestock Development in terms of dairy farming, support services by the Ministry of Agriculture and livestock Development, NGOs, information on women groups and other voluntary agencies. A number of voluntary agencies and Non-Governmental Organizations (NGOs) that operate in the area assist local people in livestock and other agricultural production activities. Livestock reduction trends show a steady increase in the grade dairy cattle. The section further gives an toalysisof the descriptive data collected on zero-grazing production systems among women in the Strict. Variables addressed include formal education, family size, age, income, marital status, farm size, group membership, husbandry practices, source of grade dairy animals, expose extension, decision-making, structure of zero-grazing, labour, zero-grazing benefits in zero-
^{tQ}rs of productivity, areas under fodder, food and cash crop and constraints ii f^{81}^ Production. It also provides information on the level of agroforestry.

Trends and Current Status of Livestock Production in Vihiga District

According to Vihiga District Development Plan, 1997-2001 (Republic of Kenya, 1997), there are over twenty different types of co-operatives of which the most prominent ones are savings and credit housing, coffee and dairy societies. The co-operative movement is very strong although a few societies still experience management problems of both administrative and financial nature.

\! The time **of** the study, there were a number of operating voluntary agencies (local and international **NGOs)** which undertook various activities. They included V E S T . (Vihiga, Emunaya, **Sabatia and** Tiriki) which undertook construction of houses, water tanks and brick making. Others **were** Maendeleo **Ya** Wanawake, Partnership for Productivity, PRIDE Kenya, Atrica 2000 **Network** under the umbrella of UNDP, Farming System Kenya Ltd., a Christian HiO of African **Inland** Church, Nakuru Fellowship; Action Aid and FIN1DA (Finish International ^elopment **Agency).** The latter six (underlined) promoted dairy farming among other activities. ^GOs in **collaboration** with the Ministry of Agricutlure and Livestock Development and ensi0n Agents **advised** on technical matters, for example, house (unit) construction, napier j^knent and **management,** organizing field days, tours, courses and mini-workshops for the and Agro-**forestry** for firewood, soil conservation and fodder.

Restock in **the** district are cattle, goats, sheep, poultry and pigs. These livestock ^ ^ h o •*olds with meat, milk and eggs but a good percentage of them are indigenous.

Due to lack of adequate feeds for pedigree animals most farmers still prefer to keep traditional M,|s Livestock production activities in the district are restricted by the small size of holdings thus **the** emphasis is on adoption of intensive production system

Table 4 1 below shows livestock production for the period 1992-1995.

j$_a$bt> **4**.1:Livestock Production Trends in Vihiga District, Kenya, 1992-1995

Type of Livestock	1992	1993	1994	1995
Dairy Cattle	6001	6731	7870	8681
Zebu Cattle	80490	139137	114881	93545
Sheep	6375	12334	1 1494	8675
Goats	8060	8926	8240	10907
Poultry	277414	275340	238595	254430
Pigs	572	1716	1768	2340

District Livestock Production Office, Mbale 1995.

Table 4 »$_s$i **ws** ^{l,lat} there was a steady increase in the dairy cattle whereas the indigenous cattle ^mbe$_{rs}$ **Exhibited** a fluctuation during the same period

cattle $_{,n}$ ^e study area increased from 6001 to 6731 between 1992 and 1993. There was a **lei** $^{n o r e a s e fro}$m 6731 to 7870 between 1993 and 1994. The increase of 1139 dairy

ttle during the period was encouraging and showed that the study area has great potential for

jrv development. Between 1994 and 1995 the increase of 811 dairv cattle was encouraging

lthough this was below the increase for 1993 and 1994 period.

Although the zebu cattle also increased during these periods, the increases were erratic.

Opportunities for dairying in Kenya are largely determined by the agro-ecological zones, milk

production system and increased demand for dairy products. In spite of the high population

density in the study area, table 4.1 indicated that there was a remarkable gain in the adoption of

grade dairy cattle in the area, and therefore it was clear that intensive farming in Vihiga is suitable

to the agro-ecological zone.

The concern of this study was with the women smallholder dairy groups that were partly

responsible for the changes in livestock production.

Socio-economic Variables

According to Lionberger et a] (1982), farmers are influenced by socio-economic variables in

to reach family goals. Bahemuka (1985) found that education, family size, age

distribution, income, group membership and marital status are important factors that could affect
?

^r factors like farm management, practices and adoption of new technologies. This study dealt

socio-economic analysis of zero-grazing production system: among women in Vihiga

Therefore, it is important to have a clear knowledge of the socio-economic profiles of
the

[n] farmers in zero-grazing production system. The thrust of the profile was to assist in

socio-economic characteristics for smallholder women farmers in the existing dairy

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p^{**roduction**} system in the district.

FORMAL *education*

Table 4.2 summarizes the various profile variables of women in **-era-grazing** groups in the

district. For the adoption of new farm practices and technologies, education is an important

variable to be considered as it explains an individual's responsiveness to change. Based on the

gathered data, the majority of the respondents had primary education of equal or less than 8 years.

An overall proportion of 49% had secondary or higher levels of education

Table **4.2: Profiles of women (respondents) in zero-grazing in Vihiga District,**

Kenya, **1997.**

Variable	Frequency	Percentage	Mean
Educational Level			
N	105		
< 8 years	54	· Jɪ	
9-to-12 years	40	38	
> 12 years	11	11	
FAMILY SIZE			
N	105		
< 3 person	18	17	
4-to-bpersons	57	54	
person	30	29	
ʌJE DISTRIBUTION:			
< 30 years	105		47
	5	5	
* ³0 to 50 years	66	63	
> years	34	32	
pOME DISTRIBUTION (KSH) /YEAR			
Reported	105		24594.00
<5000	35	33	
& 25000	7	7	1739.00
	44	42	11558.00
	19	18	63201.00
		j,721,560.00*	

* = Gross sales for Jan.- Dec. 1996

family**

jₛ jften argued that family sizes commonly compete with expenditure on farm inputs as the

f rmer has to divide his/her income between subsistence and purchase of farm inputs,

additionally, family size can also be weighted against availability of labour for farm work. In

Table 4 2, it was shown that the most predominant (54%) family size in this study consisted of 4

to6 persons per farm household. A proportion of 17% indicated that they had 3 or less persons

per farm household. However, 29% of the respondents had family sizes of 7 or more persons per

farm household.

Ace was considered as an important variable as it is known to positively influence the acceptance

of new farming practices for example, zero-grazing. Thus the *a priori* theory is that young

farmers have higher propensity to change than old ones. The latter ter,d to be conservative in

:cepting new farming techniques. The age distribution was skewed toward middle age as 63%

ot the respondents belonged to the 30 to 50 years category and 5% of the respondents were

young farmers aged 30 years or less. However, 32% of the respondents were considered as old

"rmers who were 50 or more years old. Overall the mean age of the smallholder dairy women

jrmers in lhe study area was 47 years.
'ton

"^distribution variable was approximated on the basis of the gross sales (total milk,
Restock ▷ •

• ,aes and skins and manure sales) for the year 1996 by individual respondents. The

Mounted to Ksh. 1,721,560 with a mean (hereby referred to as income for the total

9 0

population who reported their income) of Ksh 24,594. As shown in Table 4.2, the income distribution was categorized into lower income group (< 5000), medium income group (5001 - to 25000), upper income group (> 25000) and the unreported income group.

The«results showed that 33% of the respondents did not report their annual average incomes. Among those who reported their incomes, the majority (42%) were in the medium income category. This was followed by the upper income category with 18% of the respondents and the least represented group was the lower income category with only 7% of the respondents. Further, intra-group analyses indicated that the mean income in the lower income category was Ksh 1739.00, while for the medium income group was Ksh 11,558.00 and that of the high income group was Ksh 63201.000.

"'general, the results showed that the study area was dominated by smallholder women dairy termers (42%) who belonged to the medium income category of between Kshs. 5001-25000

Status

•economic variable, marital status is often associated with influences in decision-making Th' •
\   *s is because married women are considered to belong to "stable families" which offer
B w * in decision-making and adoption of new ideas. In rural settings, one "benefit" for
>r ied v,0n   .
r   neads of households is that they have individual or joint ownership of cattle and
^^ better al | .
L   e to demand assistance from the husband's family. This is as opposed to divorced

rsing'[e] women (Youssef et al. 1983). In Table 4.3, the majority (87%) of the respondents were

nied The least (3%) were the single women. Overall, the proportion of divorced women

accounted for 10% of all the interviewees.

Table *A* 3; **Other Selected Socio-economic characteristics of Respondents in**

Vihiga District, Kenya, 1997

K&RITAL STATUS	Frequency	Percentage	Mean
y	105		
Married	91	87	
Single	3	3	
livorcee/Other	10	10	
ijs one wife			
1=Yes	94	90	
0=No	10	9.5	
FARM SIZE:			
	105		3.6
< 5 acres	79	75.2	
:-to-12 acres	16	15.2	
l > 12 acres	10	9.5	
1 "ffUP MEMBERSHIP:			
	105		
i»Yes	103	98	
1 0=NO	1	1	

--rce: *Primary* **Data**

• *",e: Where cases do not add up to 105 indicates that information was not provided by some*

i tyondents. Missing cases were therefore not included in the analysis

-Wives

$^{nt0 nuiT}$ber of wives, the study was interested to find out the influence of the presence

i ^{0n} ^rms associated with zero-grazing. On the one hand it was postulated that

P^c e of$_c$

co-wives on a family farm may spur competition towards adoption of zero-grazing

^{i0n} the other l   i

^{C1} nand, they may impede the development of the system. Table 4.3 shows that

only respondents were co-wives. A high prevalence of farm families had only one wife as 90% of the respondents identified with that category.

farm Size

Economies of size is one of the long standing principles of farm management with the postulation that large farms are associated with higher productivity and profit maximization while the inverse applies to cases with small farm sizes (Anaman, 1989). Table 4.3 shows that small farm sizes dominated the study area with 75% of the respondents indicating they had farms of 5 acres or less while large farms were the least prevalent accounting for only 10% of the respondents. However, l^'oof ihe respondents indicated that their farm sizes were between 5 and 12 acres that can be I -negorized as medium sized farms.

""hership in Women Groups

[n] Vihiga District, majority (98%) of the interviewees responded in the affirmative when they tasked whether or not they belonged to a women's group Only 1% of the respondents ^eredin the negative (Table 4.3).

vcordm

£[i0] Mullins (1992) on impacts of intensive dairy production on smallholder women

^abilit astal Kenya, women who belonged to groups tended to have benefits such as V to buy food, paying school fees, hire labour and purchase dairy inputs.

L

Husbandry Practices

Management

Smallholder dairy husbandly practices examined in this study are summarized in Table 4.4. In this study, the majority (71%) of the respondents indicated that they were managers of the dairy farms and only 28% were male managers on behalf of the respondents.   However, it was surprising that hired labour was not an issue in the management of cattle in the district (Table 44). Studies on dairying at the coast of Kenya by Mullins (1992) confirmed that in a large percentage of male-contact farms, women were the de-facto managers although they were not the primary contacts for extension agents

rarm Record

^ne of the ways of increasing farm productivity and which in turn would result in increased tousehold incomes is by considering farming as a business rather than as a way of life. Farm ^ord keeping plays a pivotal role in smallholder dairy husbandry especially in farm analysis and

P'mi

[nin]§   I his is due to the fact that when properly recorded, summarised and interpreted they [u¢]$ed as in the profit/loss estimation. The descriptive analysis of the farm record (Table •®dthat 47% of respondents did not keep records while close to 44% of the respondents ^them

r

fodder Establishment

Qn-farm fodder establishments are clear indicators that farmers are ready to practice zero-grazing

otherwise it would be costly to depend on purchased fodder. Additionally, there is an

advantageous link between establishment of own fodder and production of food crops in that by

concentrating and increasing fodder production, the farmer is assured of reliable feed supply for

-he animals. Hence, an increased milk production and by extension increased household incomes

which could then be used to purchase other family needs. On the basis of the data collected and

summarized in Table 4.4, there was a high awareness of the importance of own-fodder

establishment for zero-grazing purposes. This is because 99% of the respondents indicated

bung established their own fodder.

labour

faults trom a study by Chavangi (in Martins, 1990, p. 36) on smallholder farms in western

Ma showed that women contributed substantial labour to all of the activities associated with

wy enterprises. In this study (Table 4.4) all the respondents indicated that they provided

fettta I l

^{0l}»r tor fodder harvesting. By extrapolation, this shows that fodder harvesting for

S has not been mechanized in the district.

Persons available for farm work is an important parameter to estimate the

y of Option ol a new technology such as a labour- intensive zero-grazing. Table 4.4

£ ^{ne} respondents had less than three persons available for farm work while 26%

,l the respondents indicated that they had 3 to 5 persons available for farm work. However, only 2% of the respondents indicated that they had more than five persons available for farm work.

Husband *Residents*

In this study, results shown in Table 4.4 indicate that 63% of the respondents had husband residents on the farm and only 26% of the respondents had no husband residents on the farm.
«

According to Efde (in Rangnerker et al., 1994, p. 52), husbands were not reported as being Mibsiantiall) involved in fetching water, weeding, spraying, or herding, milking, shed cleaning and grass cutting. However, Efde in her study at the coast of Kenya observed that half of the male tarm owners in the study were salaried employees and that one third of the farm owners did not consider farming as their main occupation. The low figure for husbands' labour contribution to ^ dairy enterprise suggests that an indirect impact of male off-farm employment is that of Placcment of burdens of intensive dairying on women.

Experience

ownership of cattle may be looked at as an advantage in livestock management specially wh
n new breeds which require new livestock husbandry are introduced. In Table 4.4, ^°rity (9,O
the respondents indicated previous ownership of cattle while only 3% of the indents j n r ,cated they had not owned cattle.

Tab>1e   Smallholder dairy husbandry by women group in Vihiga District,

Kenya, 1997

Variable	Frequency	Percentage
cTc-tirMimagement:		
	105	
Respondent	75	71
Husband	29	28
Hired labour/other		
Fann Record		
N	105	
I=Yes	46	44
0=No	49	47
On-Farm Fodder Establishment		
N	105	
I=Yes	104	99
0= No	1	1
Fodder Harvesting:		
N	105	
Manua 1	105	100
Machinery/others	0	0
Number of persons available for farm work		
< 3 persons	48	46
persons	27	26
> 5 persons	2	2
Group	43	41
Husband's Resident on Farm:		
I-Yes	66	63
0*No	27	26
Cattle ownership	105	
I=Yes	102	97
0=No	3	2.9

S oUrc«- Primary data collected from Vihiga District,   1997.

ote Where the percentage do not addupto 100% indicates that there Mere insufficient

Qtion provided by the respondents.   Therefore, deleted from further analysis.

4.4:   Smallholder dairy husbandry by women group in Vihiga District, Kenya, 1997

Vari^atie	Frequency	Percentage
ₑ Management:	105	
| ;ₑspondent	75	71
gired labour/other	29	28
faım Record	105	
i		
l*Yes	46	44
p No	49	47
;r.-Paım Fodder **Establishment**	105	
J'Yes	104	99
0ˢ No	1	1
I f:-der Harvesting:	105	
M a i	105	100
Machinery/others	0	0
luabcr of persons available farm work		
< j persons	48	46
persons	27	26
' ᵗ persons	2	2
16«Up	43	41
Pond's Resident on Farm:	66	63
	27	26
	105	
0ʷnership:	102	97
	3	2.9

^ c e ;
Unary data collected from Vihiga District, 1997.
VH* *Where* if,

l⁾ᵉʳᶜᵉ»tage do not add upto 100% indicates that there were insufficient

WHded by the respondents.   Therefore, deleted from further analysis.

Exposure to extension services

The role of extension services in the dissemination of information on new and/or innovative farming practices cannot be overemphasized. There are various sources through which farmers can access new agricultural information, for example, agricultural magazines, agricultural practitioners, local resource persons and other publications (i.e. text books).

Table 4.5: **Exposure to extension service information in Vihiga District, Kenya, 1997**

MjfeUUlV sources of information	Frequency	
Textbooks:		
=Yes	21	20
o=No	83	80
Experts (Ext. Agents)		
=Yes	86	83
D=No	18	17
Magazines		
=:es	15	14
G=Ho	8 9	86
local resource persons		
i Yes	59	57
ONo	4 5	43
'.•ministration		
o=No	80	77
i^ern students		
I–Yes	11	11
0=No	93	89
^ h b o i^inars, NGOs		
seminars	10	10
'fen group	7	7
eighbours	2	2
(Action Aid)	1	1

Pr-Uaary data *collected in Vihiga District, 1997.*

of the results obtained in this study (Table 4.5), data collected showed extension ^ts w_ere. I

e niost sought sources of agricultural information on new and/or innovative farming

• °Portion of 83% of the respondents indicated that the major source of information

^essj oandry were these agents. This was followed by local resource persons (i.e. ve fa ^^F ^ r s and "rain-makers" (57%), publications (i.e. text books and magazine) (34%).

98

f

The least sought source of information were the student interns (11%) and local administration (?3%) of the respondents. Other sources of information on livestock husbandry were seminars (lo%), NGOs (1%), neighbours (2%) and women groups (7%).

Another important variable in extension services is medium of creating awareness about new and/or **innovative** farming practices (i.e. zero-grazing).

When respondents were asked when they became aware of the zero-grazing practice (Table 4.6), women group was identified by the majority (84%) as the medium through which they became aware of zero-grazing technology. This was followed by agricultural extension agent (64%), and mass media (i e. radio, posters, newspapers, farm magazines) (33%). The least mentioned medium of creating awareness was NGOs (22%). Other mentioned sources of awareness were •armers' field day (4%), other groups (3%) and vocational training (1%).

Table **46:** **Sources of zero grazing Awareness**

Media	Frequency	Percentage
l=Yes	34	33
	70	67
Somen groups		
l=Yes	87	84
o=No	17	16
Agricultural **extension Agent**		
I=YfS	67	64
:=No	37	36
SGOs		
[=Yes	23	22
	81	78
Others:		
Farmers' day		
r.ther groups		
vocational training		
Types of additional training:		
'ero grazing **demonstrations**	8	
iiorkshops/**Seminar/refresher courses**	23	22
Tour visits	8	8
Field days –	26	25
Duration of **additional training**		
	105	
$ davs	43	41
5 to 10 days	14	13
>10 days	4	4
•'*:iod **attended training:**		
1*70-1979	5	5
	2	2
T90-1997	54	51

Source: **Primary data, collected** in **Vihiga District, 1997.**

*Where **cases** do not cicki up to 105 indicates that information was not provided by some* **spondents.** **Therefore** *were deleted from further analysis.*

W(iays, semin ars/workshops and refresher courses have lately become important avenues for

w agricultural information and farming practices to farmers. As shown in Table 4.6,

Were rTlentioned by 25% of respondents as important avenues of training and sourcing

nc>wledge to farmers. This was followed by workshops (22%). The least mentioned oftrai

prog and sourcing additional knowledge by farmers were the tour visits (8%) as well

T ^ n g d e m o nstrations (8%).

(41%) mentioned duration of an additional training was less than 5 days which was by 5 to 10 days (13%) and more than 10 days (4%).

A s indicated in Table 4.6, the majority (51%) of the respondents had attended additional training

/ >

in the 1990-1997 period. Prior to the 1990s, additional training attendance was negligible among farmers as only 7% of the respondents indicated attendance during that period.

Gender and Decision - Making in Zero-grazing Technology

Increases in dairy products are premised on intensification of smallholder farming systems through introduction of zero-grazing-based dairy "package" incorporating Bos taurns X Bos indicus cows, activated fodder and recycled nutrients from animal slurry (NDDP, 1984). Additionally, Hassan et al. (1994) postulated an interesting hypothesis that women are mors, prone to early adoption 'hanmen and therefore could serve as better catalysts for technical change. Estimation of decision-making in adoption of zero-grazing technology was one of the main highlights of this Hudy. Results shown in Table 4.7(a) indicated that adoption of zero-grazing was widespread in * study area with a high percentage of 98% adopting the technology. However, only a meagre non-adopters.

-r u\f 4 7(a): Decision-Making in the adoption of Zero-Grazing Technology by Smallholder F^mers in^

Vari^®	Frequency	Percentage
p_t^on of zero grazing technology		
	105	100
?=Yes	103	98
o=No	1	1
_is_ion to adopt zerograzing:		
	105	100
Respondent	50	48
Husband	3	3
	50 .	48
Agent/other	1	1
Operate Zero-grazing unit		
	105	100
N ,	97	93
l=Yes		
o=No	7	7
\qreement with rotational calf season		
	105	100
All	56	53
l=Yes		
0=No	7	7

Source: **Primary Data**

Note: Where cases dot not attain a total of 100% indicates some respondents did not provide

responses to the categories asked.

According to Hassan et al (1994), women on female-owned and femr^-contact farms exercised

water control over important dairy resources and have more autonomy in their decision-making

ability than the women on the other farm types. Table 4.7(a) showed that close to 50% of

respondents were the decision-makers in adopting zero-grazing and a similar percentage indicated

to respondents and their husbands, 3% husband alone and 1% other agents were the decision

in adopting zero-grazing.

the advantages associated with women groups in zero-grazing are merry-go-round

of _c_|f

ownership and pooling of resources for individual and £roup benefits. In Table

v j^Qre than 50% of the respondents agreed with the rotational calf system arrangement and

Ies%ʼt,iai,n ,0% not agreeing with such arrangement.

of the basic indicator of a smallholder dairy farmer is the establishment of a zero-grazing

stnicture (]**JDD**P, 1984).   When the interviewees were asked whether or not they operated zero-

i n g un jts for grade cows, over 90% responded in the affirmative and only (7%) indicating that

they did not operate such units on their farms (Table 4.7(a). Subsequently, of those who operate

a zero-grazing unit on the farm, majority (78%) obtained the unit plan* from the Ministry of

Agriculture, Livestock Development and Marketing (MALDM). This was followed by those who

made their own unit plans (25%), and those who obtained from fellow farmers (13%). The least

114%) mentioned source of obtaining zero-grazing unit plan was the Ministry of Energy. Other

sources of unit plans included seminars (4%), farmers' day (1%), NGOs (1%) and reading (1%)

t Table 4.7(b)).

4 7(b): Sources of Information on Zero-grazing Unit (PLAN) in Vihiga JjS&ot, 1997

Variable	Frequency	Percentage
Source of zero grazing unit(PLAN)	105	100
MALDM	80	78
pies	16	16
0=No		
Hin energy	14	14
I=yes	82	80
0-no		
group members	20	19
I=Yes	76	74
bellow farmers	1	1
HGOs	1	1
Reading	1	1
Years of Unit Ownership:	105	100
H	53	58
= 5 years	33	36
6 to 10 years	05	6
> io years		
So* of grade dairy animals in Unit	105	100
1 to 5 animals	86	82
6 to 10 animals	13	12
> 10 animals	1	1
So. of grade cows in milk	105	100
All	84	82
< 3 cows	80	80
= 3 cowb		

Jero-Grazing Experience and Grade Dairy Ownership

In Sub-Saharan Africa, smallholders have yet to widely incorporate dairying into their farming systems. While traditionally contributing substantial amounts of labour to crop activities, smallholder farm women may be less accustomed to working with and managing livestock, and Ocularly with the more demanding exotic breeds typically incorporated into intensive crop- -estock Production systems (Spring, 1983). Results of data collected, Table 4.7(b), showed that the J°rity ot respondents (58%) had owned zero-grazing units for five years (5) or less •die T8 that zero-grazing is a recent adoption in the study area. This was followed by those • Wned the units for six to ten years with 36% of respondents identifying with that

category and 6% of respondents had owned their units for more than 10 years.

Zero-grazing system is the most intensive milk production system characterized by keeping high-yielding grade cattle like Aryshires, Friesians, Jerseys, Guernseys ar.ci their cross breeds. These cattle are permanently kept in a cowshed, where they are fed and milked and where they also sleep. Zero-grazing farmers are predominantly market producers with about 2-5 cows (Stotz, 1983). As shown in table 4.7(b), the majority of respondents (82%) had 5 or less grade cattle in their zero-grazing unit. While 10% of respondents had 6 to 10 grade cattle in their zero-grazing units. However, only 1% of respondents had more than 10 grade cattle in the unit. This conforms with Stotz's study (1983) which found out that 2-5 cows per unit was the most common among zero-grazing farmers.

Of the respondents who had grade dairy cows, 82% indicated they had less than three cows in milk and only 8% of the respondents indicated they had 3 or more cows in milk (Table 4.7(b).

v

Recommended Zero-Grazing Structure

TL

e recommended standard for a zero-grazing structure as per the MALDM is that it should have
* Iron-sheet roof, three semi-closed sides and concrete floor. In this study, 86% of the

ents 'ndicated that they had iron-sheet roofed units, 5% had grass-thatched roofs and only

4 hart ft'»L
lei iron-sheet or grass-thatched units(Table 4.7(c).

A⁵ for the sides, 11% of the respondents had all of them open. Of the interviewees, 14%

•ₙdicated that they had one side of their units open for the purposes of feeding, watering and

either for exiting or entering the structures. Those who indicated that they had two sides

ccounted for 5% followed by 3% who answered that they had three sides open.

fable 4.7(c): Type of Zero-grazing unit structures in Vihiga District, 1997

Variable	lies	Percentage
Type of Zero-grazing structure(Roof):	105	100
* u -	85	86
Iron sheets	5	5
Thatched (grass)	1	1
Iron/glass thatc:hed .		
lero-grazmg unit walls (sides) :	105	100
N	11	11
All sides open	14	14
One side open	5	5
Two sides open	3	3
Three sides open		
lero-qrazing unit floor:		
N *	105	100
Concrete	6	6
Murram	7	7
.uarry chips	2	2
damned earth	9	9
Concrete/murram	2	2
oncrete/quarry chips	1	1
ost of zero-grazing unit construction		
	105	100
A 0 0 0 shillings	6	6
" W n k 0 20< 000 shillings	34	33
20,000 shillings	3	3

^ Primary Data

ᵒᵗ-Where cases do not attain a total of 100% indicates some respondents did not provide*

I to the categories asked.

'^ievv₍ees indicated different makes of floors of their zero-grazing units. These included floors

de of concrete (6%), murrain (7%), quarry chips (2%), earth (9%), concrete murrain (2%) and concrete/quarry chips (1%).

The average cost of constructing a zero-grazing unit in the study area was Ksh. 30,000 as reported in Sewe (1993). Table 4.7(c) indicated that the majority 33% of the respondents incurred costs of between Ksh. 10,000-to-20,000 in constructing their units which were below the average cost given by Sewe.

Benefits of Zero-Grazing

Table 4.8 shows benefits derived from adoption of zero-grazing systems by women groups in Vihiga District in 1997. When interviewees were asked to state some of the benefits associated with adoption of zero-grazing systems, the majority (42%) identified obtaining a calf as the main benefit. This was followed (38%) by obtaining mature grade cows .

le other mentioned benefits included milk production (0.4%), employment (1.8%) manure ^o) credit (1 8%) and group membership (1.8%).

fable   Bene^^ts derived from adoption of zero-grazing systems by women

groups in Vihiga District, Kenya, 1997.

Benefit	Frequency	Percentage
	70	41.7
Gain skills	6	3.6
Employment	3	1.8
Manure	3	1.8
Grade cow	64	38. 1
Milk	1	0.4
mcome generation	6	3.6
Access to training	9	5.4
Credit .	3	1.8 •
Group membership	3	1.8
	168	100

Source: Primary Data

Agroforestry systems practised by smallholder dairy women group in Vihiga District, 1997.

The **importance** of agro-forestry practice as an innovative farming technique cannot be

overemphasized as it increases farm productivity in improving soil fertility as well as provision of

animal **fodder.** Results (Table 4.9) from the study area indicate that there was reasonable

-ppreciation **of** the practice of agro-forestry as an innovative farming technique. **A** proportion of

the respondents (40%) indicated that they practiced agro-forestry. However, 60% of

^pondents **had** not adopted the practice.

i_e 4.9: **Agroforestry systems practised by smallholder dairy women groups Vihiga District, Kenya, 1997.**
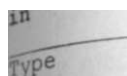
	Frequency	Percentage
„ artice **of agroforestry** P^{racC}	105	100
*	42	40
	63	60
qsNo		
Tree/pasture		
I=Yes	8	8
C=No	34	33
Trees/crops		
I-Yes	41	39
0=No	1	1
Trees/with **animals**		
I=Yes	2	2
0=No	40	39
Special **Nesting**		
I=Yes	4	4
0=No	38	37
Ithers (Desmodium ::iter **cropping with napier)**		
I-Yes	2	2
C=No	4 0	38

Source: Primary Data

ᴵ<ote *Where* *the percentages do not add up to 100% indicates missive information*

*""">some **of I** he respondents.*

ᵉn the interviewees were asked the specific agro-forestry systems they practised, the majority

$^{/o}$) of respondents identified trees with crops as the agro-forestry system followed by trees

PP®sture (8%)> special nesting (4%) and trees with animals (2%). Other agro-forestry systems

^included desmodium, and inter-cropping of napier identified by 2% of the respondents,

^ever, 3 go/ ,>
^{0} ot the respondents did not mention any other agro-forestry system practised.

in order to analyze this variable further, interviewees were asked to state the main reasons for the above specified agro-forestry system practised. As indicated in Table 4.10, improvement of soil fertility was mentioned by the majority (28%) as a major reason. This was followed by provision offodder (19%), provision of tree products (15%) and as wind-breakers (2%). Other reasons for the specified agro-forestry practices included provision of firewood (4%) and retention of soil (2%). However, 34% of the respondents did not give reason for the specified agro-forestry systems practised.

Table 4.10:   Reasons for practicing agroforestry by women groups in Vihiaa
               District, 1997.   y

Reason	Frequency	Percentage
Improve soil fertility		
	105	
>Yes	29	28
0=No .	14	14
For tree products		
I=Yes	16	15
0=No	26	25
dind breakers		
l=Yes	2	2
0=No	40	39
•rovision of fodder		
.=Yes	20 on	19
0=No	22	21
;:ner reasons:		
«etain soil	6	6
•=Yes		
r; rewooci	2	2
	4	4

productivity

Average Annual production costs and returns among the smallholder dairy women groups are indicators of productivity. Table 4.11 shows the production costs and returns associated with women dairy farmers in the study area. There were 3 major costs associated with production among the smallholder women dairy farmers. These were labour, feed and veterinary services. Among these costs, annual average expenses associated with labour were the highest (Ksh. 9260.oo) followed by feeds which had an annual average cost of Ksh. 8486. Veterinary services had the least annual average cost of only Ksh. 1337.00

Table 4 ^: Annual average production costs and Returns among the Smallholder Women Groups m Vihiga District, Kenya, 1996

Variable	Value (Ksh)
AVERAGE COSTS:	
Labour	9260.00
Feed	8486.00
Veterinary	1337.00
Total Average	19083.00
mean RETURNS:	
Household milk consumption	6551.00
y.iik sale	15906.00
Livestock sales	25862.00
ides and skins	2811.00
'.otal Mean returns	51130.00

Source: *Primary data collected in the study area, Jan. - Dec. 1996*

The results showed that livestock sales had the highest (Ksh. 25,862) annual mean returns to the ^ women farmers. Other significant sources of income included milk sales which had an •^average return of Ksh. 15,906.00, followed by milk used for household subsistence valued [na]nnual mean of Ksh. 6551.00. Hides and skins provided for the least annual average returns [!Ksh] 2811.00.

r

Comparatively, the results gave a positive indication that it was profitable and therefore cost-

effective to engage in smallholder dairy production by women farmers in Vihiga District. This can

^supported by the fact that the total annual average returns (Ksh. 51,130.00) exceeded the total

annual average cost of production of Ksh. 19,083.00) by as much as Ksh. 32,047.00.

\rea **Under Fodder, Food and Cash Crop**

Table 4.12 shows divisions of farm for various production activities by women smallholder dairy

farmers in Vihiga District. Based on the obtained results, the majority (94%) of smallholder
«

Aomen dairy farmers allocated less than 5 acres of their farm to fodder production. This was

followed by area under food crops (92%) which was less than 5 acres. Among farm production

activities, 51% of the respondents allocated less than 5 acres of their land to cash crops.

Furthermore food production activity was the only one which respondents indicated they

^located larger portions of their farms for that purpose.

Prospects

wish **to** diversify and intensity agricultural production are inducing farmers to redefine

Vc#ock and its benefits in order to favour dairy production in rural dairying districts. The scope

reasing pasture and fodder production is substantial. Introduction of special purpose
'odder err

P^s **to** smallholder farmers has continued to be supported by adequate research support

C ^ional level **A**
       C1   Appropriate todder varieties adapted to specific production areas must be

identified   For example, in Vihiga District, Napier grass as fodder has proved to be suitable due to good growth.   Groups should play a more aggressive role in providing extension services to their members.   The area of feeds should be considered so as to tackle the problem of low quality feeds. Processing of crop residues especially chopping may be handled by groups whereby chaff cutters can be purchased to serve group members.   Table 4.12 shows reasonable land acreage in the study area allocated to production of fodder, food and cash crops   This indicates that food, fodder and cash crops substitute and supplement each other in the provision of feeds to the dairy zero-grazing units.

identified   For example, in Vihiga District, Napier grass as fodder has proved to be suitable due to good growth. Groups should play a more aggressive role in providing extension services to their members. The area of feeds should be considered so as to tackle the problem of low quality feeds. Processing of crop residues especially chopping may be handled by groups whereby chaff cutters can be purchased to serve group members. Table 4.12 shows reasonable land acreage in the study area allocated to production of fodder, food and cash crops   This indicates that food, fodder and cash crops substitute and supplement each other in the provision of feeds to the dairy zero-grazing units.

4.12: Divisions of farm for various production activities by smallholder dairy women farmers in Vihiga District, Kenya, 1997

	Frequency	Percentage	Mean
Food crop			
N	105		1.3
(< 5 acres)	97	92	
Medium (5 to 10 acres)	4	4	
urge (> 10 acres)	1	.1	
Cash crop			
	105		0.8
Small (< 5 acres)	53	51	
Medium (5 to 10 acres)	0	0	
Large (> 10 acres)	0	0	
Grass			
N	105		0.5
Snail (< 5 acres)	91	87	
Medium (5 to 10 acres)	1	0.1	
Large (> 10 acres)	0	0	
Fodder			
N	105		
Small (< 5 acres)	99	94	
Medium (5 to 10 acres)	1	0.1	
Large > 10 acres	0	0	

Source: Primary data collected in Vihiga District, 1997,

Constraints in Zero-grazing Dairy Production

Oneol the objectives of this study was to identify major constraints to dairy production in Vihiga District.

Tabl* 13 below shows durations taken before getting a calf as a constraint in the merry-go-'^rouP rotation. The majority (41%) of respondents had to wait for less than 3 years before

obtaining calves in the rotation system while 14% had to wait for between 3 and 5 years. The

least mentioned duration of waiting for a calf was more than five years. This period was given by

only 5%   respondents.

Table 4.13: Major constraints in production in zero-grazing smallholder dairies   among women groups in Vihiga District, 1997.

Conslfant	Frequency	Percentage
ftepier7bana grass		
N	105	
I=Yes	84	80
0=No	19	18
Concentrates availability		
I=Yes	30	29
0=No	73	70
Concentrates cost		
I=Yes	52	50
0=No *	51	4 9
Poor price		
I=Yes	29	28
0=Wo	74	71
Poor markets		
I=Yes	33	31
0=No	70	67
disease problem		
-=Yes	53	51
0=No	50	4 8
^hers major constraints		
^rugs/veterinary services	16	15
Feeding	2	2
A.I services	9	9
^moteness	1	1
'heft	1	1
Ration of Calf Rotation		
J³ years	43	41
> 5 years	15	14
years	5	5

        Primary Data

i$_n$ Table 4.13, the majority (80%) of the respondents identified lack of napier/bana grass as the major constraint in milk production.

Other major constraints identified included animal disease (51%) followed by cost of concentrates p0%) However, the least identified constraint was poor milk price as 71% of the respondents indicated that it was not a problem. This was followed by availability of concentrates as 70% of the respondents indicated it was not a major constraint in milk production.

Additionally, unavailability of the markets was not a major constraint to milk production since 67% of the respondents listed it as not a problem.

Medicine cost/veterinary services (15%) and poor A.I. Services (9%) were among other distraints to milk production reported by the respondents. However, feeding (2%), remoteness •"o)and theft (1%) were the least mentioned constraints.

onclusion

Mile of dairy woman farmer in the study area indicated a primary level of education, a B P family size (4-6), married and mostly of middle age (30 to 50 years). Such a farmer had *·ⁿthe medium category (5001-to-25000), a small farm size (5 acres or less) on which she Managed grade dairy cows (1 or more), grew fodder, food crops, cash crops with

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assistance of farm household and hired labour. Information for husbandry practices was obtained "om extension agents, women groups, mass media, field days, seminars and workshops. Decision-making for adoption and operation of zero-grazing dairy system was made by the oman or the woman and her husband. The grade cows were associated with various benefits including milk, manure, credit, employment and group membership.

V>roforestry was practiced for soil fertility, fodder, tree products, wind breakers, etc. Although zero-grazing was found to be profitable and cost-effective for the woman farmer to engage in, lack of feeds and cost of concentrates, labour costs, animal diseases, Artificial Insemination services and veterinary services were found to be major constraints in the system.

CHAPTER 5

ANALYTICAL TECHNIQUES

introduction

This chapter is divided into three sections. The first section shows associations analysis. The associations are between zero-grazing dairy units and various socio-economic characteristics. Associations between zero-grazing operations by women groups v*ith agroforestry practices; zero-grazing operations and purposes of practicing agroforestry; associations between sources of information and adoption of zero-grazing practices.

The second section deals with multiple regression analysis. Twelve variables (income, area under 'odder and food, feed costs, wife's education, number of children, labour costs, veterinary costs, "umber of grade cows, age, farm size and husband's education) were introduced in the regression ʳ^del in order to select optimal set of explanatory variables.

^ third section deals with path analysis in which standardized path coefficients are used to ^Pare between effects of causal variables.

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J $_{aSS}$0CIATION **ANALYSIS**

The data obtained from the respondents were further subjected to cross tabulation analysis to determine the association between zero grazing technology and animal husbandry, extension services, agroforestry practices and personal characteristics of the women dairy farmers.

These types of analyses were carried out because most of the variables obtained in the study were categorical. Further, the few continuous variables for example, number of animals, acreage, milk yield and income were also categorized. However, these variables (continuos) were further analyzed using parametric methods, namely, regression analysis.

Hypotheses

The first two hypotheses were concerned with the effect of socio-economic characteristics and espondents' husbandry experiences on the adoption of zero-grazing and productivity. The third pothesis investigated the relationship between quality of husbandry and productivity (milk JW The fourth hypothesis concerned the associations between the practices of agroforestry adoption of zero-grazing. The last hypothesis examined the associations between sources of on '"formation on dairying and adoption of zero-grazing. Cress-tabulation analyses using were used to determine the associations between the variables in hypotheses 1,2,4 and

hypothesis i was tested using multiple linear regression analysis.

Relationship Between Socio-Economic Characteristics and Adoption

ₑjj established phenomenon in developed countries is that younger farmers are more likely to adopt new technologies than older farmers (Lionberger, et al., 1982). in this study, sources of obtaining animals (grade) were investigated by cross tabulating the variables age groups with sources. One may be influenced to adopt the zero-grazing system depending on the source of the dairy animal. Table 5.1 shows that women groups contributed more towards obtaining mature cows followed by "purchased animals". The interesting finding was that majority of the respodents who obtained the cows either through the groups or own-purchases, were in the 30-to-50 years age category. These results indicate that age was as an important variable in adopting
f
new technologies but was more skewed towards older farmers contrary to the above assumption. Older people are credit worthy, own land titles and collaterals. The mean age of the respondents was 47 years.

'able 5.1 Distributions of Age Groups by how mature cows were obtained by women in Zero-

-^zing dairies in Vihiga District, Kenya, 1997.

How Dairy Cows were Acquired							
Respondents	NGO	Purchased	Women Group	Bought W Group	Grant Breeding	Bought Calved	N A
$_{Age}$(Years)							
<30	-	6(7.3)	-	-	1(1.2)	-	2(2.4)
31-50	2(2.4)	19(23.2)	14(17.1)	7(8.5)	-	1(12)	1(12)
$_i$ >5o	4(4.9)	3(3.7)	14(17.1)	7(8.5)	-	-	-

P = Value .00043

( ) percentages.

\/A= Not Applicable   NGO = Non-Governmental Organization

However. ihe actual age-group as a socio-economic characteristic among the farmers was not

sgnificantly associated with adoption of zero-grazing dairy units (Tab'e 5.2). Thus age was not a

iitTerentiating resource in the adoption of this technology (P = 0.64). Therefore, it is probable

that there were other underlying family proxies determining the adoption rates (Table 5.2).

|.,ble **5.2:Associations between operating zero-grazing dairy units and socio-economic**

haracteristics among women groups in Vihiga

District, **Kenya, 1997.**

Characteristic	P - Value
AgegrouP^s	
(<30,31-50, >50).	.0.63782
Number of Children	
,<3,4-6, >6).	.0.04324*
Husband lived on farm.	.0.13834
Formal education up to 8,	
Form IV, above Form IV	
Wife.	.0.06916**
Husband.	.0.01534*
'Vner Family Members on farm	
(<3.3-5,6-8).	.0.82192
Member of dairy	
^{Ao,Tlen} group.	0.00005**

T "

         Significant at P<0.05

  Significant at P<0.10

I   mbers in this study comprised the mother, husband, children and other members

        $^{e\ f}$arm (extended family members). It is interesting to note the importance of

children in zero-grazing practice. Table 5.2 shows the number of the children in the family were .j,,iificantly (p< 05) associated with the practice of zero-grazing. Therefore, it can be concluded that **zero**-grazing operations relied (P<05) on the presence of the children on the farm. The presence of the husband and other family members were not significantly (P>.05) associated with gazing operation. This would explain why women play a big role in decision-making. However, even the relatively short period the husband is on the farm and the presence of other members in the family are of importance to the proper functioning of the societal systems and institutions (Lionberger et al., 1982).

popkin et al. (1976) indicates that "there is close to a one-to-one correspondence between an ncrease in the maternal-work-time and a decrease in the maternal leisure time. . . . . .When \omen work, older children substitute for "mother" in the home chores and care of the siblings-it is mothers and children who substitute for each other in cooking, hauling water and animal car*'. It was hypothesized that personal and smallholder dairy characteristics had an effect on the adoption of zero-grazing. Of critical importance in this study were questions concerning current umber of children "actual family size", and "total number" of children in the family. This is fcause it was anticipated that these two variables would significantly contribute to the farm abour.

ꞌᵉᵗ ᵃꞌ > (1983) reported that "men devote almost all their fundamental time to work that P ⁰ ^ market income and in the form of wages. In contrast, women devote their work time to j ' tion ot market work (work that generates cash income or "income in kind"-this can " ⁰ⁿ family farm or home garden) and maintenance. The results of this study are

con^{sistent} with these views.

_tilucatio"

ki (1966) asserts that, "some people value knowledge for its own sake, others have sought it chiefly because they thought it is useful. To attain these goals, individuals are obliged to utilize, as best they can, the various resources with which they are endowed by nature and society. Individuals use these in an effort to achieve those things they most value in order to obtain

«

ultimate satisfaction such as comfort, health and life itself. Additionally, Selowsky (1983) reported •hat "female participation in education may have a far-reaching impact on the structure of the educational and labour forces and labour's contribution to the economy. Women as "mothers," iherefore, make first investment that are critical to future economic growth," Nonetheless, in this study, it was observed that the wife's level of education was not significantly (P>.05) associated ith zero-grazing operations (Table 5.2). On the contrary, the husband's level of education was

j significantly (P< 05) associated with the operation of the zero-grazing dairy units on the farm .

Thus the husband's educational level contributed to the practice of Zero-grazing. This would

^eanthat whether the husband is present on the farm or not, an educated husband is expected to

°pen-minded and responsive towards change and therefore supportive to the wife's agricultural

^{es} The reverse would be the case for husbands with less formal education. That the wife's

education was not significantly associated with zero-grazing operations does not mean

roen s education plays a negative role or contribution in zero-grazing. Statistical l^ficance k

»s not equivalent to practical significance. In this case the women's education has a

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value whose benefit is over and above that of no education at all. It does not mean that a woman thout education is equivalent to one with some education in their perception and participation n the adoption of technologies. Furthermore, the data provided only three levels of education (primary, secondary and above secondary). The case might have been different if the -lassification was expanded to include sub-classes which could help pick up the value of education ofthe women. This particular finding is therefore only confined to the locality of the study sample.

The sample limited the study to three educational categories giving the finding a narrow range of validity. However, majority ofthe respondents had primary education of equal or less than 8 \earsand were housewives in subsistence family households. They therefore had low exposure to sources of information. Further, research is needed to investigate what aspect ofthe husband's education flows into the zero-grazing operations. Perhaps this is what Birdsall (1983) alludes to When she states "rural women whose husbands are temporarily absent have an advantage over •omen who have never been married only if their husbands regularly send cash remittances efficient to support tne household , and return regularly to assist in advice and farm activities". Is gender amity at family level is a positive impact to farm operation.

I N * r of dairy women group

^(1966) asserted that "man is a social being obliged by nature to live with others as a

member of society". This proposition stipulates that social life is essential not only for the

survival of the individual but also for the maximum satisfaction of human needs and desires. Thus

through **co**-operative activities people can satisfy many needs and desires which could never be

Act otherwise. Akong'a (1996) concurs with this proposition and further points out that the

encouragement of co-operatives as media for organizing people to produce and market their

agricultural produce is part of the ethic mutual responsibility paramount in traditional African life.

It fosters feelings of community, solidarity and security.

i̇r

i Results from this study (Table 5.2) indicated that there was a high significant (P = 0.00005)

association between operation of zero-grazing dairy units and member of dairy women group.

This implied that the women groups have taken up the challenge and purchased or obtained

animals both for social and business enterprises. Hence, group membership provided the women

u\\ a strong socio- economic base, and exhibited a high level of positive affects (friendliness)

among them. Since these groups, like the Norwegian Masking (Bertrand, 1967) had a task-

lentation as a kind of external condition for group action and affective (warmly Personal)

fraction as an internal condition, the role structures (and thus norms) that provided this

Parity might have grown out of the need for predictability.

F»ĩŋ Size

critical importance in production. As noted earlier in chapter 4, the average farm

Pfte study area was 3.6 acres. This figure is based on the data collected. The figure is

*b°ve official average farm size per household (1.5 acres) quoted in Vihiga District

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pevelopment plan (1997-2000). It is often argued that because of the culture of sub-dividing

parcels of land into small units, (to accommodate the high population growths), provided fodder

and water are available, small scale dairy farming based on zero-grazing can become a viable

alternative farming activity. In this study, there was no statistical significance (P=0.34594)

between the operation of zero-grazing units and farm size (Table 5.3)

fable 5.3: **Distribution of Operating Zero-Grazing Dairy Units by Farm Size in Viliiga**

District, **Kenya, 1997**

Farm Size . (Acres)	Ownership of Zero-Grazing Units		
	Yes	No	Totals
< 5	71(71)	7(7.0)	78
5 - 1 2	16(16)	.	16
>12	6(6.0)	.	6
Totals	**93(93]^**	7	**100**

$X^2 = 2.12297,$ **P** $= 0.34594$

) are percentages.

Nonetheless, the majority (71%) of those who operated zero-grazing units had less than 5 acres of

land. These results implied that adoption of zero-grazing is independent of land size. There are

underlying causes in this observation. Since the commercial objective is a priority in the Vihiga

farmers adopted zero-grazing because it was a land-saving enterprise and it is also

^pHmentary to crop production in terms of its utilization and it supplies cash for purchase of

^ts like fertilizer, seeds and drugs as well as manure.

M^gto the National Dairy Development Project (Van der Vale, 1990), small scale farmers

arnung along commercial lines instead of only for the provision of their families'

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needs This commercial perspective may be as a result of resource constraints, especially when

their farm units are very small. Dairy cows on a small farm provide the farmer with more milk,

more money from sales, manure and employment among other benefits (Mbogoh, 1984).

In this study, results show that farm sizes were significantly (p=0.00183)associated with the

number of mature grade cows (Table 5.4). This implies that the farm sizes were utilised for the

zero-grazing activities. This could also be attributed to Dairy Extension Package to zero-grazers,

such as the National Dairy Development Project which was involved in the establishment of zero-

grazing enterprise in the district.

f-*ible SA'»* Associations between Farm sizes (<5,5-12 and >12

^res) and Socio-Economic characteristics of smallholder Dairies in Vihiga District, Kenya,

1997.

Variable	P-Value
^rcber of mature grade cows	0.00183**
Number of grade bulls	002489
Number of traditional bulls	0.V8423
Number of grade heifers-—	0.01536
Number of traditional heifers	0.85969
Number of traditional heifer calves	0.54274
Number of traditional bull calves	0.03853
Number of grade bull calves	0.83025
Wife manages cattle	0.06355
Husband manages cattle	0.279922
Hired labour for managing cattle	0.00222***
Graze cattle on free range	0.14875
Graze cattle on roadside/communal-public land-	0.56812

Swrce: Primary Data

ANong'a(l996) observed that services of the bull schemes are cheaper than artificial insemination

!) where it exists. Farmers have to travel long distances to veterinary and AI centres. The

ʳ is then expected to pay up to 600 shillings for one service. In addition the farmer must

* transport costs.

ˢ^ows that grade bulls were significantly   associated with farm sizes. Grade bull calves

:?ˣPected ᵃˢ a replacement for mature bulls which are retired from natural service as opposed

(0 **ai**. The presence of grade cows in the zero-grazing units made it a ..ecessity to keep grade and traditional bull calves due to poor AI services.

Xhere is Limited free range, either on public or communal land due to high population density and consequent pressure on the available land . In Table 5.4, there were no significant associations of grazing land on road side, communal, public or any free range with farm sizes in this study area.

Akong'a (1996) found that when men were away on migrant labour, their spouses remained in charge of the home and that grade cows belong to men if they were bought by the family and to the women if they were acquired through their groups. Nonetheless, the cattle belong to the family, so do the benefits that accrue. In this study, the farm sizes tended to be associated with participation of the wife as a manager of the cattle, compared to the husband (Table 5 .4).

The women respondents were members of zero-grazing groups. Dairy units were acquired by the Me tlirough her group membership. Earlier results showed that the educational level of the v usband rather than the wife was significantly associated with adoption of zero grazing systems. Therefore, women had a lot of leeway in making decisions in consultation with their husbands.

pre-conditions for joining women grazing groups (such as planting napier, having a zero-

. water availability, basic disease control facilities such as spray pump) indicate intense

of the system. In case of limited or unavailable family labour support, the farmer was to

^labourers to supply fodder, water to the animals, clean the unit, take the cows to the bull, uitting grass for the animals, milking and marketing. In this study it was also found that hired labour was significantly associated with farm sizes (Table 5.4). This strongly indicates that hired labour is an important factor of production in zero-grazing system.

From the results it can be concluded that the wife managed cattle but w/as supported by hired labour. That hired labour was high in the small holder zero-grazing dairy farms. That the farmers id not free the cattle to forage for themselves on the roadside, public and communal lands since aev relied on hired labour to bring fodder, water and other feeds to the confined animals. It was also observed that a few (4.8%) of the zero-grazers kept traditional bull calves. These were robably for cross breeding with exotic dairy cows to enhance genetic resistance to diseases such ISECF.

The Fourth Hypothesis

fourth hypothesis concerned the relationship between the practice of agroforestry and -option of zero -grazing. It stated, "There is a positive relationship between the practice of forestry and adoption of zero-grazing". This means that agroforestry practices are highly ^oced by the operational objectives of zero-grazing units among women groups. Chambers P) defines Agroforestry as "a holistic approach to land use, based on the combination of trees I shrub* u/n
r^8 with crops, pastures or animals on the same land unit, either in sequence or at the same

time

There is no doubt that the success of achieving the desired objective of increasing milk production rapidly depends upon the provision of sufficient nutritious green fodders and adequate concentrates to feed the cattle in the zero-grazing units.

The major objectives of Kenya Forestry Research Institute (KEFRI) as far as agroforestry is concerned is:

a, To improve the quantity, quality and seasonal distribution of forage on farms by planting

fodder tree\shrubs species in the grazing areas and by developing cut-and-carry forage

systems, and

b) To reduce the labour input requirements of the free-grazing systems and fencing costs by establishing living fences around the grazing lands (Sang, 1986).

As noted earlier in this study, smallholder dairy women groups in Vih»«a District had adopted utilitarian approach to agroforestry with the view of short-term and long term objectives. Trees

crops, trees with pasture, trees nested into special places in the landscape and trees with

"lrnais shade and shelter from the winds and direct solar radiation were rated respectively in this orrfp

cr as major agroforestry practices. Other agroforestry practices (medicinal trees, trees for

e*het,c reasons) were also noted.

Table 5-5 shows that those who operated zero-grazing units also practised agroforestry. This is confirmed by the significant association (P=0.01138) between the two practices by women groups Agroforestry of trees and crop mixture, agroforestry of pasture mixed with trees, fodder fljxed with trees in special landscape all exhibited significant associations with operations of zero-grazing by women groups (Table 5.5). However, other types of agroforestry groups of utilitarian purposes directly or indirectly in the zero-grazing units, such as agroforestry for medicinal herbs md for any other aesthetic reasons did not exhibit any significant association with zero-grazing operations. The results imply that agroforestry rather than competing for the limited resources ,ith (small land parcels per household, labour, capital) fodder, it has become a complimentary esource in the provision of inputs to zero-grazing enterprises.

Table 5.5: **Associations Between Operating Zero-Grazing Units by Women Groups with Agroforestry Practices in Vihiga District, Kenya, 1997**

Variable	P - Value
Whether They Practiced Agroforestry	0.01138
Agroforestry of mixed Trees & Crops	0.03669
[1] Agroforestry of mixed Trees and Pasture	0.00881
Agroforestry of "fodder Trees"	0.03086
4 Agroforestry of trees on special areas	0.02123
5 Other Agroforestry Types	0.11986*

The importance of agroforestry practiced within the zero-grazing farms cannot be underestimated. The purposes of practicing agroforestry are many and varied . However, in this study five Eposes were investigated among the women groups. Table 5.6 shows the associations between different purposes of practicing agroforestry with operation of zero -grazing units among the ^omen groups.

Table 5.6: **Associations between different purposes of practicing Agroforestry with operation of Zero -grazing units among Women Groups in Vihiga District, Kenya 1997.**

Variable	P-Value
Purpose Of Practicing Agroforestry	
jl improve soil Fertility	0.00147*
,: Obtain Tree Products	0.00067*
3 Increase Crop Production	0.03086
4 Provide Fodder	0.00322*
$ Other Purposes	
leg. medicinal, aesthetic........)	.06143**

Source: Primary Data

```
*P.Value Not significant(P>0.05
** Significant atP< 0.10.
```

interestingly, there were statistically significant associations between the investigated purposes of Rising agroforestry with the zero-grazing operations. These findings bring to the fore the

how much could agroforestry substitute for purchased inputs for example, concentrates (Utilizers for raising of fodder in the zero-grazing units?" The ranking of the P-Value in Table

- the obtaining of tree products, improvement of soils and the planting of more trees in their importance.

It has been argued that in rural areas, inequalities in the delivery of agricultural extension programmes to women who are farm managers have reinforced the disadvantaged position of these women (Kerven, 1979; Ahmad and Loutfi, 1981).

Staudt (1979) further observed that in Kenya great disparities have been found in the delivery of services in farms managed only by women versus those managed, at least in part, by men. Women's access to technical information, training and other resources continued to be restricted even after agricultural extension agents had been instructed to disregard economic standing and and size in making their programmes available. As a result there were negative effects on women's productivity.

P 5.7   Associations Between Sources of Extension Service on

Information and Adoption of Zero-Grazing Practices

among Women in Viliiga District,Kenya 1997.

rgJ^sOf Information	P-Value	Association
Experts	.03064*	Significant
Through Gen. Ext.	.71385	Not Significant
• Govt. Ext. Agencies	0.00023*	Significant

v,urce: **Primary Data**

   Significance value at P<0.05

Table 5.7 shows the associations between sources of extension service information and adoption

: zero-grazing practices among women groups in the study area. The results in this study show

"it extension service information from both the experts and Ministry of Agriculture extension

•pntswere significantly associated with adoption of zero-grazing practices. However, the

wral extension agents (extension services provided through local administration such as chiefs

bazas') was not significantly associated with the adoption of zero-grazing practices. This is

   ie d because they do not target particular commodities like dairying in their messages,

   groups seem to facilitate the sourcing of extension services information from experts

   e rare and expensive to obtain on individual farms.

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table 5.7 **Associations Between Sources of Extension Service on Information and Adoption of Zero-Grazing Practices among Women in Vihiga District,Kenya 1997.**

Sources Of Information	P-Value	Association
Experts	.03064*	Significant
Through Gen. Ext.	.71385	Not Significant
Govt. Ext. Agencies	0.00023*	Significant

Source: Primary Data

Significance value at P<0.05

Table 5.7 shows the associations between sources of extension service information and adoption
' zero-tjiazing practices among women groups in the study area. The results in this study show
'^extension service information from both the experts and Ministry of Agriculture extension
«?«ntswere significantly associated with adoption of zero-grazing practices. However, the
pRl extension agents (extension services provided through local administration such as chiefs
^fcas) was not significantly associated with the adoption of zero-grazing practices. This is
'teted bibecause they do not target particular commodities like dairying in their messages.
%en groups seem to facilitate the sourcing of extension services information from experts
ler*reand expensive to obtain on individual farms.

government agents who are charged with the responsibility of promoting dairying are able to target their packages inexpensively and effectively when women are organized in groups The organization of women into target groups, such as, the zero-grazing women groups, bring with diem the benefits of economies of scale in the costs of provision of extension services by any agents. This facilitates better information dissemination and adoption rotes.

2 Multiple Regression Analysis

The correlation matrix was used to select important variables for further analysis. The selected variables from the correlation matrix were included in the multiple regression analysis. The variables dropped had higher multicollinearity (See Appendix 1).

Multiple Regression analysis was done to determine how the selected variables explain certain outcomes. When a regression equation is used for prediction of future events as well as for explanation, Alwin and Mauser (1981) suggest that investigators may include only the variables 'tat add to prediction in a statistically significant way. To reduce the number of variables, all tables are introduced into the regression model, then the variables that do not have significant Session coefficients are not included in the prediction equation. However, statistical -^niticance does not mean that the variable is not important in explaining the relationship. Penally, a prediction equation is also arrived at by forward selection and backward B*°n procedures (stepwise selection). In stepwise selection, <jfter each addition of a new ^ to the equation, all previously entered X variables are checked to see whether they

[taintain their level of significance. Previously entered X variables are retained in the regression jquatio" o'''Y $^{t'ie't}$ removal would cause a significant reduction in \V. The results from this procedure did not show a significant departure from the method of deduction procedure used in this study. Levin (1987) notes that generally, these approaches may not produce identical regression equations, but conceptually, the approaches (stepwise) determine a "Parsimonious" equation.

The regression **equation then is reconstructed using only variables with significant t-values. This** sbecause **the regression coefficients have different values when some variables are removed from** the analysis.

\ second regression analysis is then carried out and the results used to predict outcomes for "Jure events.

Ih«Empirical Model

^ Palliation of the estimated variables was based on the traditional multiple regression model y the independent variables are numerically measured as well as the dependent variable k

Sanatory variables were used in a multiple regression model to explain the variation in

the productivity of the dairy enterprise of the respondents. A list of variables considered for

multiple regression is shown in Table 5.8.

«f$_a$bl^e ^ •^{8} : Variables Considered for Multiple Regression in the study

	Explanation And Catergories	**Unit**
jjome **(D)** And **(1)**	Gross output from Dairy Total milk consumed and sold Total animal, hides and manure sales: (1 = < 5001 to 25000 3 = > 2500)	Kenya Shillings
\reafodd (1)	Area under Fodder crops (1 =<.75, 2 = >.75)	Acres
i m	Total Feed Costs (P.A.) (1 =<980, 2= 1000 to 2000, 3 = <2000)	Kenya Shillings
	Wife's education (1 = 8 yrs, 2 = 9 to 12yrs, 3 => 12 yrs.	Years of Schooling
Children (I)	Number of children (1 =<3, 2 = 4 to 6, 3 =>7	Number
Areafood (1)	Area under food (1 =<.75, 2 = >.75)	Acres
ilbr(l)	Total labour costs (1 =< 5000, 2 = 5001 to 15000, 3 => 1500)	Kenya Shillings
'tvt(l)	Total Veterinary Costs (1 =< 1000, 2= 1001 to 2000 3 = <2000)	Kenya Shillings
racows(I) And (D)	Number of mature grade cows (0 = 0, 1 = 1 to 3, 2 = 4 to 24)	Number
W)	Age of respondent (1 =< 30, 2 = 31-50, 3 =>50)	Years
Total (I)	Total Farm Area (1=< 4, 2=4.01 to 12, 3 => 12)	Acres
hus (I)	Husband's education (1 =<8, 2 = 9 to 12, 3 =>12)	Years of schooling

^{De}**Pendent Variable I = Independent Variable.**

Primary Data

$^{'es'n}$ fable 5.8 were introduced into the regression model in order to select an optimal
*of
$^{p\ nator}$y variables to be included in the predictive equations. Table 5.9(a) and Table

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*9(W $^{S\wedge 10W}$ $^{re}8^{ress\prime on}$ coefficients obtained by regressing the eleven variables (independent)

annual gross income and the number of mature cows respectively as dependent variables,

fli&e analyses were carried out in order to assess how the algebraic signs of our estimated

efficients $_{ta}$Uy with or deviate from the *aprior* expectations. The results are shown in the

Appendices **2 and 3.**

fable 5.9(a):Multiple Regression Analysis for (lie Eleven Variables on Income in Vihiga District, 1997

Dependent **Variable** **Income**

I **Variables in the Equation**

friable"	B	SE B	Beta	T
Areafodd	-.044851	.113736	-.045559	-.394
Ttfd	.200620	.106790	-.045559	1.879
Eduwife	-.274960	.147268	.196237 A	-1.867
1 Children	-.260746	.120850	-.227140	-2.158
Areafood	.050935	.171269	-.224789	.297
Ttibr	.658256	.138760	.033484	4.744
Twt	.016383	.109142	.509455	.150
';idCows	-.081375	.233698	.015826	-.348
Age	.384624	.153348	-.037915	2.508
Total	-.071700	.189484	.302632	-.378
^uhus	.044349	.122665	-.047052	.362
°nstant	.639193	.549700	.049218	1.163

r»«rce: p.imary Data

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fable 5.9(b): Multiple Regression Analysis for the Eleven Variables on the Number of Mature Grade Cows in Vihiga District, 1997
Dependent Variables   **Grd Cows**

Variables in the Equation

Variable	B	SE B	Beta	T
\reafodd	.134133	.055536	.292430	2.415
Income	-.020950	.060165	-.044964	-.348
Eduhus	.125028	.060504	.297810	2.066
Areafood	.248952	.081782	.351255	3.044
Children	-.029703	.063199	-.054959	-.470
Ttvt	-.015058	.055358	-.031221	-.272
Ttfd	.060381	.055050	.126762	1.097
Ttlbr	-.103604	.079856	-.172096	-1.297
\ge	.174394	.078499	.294506	2.222
Total	-.051165	.096048	-.072064	-.533
Eduwife	.039787	.076390	.070542	.521
Constant	-.106039	.281276		-.377

V(JUrce, **Primary Data**

^{v}ariables in the new model arising as shown in Tables 5.9(a) and 5.9(b) are specified thus:

Income, Annual gross income, symbolized X_i when used as independent variable.

Grdcows, Number of mature grade cows, symbolized, X_2 when used as independent

^{i}.able TI. *ne multiple regression assumption was not violated since income was of 1996.

I *^{3} ^ Ttfd   = Total Feed Cost

X4 = Eduwife   = Education of the respondent

Xs = Children = Number of Children in the household

X6 = Areafood= Area under food

X7 = Ttlbr   = Total labour costs

Xs = Ttvt   = Total Veterinary costs

X9 = Areafodd = Area under fodder

Xl0 = Age   = Age of the respondent

Xu = Total   = Total farm area

X12 =   Eduhus   = Education of the husband

The specification of the above variables reflect that in the *ciprior* assumption.

Examination of Table 5.9(c) shows that on the basis of the regression analysis, t - values of three explanatory variables, Children, Ttlbr and Age on annual gross income were statistically Significant for model equation 1 and the t - values for four independent variables, Areafood, '•eafodder, Age and Eduhus on number of mature grade cows owned were statistically ^nificant for model equation 2.

[c] variables that did not have significant t - values were eliminated from further analyses of the

     The regression equation in both cases was recalculated using only the variable retained.
^Vn

     three_significant variables were regressed on the annual gross income from the zero-operations and the <u>Four</u> significant variables regressed on the number of mature grade fr[1]^' die results indicated predictive equations as shown in Table 5.9(d).

g₀ₗᵤtion to tlie Simultaneous-Equation Bias

,^0-stage least squares approach)

rjietwo regression equations Yi (Annual Gross Income, Symbolized Xi when used as

independent variable) and Y2 (Number of mature grade cows, symbolized X2 when used as

independent variable), show that Xi and X2 were used interchangeably both as dependent

variables in the model equations 1 and 2. This was because income can afYect number of grade

| cows and vice versa. If ordinary least squares technique is used in such a case, simultaneous-

equation bias results because one of the independent variables, either Xi or X2, has a relationship

with **the error** term thus violating the assumption of no correlation. This makes the equation to

vei-estimate the relationship. To solve this problem, the two-stage least squares tehcnique is

plied.

"age 1: In the first stage, the Ordinary Least Squares (OLS) was used in forming the

nation thus:

$$Yi = B_0 + 6, Xi + B_2 X_2 + — + Bl2 X12 + e$$

this analysis, the source of the bias was likely to be the existence of endogenous variable in the

[a]explanatory variables in the function. The unobserved random component causes the

^ance of the simultaneous-equation bias in the least squares estimates. In the first stage,
— H ^

[re]> OLS was applied in order to obtain an estimate of the observed dependent variable and

⋆⁵ᵐᵈⁱ components of the endogenous variable. Thus Yi (Xi) was regressed on all the pre-

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•gfinined variables considered important for the study, that is, X2 X3X4 — Xn . This yielded a

predicted value of Yi, symbolized as 9 •

$g_{ta}g_6$ 2: In the second stage, the computed va'<ue, $9i$, was then used

in the original equation instead of Yi.

Thus: $91 = Bo + B1X1 + n_2X_2 + \overline{\qquad} + B12X12 + e$

Since the OLS estimates are unbiased, and efficient, when the

observed Yi values are replaced by the 9i, the equation is now

nbiased. Thus the annual gross income observed values are

replaced with the estimated annual gross incomes in the OLS

equation. The bias was therefore removed.

The procedure above was applied in the case where the number of

mature grade cows was treated as the dependent variable. Y_2

'ds regressed on all the pre-determined variables to yield a

predicted value of y_2.

«

The results of the two-stage least squares method (2SLS) on the two equations were not

^tistically different from the ones obtained by milticollinearity test technique (See Appendix 1

Table 5.9(d). However, the value of X_6(Area of land grown wit! food crops) changed in

1, (Table 5.9(c)). This indicated that though weak, area under food crops was

i N ' y significant for model equation 1. The results did not affect the value of X_6 in Table

The rest of the analysis was not affected either. The value of X_6 (Table 5.9 (c)) changed

from051 with t-value of (0.30) to .205 with a t-value of (1.92).

application of the two-stage least squares method indicated that the simultaneous equation **bias had** been minimized by multicollinearity test. The estimates, therefore, used in the analysis ₃ₑ BLUE (Best Linear Unbiased Estimators).

Table 5.9(c): Twelve Socio-Economic Factors Influencing Productivity (Income and Number of Mature Grade Cows) in Vihiga District, 1997

Independent Variables

Equation	Constant	XI	X_2	X_3	X_4	X_5	X_6	Xt	X_8	X_9	X10	XN	X_{12}
1	0.639	DEP*	-.081	.201	-.275	-.261	.205	.658	.016	-.045	.385	-.072	.044
		(-.35)	(1.88)	(1.87)	(-2.16)	(1.92)	(4.74)	(0.15)	(-0.40)	(2.51)	(-0.38)	(0.36)
2		-.021	DEP	.060	.040	-.030	.249	-.104	-.015	.134	.174	-.051	.125
	-0.106	(-.35)		(1.10)	(0.52)	-.47	(3.04)	(-1.20)	(-.27)	(2.43)	(2.22)	(2.53)	(2.07)

() t values

The Table above shows the results of the first regression analysis involving the twelve variables considered important for the study. Annual gross income (Xi) and number of mature grade cows **(X2)** were used interchangeably both as dependent and independent variables in the model equation 1 and 2. Annual income was of 1996 whereas number of grade cows were of 1997.

The two equations considered:

Yi = .519 - 0.196848 (Children) + 0.676459 (Ttlbr) + 0.364109 (Age)

Y2 = -0.001 + 0.208 (Areafood) + 0.134 (Areafodd) + 0.123 (Age) + 0.101 (Eduhus)

Table 5.9(d): Socio-Economic Factors Influencing Productivity (INCOME)
and Number of Mature Grade Cows Owned), in Vihiga District, 1997.

Equation	Constant	X!	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X10	Xn	X_{12}
1	.519	DEP*	-	-	-	-.197	-	.676	-	-	.364	-	-
						(-1.80)		(5.72)			(2.88)		
2	-.001	-	DEP	-	-	-	.208	-	-	0.134	0.123	-	0.10
							(3.18)			(3.22)	(2.06)		(2.06)

Note: - = Not included in the equation. DEP Dependent Variable

Source: (Primary Data)

p₀r Income, as the dependent variable, the prediction equation of Yi (Income) on the basis of

children in the household, total labour costs and age of the respondent is given as:

Yj = a - bs X5 + b7 X7 + bio X10

Where:

y,   =   Dependent variable, Income; Income from total milk consumed,

                  milk sold, animals sold, hides and manure sold.

, | >   =   Constant, the Y intercept value at which the regression line

                  crosses the Yi - axis. This is the predicted income when values

                  of independent   variables are zero.

          =   The first independent variable, Children

                  The regression coefficient associated with Xs

                  The second independent variable, Ttlbr

                  The regression coefficient associated with X7

                  The third independent variable, Age

                  The regression coefficient associated with X10

[lhe] coefficients bs, b?, b10 describe how marginal changes in X5, X7 and X10 affect the value of

Y,

   [em]**Pincal data, the equation that predicted annual gross income o11 the basis of the three**

^riables is:
y ^

 [1 5 8] - 0.196848 (Children) + 0.676459 (Ttlbr) + 0.364109 (Age)

        shows the results of the goodness of fit of the above equation. The interpretation of

fable 5.9(e) and the variables in the equation follow:

fable 5.9(e) Dependent variable   Income variable(s) entered on step number.

j Ttlbr   total labour costs

i Children, number of children

3 Age (Years)

Results **of regression of income** 011 **total labour costs, number of children and age of**

respondent

Multiple R   .54390

R Square   .29583

Adjusted R Square   .27261

Standard Error   .65915

Analysis of Variance

	Df	Sum of Squares	Mean Square
Regression	3	16.61004	5.53668
Residual	91	39.53733	.43448
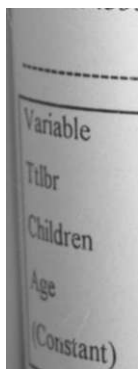
Variables in the Equation

Variable	B	SEB	Beta	T
Ttlbr	.676459	.118197	.506974	5.723*
Children	-.196848	.109332	-.172709	-1.800
Age	.364109	.126359	.276682	2.882*
(Constant)	.519215	.346761		1.497

Statistically significant at 5%

Statistically significant at 5%

The significant results of the analysis indicated relationship that should not be expected by chance. The variables, therefore, account for substantial proportion of the variation in dairy income.

The analysis shows the multiple regression model was highly significant (P<01) as a whole.

The figure of more substantive importance in this instance is the R^2 of .29583. R^2 is usually defined as the proportion of variance of the response that is predictable from (that can be explained by) the regressor variables. Whether a given R value is considered to be large or small depends on the context of the particular study. In this study, the R square indicates the amount of variability in the income from zero-grazing operations that is accounted for by how much was spent on labour, the number of children in the household and the age of the respondent. The three variables combined statistically accounted for approximately 30 per cent of the variation in the respondent's yearly gross income from zero-grazing operations.

I from the above predictive equation, the following observations were made:
pe unstandardized regression coefficient (B) indicated positive sign tor labour and Age of the respondent thus describing the direction of the relationship with the dependent variable. This was Positive relationship as opposed to the inverse relationship between number of children and pome(see above predictive equation).

fo

for labour expenses, for each shilling (unit) increase in labour costs, zero-grazing income V Ksh .676459 (68 cents). This indicated labour is the . iost expensive factor in the

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operation of zero-grazing by the women groups in Vihiga District. Its significance at P< 01 (t = 5 723) indicated no probabilistic observation, that is, no guessing.

The *og^e* of the respondent in zero-grazing is also important in explaining income from the small dairy operations. The positive relationship between *Age* to the respondent and *Income* indicates for every^ increase in the age of the respondent (in years) income froflfl the zero-grazing increased by KShs. .364109. Its significance at P< .01 (t = 2.882) indicates no probabilistic observation.

The number of children in the household was found to be inversely related to income from zero-izing. Thus, for each one child increase in the household, income from zero-grazing was predicted to decrease by KSh. .196848. This is consistent with the *aprior* assumption.

Tta standardized regression coefficients (Beta) assist in comparing the magnitudes of fhe 'egression coefficients to enable us draw conclusions about which explanatory variables play an mportant role. That is, they are used to compare the effects or regressors measured in different ^ts by using standard deviation as the unit of measurement.

this analysis the standardized B is obtained by dividing the B by the standard deviation of B.

Beta was used to correctly rank the variables in the equation according to their i ^ution in the variation of annual gross income.

I fc^ring the standardized regression coefficients indicated that total labour costs (Beta =

$06974) had a stronger effect on income than age and number of children in the household.

The analysis of variance summary table for the regression of Income on number of children, total labour costs, and age of respondent is constructed in Table 5.9(f) below. The Anova table compares mean squares relative to their expected values under the null hypothesis.

.„t,lysis of Variance Summary

] ,blc 5.9(0- The regression of Income 011 Ttlbr, Children and Age

Source	Df	Sum Of Square	Mean Square	F
Regression	3	16.61004	5.53668	* 12.7434
Residual	91	39.53733	.43448	
: Total	94	56.14737		

U   P < .05

One of the hypothesis of this research was that there is a positive relationship between socio-economic characteristics of the respondent and productivity.

The F-test and the direction of the regression coefficients for total labour costs (economic) and age (social) indicate that the empirical data were consistent with the hypothesis that productivity (gross income /year from the zero-grazing operations)was positively associated with total labour costs and age of the respondent.

-•neethe probability is small, that is, significance is .0000 (P <01) we would conclude that the ^P'rical data are consistent with the research hypothesis that zero-grazing productivity is Wtively associated with socio-economic characteristics. And we would be wrong in rejecting IIIII hypothesis less than 1 percent of the time.

Wowing conclusions are in order. The *aprior* expectations were that there should be a

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positive relationship between socio-economic characteristics of the respondents and productivity. However, the empirical data analysis showed that, of the three explanatory variables considered /j_e *total labour costs, number of children* in the household and *age* of the respondent), *total labour costs* had a high t-value (t=5.723) indicating a strong influence on the gross income from zer0-grazing unit. Zero-grazing being a labour intensive enterprise requires considerable expenses on labour for profit maximization (income).The above results confirm our *aprior* expectations of the positive relationship between labour cost as an economic factor and income as an estimation of productivity. Additionally, age as a social variable was also identified as having a relatively strong influence on income from zero-grazing as indicated by a t-value of 2.882. This further confirms our *aprior* expectations of positive relationship between socio-economic factors and productivity. Therefore, the empirical results show that older farmers tended to have higher iiross incomes per year compared to younger farmers. On the other hand family size measured by number of children in the household had a relatively strong but inverse relationship with gross ncome per year from the zero-grazing operations. This was shown by a t-value of -1.80. The ^plication of this results was that households with large family size tended to have lower gross "come per year from the zero-grazing operations as compared to households with smaller family -Ze .This was consistent with the a prior expectation which assumed negative relationship.

Wiptober of mature grade cows as the dependent variable, the prediction equation of Y2

 ^{Qcov}**vs) on** the basis of area of land under food crops (Xr>), area of land under fodder (X9), *age oftli$_e$* ^{es}Pondent (xio) and *education of husband (Xn)* is given below:

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$y_2 \hat{} a + b6\ X6 + b\text{«}jX9 + bioXio + bi2Xi2$

Where: $Y_2\hat{}$ Dependent variable , *Gn/cow,* number of mature grade cows owned by the respondent

constant, the Y intercept value at which the regression line crosses the Y_2-axis. This is the

predicted number of grade cows when values of independent variables *re zero.

X_6 = The first independent variable, Areafood

k = The regression coefficient associated with X6

Xo = The second independent variable, Areafodd

b9 = The regression coefficient associated with X9

X_u = The third independent variable, Age

b_{io} = The regression coefficient associated with X10

X_{l2} = The fourth independent variable, Eduhus

$b2_*$= The regression coefficient associate with **X12**

The coefficients **b6.b9.b10** and bi2 describe how marginal changes in **X6.X9.X10** and **X12** affect the

value of **Y2.**

The empirical data analysis constituted the following predictive equation that predicted the

^{J}niber of mature grade cows owned by the respondent on the basis of the four variables:

$Y_j=$ -0.001 + 0.208(Areafood) + 0.134 (Areafodd)+ 0.123(Age) +0.101 (Eduhus)

shows the results of the goodness of fit of the above predictive equation. The

r

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T;ible 5.9(g):   Results of regression of Number Of Grade Cows on Areafood,Areafodd, Age Al!d Edulms.

Dependent Variable.. Grdcow, No.Of Mature Grade Cows

Variable(s) entered on step number

1. Areafodd   Area under fodder crops

2. Eduhus   Husband's education

3. Areafood   Area under **food**

4. Age   -   Age in years.

Multiple R   .53583

R Square   .28711

Adjusted R Square .25434

Standard Error   .30812

\nalysis of variance

df	sum of squares	mean square
Regression 4	3.33303	.83326
ftesiduai 87	8.27567	.09512

!-8.75983   signif F = 000

Variables in the Equation

Variable	B	SE B	Beta	T
Areafodd	. 133611	.041477	.297072	3.221*
Eduhus	.100777	.041073	.247006	2.454*
Areafood	.208436	.065614	.293321	3.177*
Age	.123237	.05882	.206959	2.058*
(Constant)	-. 001454	. 198891		-.007

' Stat Really significant at 5%

flie multiple regression model was highly significant as a whole, since prob > F is 0.000. The R Square =.28711, for the four variables together explain about 29% of the variation in the adoption of the *number of mature grade cows.* That is, knowledge of *acreage under food crops, acreage under fodder, age* of the respondent and the *husband's educational level* together statistically account for approximately 29 percent of the variation in the *number of mature grade cows in* the zero-grazing unit of the respondent.

The unstandardized regression coefficients indicate positive sign desci.bing the direction of the | relationship with the dependent variable . *Area under fodder* is positively associated with the **number** *of adopted mature grade cows.* Thus, for each 1 acre increase in area under fodder, the I number of mature grade cows owned was expected to increase . 13361 l(units) cow; *education of* I *iiv husband* was positively associated with *the number of mature grade cows owned.* That is to) ay for each 1 year (unit) increase in the education of the husband , the number of mature grade I 'ows adopted by the respondent increased .100777 units; *area under food* was also positively I associated with *number of mature grade cows,* that is for each 1 acrc- increase in area under food, | number of mature grade cows owned increased .208436 units; and finally *age* was positively ^ociated with *number of grade cows owned.*   That is, for each 1 year (unit) increase in age of Respondent, ownership of mature grade cows increased .123237 units.

Standardised regression coefficient (Beta) assist in comparing the magnitudes of the ^•on coefficients to enable us draw conclusions about which explanatory variables play an

Important role.

In this study, the Beta was used to rank the variables in the equation according to their contribution in the variation of the number of mature grade cows owned by the respondent . In c0ITIparing the Betas, the results indicated that the economic variable, *area under fodder,* had the strongest effect on the *number of mature grade cows owned* by the respondent.

[he following is a summary of the analysis of variance for the regression of *Grdcows* on \ *Area/odd, Eduhus, Areafood* and *Age.* Table 5.9(h), compares mean squares relative to their expected values under the null hypothesis.

lable 5.9(h) : Analysis of variance summary Table for the regression of Grdcows On \reafodd, Eduhus, Areafood and Age in Vihiga, 1997

Source Df	Sum Of Squares	Mean Square	F
degression 4	3.33303	.83326	8.75983
Residual 87	8.27567	.09512	
Total 91	11.60870		

P < .05

^ **under** fodder was found to be significant at the level P <.01 (t=3.221), education of husband ' :he **level** of P< 05(t=2 454).

SlSnificant results of the analysis indicated relationship that should not be expected by chance

Yl$_{ie}$ Variables, therefore account for a considerable proportion of the variation observed in grade $_{c0}$w ownership.

tee of the respondent, *education* of the husband are two important social variables and their explanatory value have a lot of implications for this study. It is also apparent that area under fodder and area under food as economic variables explain a good proportion in the variation of the adoption of grade cows. From the results the following observation are in order. In an effort jo estimate the relationship between productivity and social economic factors associated with zero- grazing operations. The *number of mature grade cows owned* by the respondent was used is a predictor of productivity, while *area under food and fodder* (acres), *education of the husband* \ears) and age of the respondent (years) were used as explanatory variables. On the basis of the •mpirical data analysed, all the explanatory variables had relatively strong and positive influence .n the number of mature grade cows owned by respondents as indicated by the t-values of 3.22, ⁚ 18,2.45 and 2.06 in that order (Table 5.9(g).

implication of these results were that *area under fodder* (Acres) had the most positive and congest influence on the *number of mature grade cows* that respondents owned hence, the more Njfthe higher the number of mature grade cows a respondent would own and vice versa as ptted by the empirical t-values above. Subsequently, the *larger the area under food crops* the

number of mature grade cows a respondent would own. This would probably imply

Pners with larger areas under food crops are able to use food crops for both family

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subsistence and as feeds to the grade cows. These results also further confirm our *aprior*

expectations of a positive relationship between economic characteristics of the respondents and

productivity.   Similarly *education of the husband* and the *age* of the respondent as social factors

had relatively strong and positive influence on the *number of mature grade cows owned* as shown

by the t-values above .

The interpretation of these results was that respondents with better educated husbands were more

likely to own larger numbers of mature grade cows than respondents with less educated husbands

is indicated by the empirical data analysed. *Age* as a social variable was found to be relatively

] strong and positively influential in ownership of *mature grade cows* by respondents as indicated

 by the t-values. On the basis of empirical results the interpretation was that older respondents

I tended to have larger numbers of mature grade cows than younger respondents. This conforms

  Mthour a prior expectations of a positive relationship between social characteristics of

[1] espondents and productivity (number of mature grade cows owned, see Appendix 5).

[5]   **PATH ANALYSIS**

Multiple correlation of twelve variables used in the multiple regression was used to get a matrix

   Efficients of correlations among the variables (see correlation matrix Appendix I).   The

   ^iation matrix of the variables was necessary in the construction of the path model for path

      • ^th analysis is a method for explicitly formulating theory, and attaching quantitative

gstimates to causal etYects thought to exist on *aprior* grounds. The analytical technique of path

$_8$naly^{sis} ^{ir}'akes ^{use} diagrams to represent the cause and effect relationships among empirical

indicators. The statistical significance of the correlation between any two variables determines

whether a line should be drawn joining the two variables. The strengths of relationships among

variables as calculated from a regression analysis are represented by the standardized regression

coefficients (path coefficients).

The quantitative estimates attached to the causal links may be either standardized or metric

regression coefficient (Duncan, 1972). For purposes of this reseaicii, standardized coefficients

have been used. Equally, the variables and the correlation coefficients have been put in

standardized form, or Z - scores (see Appendix 1). According to Wolfe (1980), if all path

coefficients are standardized, comparison between effects of causal variables is straight forward.

One of the most widely known models' of status attainment is that of Otis Duncan (1972). The

Model examines socio-economic variables, family background, education, family size, employment

^d age in their contribution to the level of income. However, Duncan's study was of men only.

McClelland (1961) used experimental conditions and motivation to demonstrate that the need for

^'evement predisposes individuals toward modernity. He found that men with high achievement

f ^ s will fmd a way to economic achievement, collective responsibility and feelings of

^{on}ty over others. More important was the finding that economic growth was reflected in

income.

In this study, the Duncan structural model of socio-economic achievement was used to describe the effects of two exogenous variables (predetermined), age of the respondent *(Age)* and the jespondent's education, that is, wife's education *(Ednwife)* on two endogenous variables, number **of** mature grade cows owned by the respondent *(Grdcows)* and gross annual income from the zero-grazing enterprise. This model specifies a recursive effect where direct and indirect effects on the endogenous variables can be noted.

I In arder to be selected, respondents must have indicated awareness of zero-grazing system, that I is, they owned or intended to own the grade animals by registering as such. Education of the j espondent *(Ednwife)* was the highest year of school completed as a measure of education. Age was the chronological age of the respondent measured in years. Categorical income information *as converted to Kenya shillings for analysis.

ri§ure 3a is a presentation of the Vihiga study causal model that is similar to Duncan's model, "fcset of structural equations can also be examined below the figure. It was hypothesized that ^ would be a direct and positive effect between the exogenous variables of respondent's age ^education on respondent's productivity. However, any results were expected since Duncan • j *[not] test the model with women.

Figure 3a: Recursive path model of socio-economic Achievement, as applied to Study area
              1997
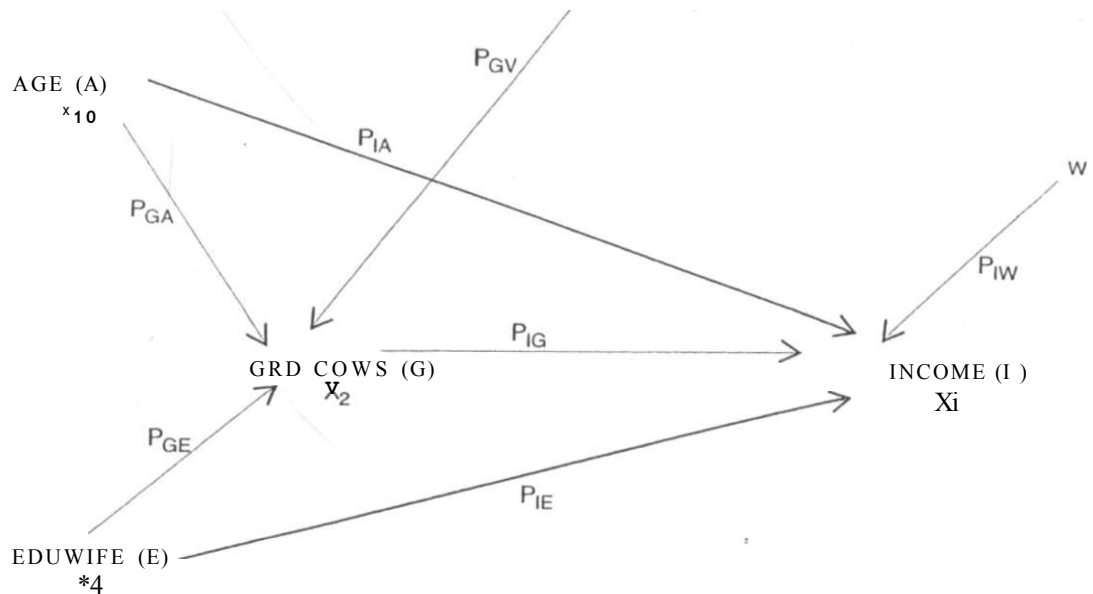
Set of $X, = P_{,G} G + P_{ia} A + P_{iE} E + P_{iW} W$
structural
Equations $\wedge = PQAA + P_{ge} E + P_{GV} V$

Algebraically, the equations above would be represented as below

Set of $X, = P_{,2} X_2 \; PI_4 X_4 + P_{i\,10} X_{10} + P_{1W} W$
structural
Equations $x_2 = P_{24} X_4 + P_{2\,10} X_{10} + P_{2v} V$

The first subscript in term is the dependent variable. For example,

Pi $_2$ 1 represents the dependent variable X, and 2 represents the independent variable
                X_2 in that term, Also $P_{2\,10}$. 2 represents the dependent variable X_2 and 10
                represents the independent variable X_{10}

fhe diagram shows that the endogenous variables have arrows drawn from uncorrelated residual factors (V and W), to indicate that there were other causes of mature grade cows ownership and gross annual income. The double-headed arrow represents a correlation between two variables to which no causal interpretation is attached. The two independent variables on the left-hand side of the diagram are called exogenous variables, because the causes of these variables, whatever they are, come from outside the model. On the other hand, endogenous variables have causes that are explicitly included within the model.

Structural Equations

The four variables *(Age)*, education of the respondent *(Ediavife)*, mature grade cows owned *{Qrdcows)* and annual gross income *(Income)* Xio ,X4 ,X2 ,Xi respectively, can be represented by HO equations.

The first equation relates age, education of the respondent and mature grade cows ownership to fflnual gross income (I). If P represents the path coefficients (numerical estimates of the causal "elationships between two variables in a path analysis), the equation is:

[5] $P_{IG}G + I_AA + P_{IE}E + P_{iw}W$. In algebraic form, the equation is:

[15] $P_{12}X_2 + P_{,4}X_4 + P_{,0}Xio + P_{lw}W$

^ path coefficient for each of the variables assumed to cause annual gross income are included, plus one from the residual variable W. The second equation captures the hypothesized relationships between age of respondent, education and the ownership of grade cows, making the **assumption** that the two independent variables are linearly related to the dependent variable.

$X_2 \approx PgaA + Pgi{:}E + PgvV$. And in Algebraic form:

$X_2 = P24X4 + P_2 \ io Xio + P_2 VV$

Notice that a path coefficient links age to mature cows owned (Pga) and another such coefficient links education to mature grade cows owned (Pge). Included is a path coefficient (Pgv) to capture the relationship between the unobservable residual term, V, and the dependent variable, X2.

The relationships between the equations and the causal arrows are shown in figure 3a.

To get estimates of the coefficients, the dependent variable, X2, was regressed on *Age* and education of the respondent *Edit wife,* and the estimates of the path coefficients for *Age* and *MMwife* are simply the beta weights. Similarly, the path coefficients for Xi, was estimated by pressing annual gross income from the dairy enterprise on *Age, Eduwife* and *Grdcows.* The delation between the independent and dependent variables involved the division of correlation Efficients into component parts for direct effects and indirect effects. This is decomposition

Decomposition Rule is Total Effect= Direct effect + sum of indirect effects + spurious

The path coefficients for this analysis are shown on the path diagram in figure 3b. The residual paths Piw and PGV are found by taking the square root of 1 minus the appropriate coefficient of determination^2).

The results of the regression analysis and correlation matrix variables included in the path model are shown in table 5.10(a) and 5.10(b).

The path coefficients for this analysis are shown on the path diagram in figure 3b. The **residual paths** P$_{IW}$ **and** P$_{GV}$ **are found by taking the square root of 1 minus the appropriate coefficient of determination^).**

The results of the regression analysis and correlation matrix variables included in the path model $_d$re shown in table 5.10(a) and 5.10(b).

Recursive path model of socio-economic Achievement, as a_{PP},ied ,$_o$ Study area,

AGE (A)
X_{10}

$R^2 = .314$

.828

.303

.295

-.3491

W

.76

$R^2 = .42?$

-.038

GRD COWS (G)
X_2

INCOME (I)
X_1

.071

-.227

EDUWIFE (E)
X_4
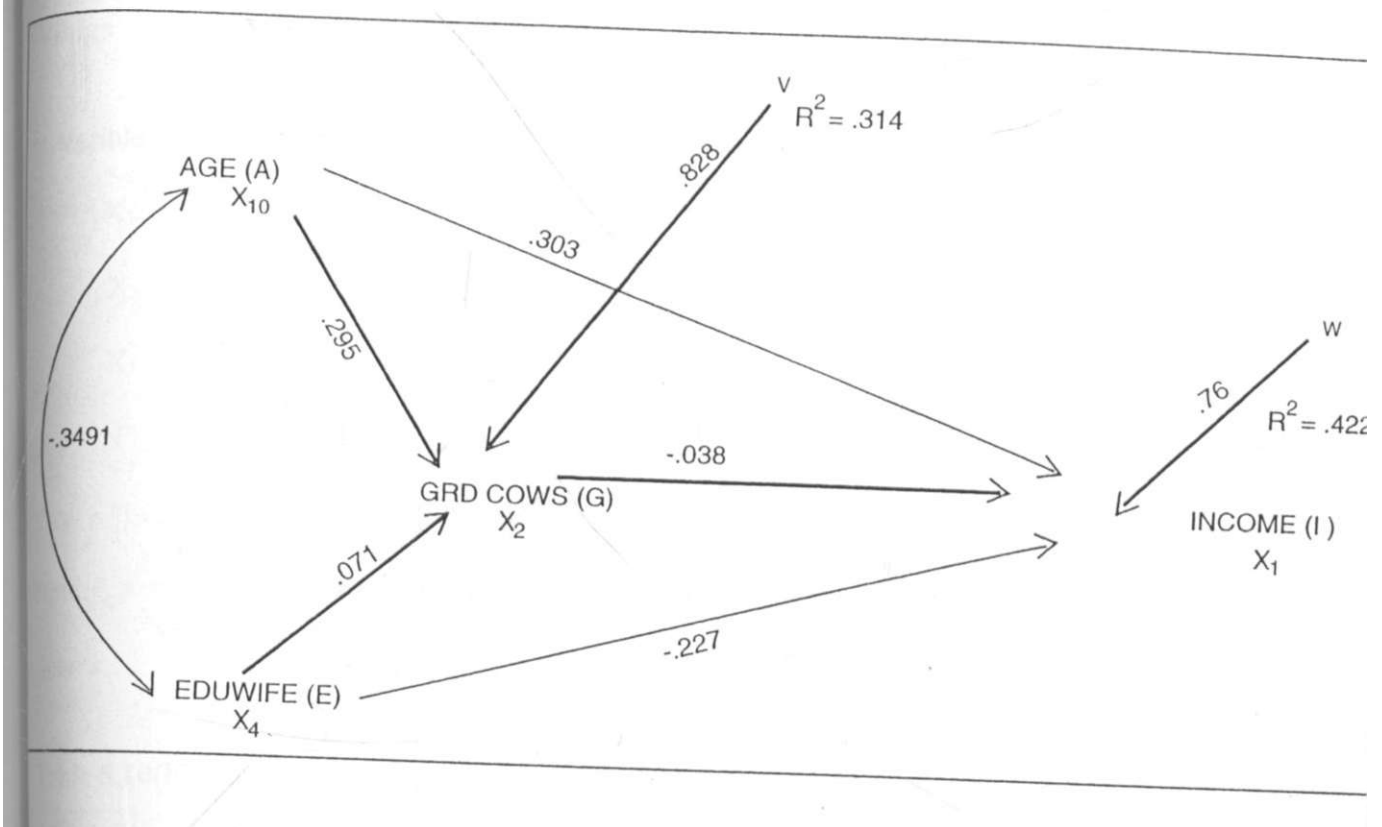
$$= RgG + HaA + F)_e E + H_{ww}$$

Algebraically,

$$x_i = Pi_2 X_2 \quad P,_4 X_4 + P_{110} X_{10} + p_{1ww}$$

$$X_2 = P_{GA}A + P_{GE}E + p_{GV}v$$

Algebraically,

$$x_2 = P_2 {}_4 x_4 + P_{210} X_{10} + P_{2V}v$$

Varible List	X4 (Eduwife)	Xio(Age)	X2 (Grdcows)	Xi (Income)
X10	-.3491			
X2	.1423	.1576		
Xi	-.1506	.2254	-.0523	
N*	83	83	83	83

I Note: N_s Weighted Valid N

i Source :   Primary Data

Table 5.10(b): Regression Analysis For Mature Grade Cows Owned And

Annual Gross Income Variables

Independent Variables	Grd Cows (X2)	Income (Xi)
Age(X_{10})	.295	.303
Eduwife($X-i$)	.071	-.227
^dcows(X_2)	-	-.038
Coefficient Of Determination (R^2)	.314*	.422*

a = <.05

Figure 3b shows the arrow heads pointing toward the influenced variables. The arrow from ^ to Ki, for example, represents the verbal statement, "the age of the respondent (woman) is a cause of her annual gross income from zero-grazing enterprise," or "a change in a woman's produces a change in annual gross income." The numbers along each path are estimated standardized regression coefficients obtained by regressing each criterion variable on the variables thought to be causes of it. The numbers are in standard deviation units. For example the path coefficient from *Eduwife* to *Income,* PIE, (PH) suggests that income of the woman respondent decreases by .227 SD for each standard deviation decrease in the respondent's educational level. Similarly, PIG (P$_{12}$) = -0.038 means that income decreases 038SD for each standard deviation decrease in grade cows owned. It is interesting to note that relatively older relative women respondents *own mature grade cows* (PGA=.295), but their *education* has little impact on grade cows ownership. This is contrary to the *aprior* expectation that respondents \v[th higher education would increase their productivity. It is not surprising that the women respondents, had more gross income than younger women.

The indirect effect of *Age* on *Income* via *Grdcows* is estimated as (-0.038)(.295)=-.01121. By **adding** together the direct and indirect causal effects and comparing the sum to the observed correlation in Table 5 .10(a), we can see how much of the covariation is due to the correlated ᵉffects involving education. Thus, the observed *Age-Income* correlation is 0.2254, the direct ᵉfiect is 0.303, and the indirect effect is -0.01121, which leaves 0.080 of the observed correlation to their dependency on education, that is

I p_{cER} AE+PU-rAE =(-.038)(.071)(-.349)

H T   +(-.227)(-.349)

=0.0801646

gy squaring the path coefficient from the residual variables (Piw and Pgv) we discover how much

variance in the dependent variables remains unexplained by the hypothesized causal process. Both

values are large, $(.828)^2$ or (68.6%) of the variance in owning grade cows and $(.760)^2$ or (54.8%)

of the reported annual gross income cannot be explained by the causal structure in fig 3a and 3b.

If we were to pursue this research, we would want to specify more elaborate models including

•dditional possible sources of variation in annual gross income.

Variable such as education of the husband (Eduhus), family size , that is, number of children

Children), Acreages under food (Areafood) and fodder crops (Areafodd) which had significant

nfluence on productivity were left out in the path analysis. This does not mean the path model

reified in this study was an underidentified model. The path analysis examined in this study was

*cdon *aprior* expectations. For instance, although the respondent's level of education was not

^'.stically associated with zero-grazing operations, it was found imperative to include it in the

TO analysis as an important explanatory variable.

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^^{ttn} s model of socio-economic achievement can be useful in illustrating and facilitating

^ ^{ex}Planations f the socio-economic achievements of both men and women. It is useful to

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illustrate that factors which contribute to the attainment are functioning even for women.

Inspection of the path model discussed above leads t o the following conclusions:

The assumption that older respondents are expected to be less responsive towards change, thus low productivity as measured by grade cows owned and annual gross income does not hold. Instead these respondents who were above middle age were found to have positive and direct effect on productivity. Similarly, the expectation that better educated spouses were more likely to be influenced towards increasing productivity as estimated by mature grade cows owned was supported by the model. However, education of the respondent (woman) was found to have a negative and direct effect on annual gross income from the dairy enterprises (see the path model).

Similarly, owning mature grade cows had negative impact on income, fhe results are interesting and unexpected. The negative and direct effect of education on income and the positive and direct small effect of education on grade cows owned leaves a lot to be desired in explaining the respondent's (women) education as an attribute preparing women for more income and ownership of dairy animals. The study found the education of the husband to be unexpectedly an important explanatory variable(see the p-values and initial regression analyses). This observation suggests ^inclusion of the education of the husband would reduce the magnitude of the contribution of Wious associations found in this study. As seen above the spurious associations contribution to Nations in productivity were high. It must be noted that most of the variables in the multiple

regression found to significantly influence productivity were not included in path analysis. Those analyzed in the model had higher explanation of the respondent's personal characteristics.

Conclusion

The findings from this chapter indicated women groups in addition to providing a strong socio-economic base, were the main sources for obtaining grade cattle. Respondents who obtained
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animals were in the 30-to-50 years age category. Zero-grazing relied on the presence of children on the farm for labour. Equally, hired labour was found to be an important factor in the system.

Farm sizes were significantly associated with grade cows and participation of the woman as a manager compared to the husband. Respondents who practiced zero-grazing units also practiced juroforestry. There was statistically significant association between zero-grazing and purposes of practicing agroforestry. Agroforestry was practiced for improvement of soil fertility and provision of fodder. Area under fodder had the strongest effect on the number of grade cows owned by respondents.

^anized women groups benefited more from experts and extension service information than dividual farmers. Explanatory variables (income, children, labour cost, age) accounted to ^stantial proportion of the variation in dairy income. Age of the respondent was found to be a ** of annual gross income from zero-grazing enterprise. Older women owned grade cows but ^formal education had little impact on grade cows ownership. Respondents who were above

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middle age were found to have positive and direct effect on productivity and that the husband's formal education was important in a wife's adoption of zero-grazing. Duncan's Model of socio-economic achievement is useful in illustrating socio-economic factors which contribute to gender achievement. The study casts doubts on women's education as an attribute preparing women for more income and ownership of dairy grade cattle.

CHAPTER 6

SUMMARY, CONCLUSIONS IMPLICATIONS FOR FURTHER RESEARCH AND POLICY.

The major purpose of this study was to investigate the underlying socio-economic factors related to women's participation in zero-grazing in Vihiga District of Kenya.

The following are the major findings of tlie study:

Respondent **Profile:** The typical profile of the respondents was that they had mostly less than eight years of education (primary), family size of 4 to 6 persons, would be between 30 to 50 years loi **age,** obtained annual gross income of 5,000 shillings to 25,000 shillings and had farms of less ; han **five** acres in size.

Smallholder Dairy Husbandry: Most of the respondents (71%) had experience in cattle management but had low farm record keeping. However, the majority (99%) had established on-an n fodder and manually harvested fodder, had at least less than three persons available for farm work and owned one or more dairy grade cows.

tension Service: In terms of preferences, most of the respondents identified extension agents ^e most preferred source of information on dairy farming. However, women groups to which

the respondents belonged were indicated as the most frequent source of awareness of zero-grazing information.

adoption of **Zero-grazing Technology:** The decision to adopt zero-grazing enterprise was either made independently by the respondent (48%) or by both the respondent and the spouse (48%). Majority (78%) of the respondents obtained the plan for construction of the zero-grazing **unit from** the Ministry of Agriculture Livestock Development and Marketing. Other sources of **j information** of the unit plan was obtained from own fellow women farmers.

Constraints to Zero-grazing: The major constraints to zero-grazing were identified as unavailability of napier/grass (80%), cost of concentrates (50%) and disease problem (51%). **Other** major constraints included drugs/veterinary services, Al services and feeding.

\groforestry Practices: A considerable number of respondents (40%) practised various forms of agroforestry, including trees/crops, trees/pasture and special nesting. The major reasons cited for trese practices were: soil fertility, provision of fodder and for tree products.

Eduction Costs and Returns to Zero-grazing Enterprise: The major components of the **Eduction** costs were labour, feed and veterinary services. While the major returns were psehold milk consumption, livestock sales, milk sales and hides and skins sales. The results [e] **indication** that it was profitable and therefore cost-effective to engage in smallholder dairy

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production by women farmers in Vihiga District.

Quantitative Results: Data obtained was further subjected to cross-tabulation analysis to determine **the association between zero-grazing and animal husbandly, extension services,** agroforestry **practises and personal characteristics of the women farmers.**

The results indicated that age was an important variable in adopting new technologies but it was skewed toward old age category. The mean age of the respondents was found to be 47 years. Number of children in the family was found to be significantly associated with the practice of zero-grazing. Therefore, it can be concluded that zero-grazing operation relied more on the presence of the children on the farm. However, it was observed that the wife's level of education was not significantly associated with zero-grazing operation but on the contrary, the husband's education level was found to contribute to the practice of zero-grazing.

Operation of **zero-grazing dairy units and membership in dairy women groups:** This implies ^**at the** women groups have taken up the challenge and purchased or obtained enterprises, ^**erefore,** group membership strengthened their social economic base and exhibited a high level [01] **Positive** affect (friendliness) among members.

resize was expected to be one of the important factors in making one decide to adopt zero-

    It was therefore surprising that there was no statistical significance between the

operation of the zero-grazing enterprise and farm size. Nevertheless, the majority (71%) of those who operated zero-grazing units had less than 5 acres of land. On the other hand results of the study showed that farm sizes was significantly associated with the number of mature grade cows. This implies that most of the farms in the study area were utilized for zero-grazing activities.

Further results indicated that hired labour was significantly associated with farm size implying that hired labour is an important factor of production in zero-grazing systems. Thus the respondent (woman) managed zero-grazing production systems but was supported by hired labour. It was therefore concluded that the more intensive the dairy production system on a small tarm the more the hired labour required.

The study showed that those who operated zero-grazing units also practised agroforestry. This was confirmed by the significant association between the two practices by the women groups. This implied that agroforestry rather than compete for limited resources with established fodder it ad become a complimentary resource in the provision of inputs to zero-grazing enterprise.

Results of extension service information adoption of zero-grazing practices among women groups towed that extension service information from both the experts and government extension %ents were significantly associated with adoption of zero-grazing practices. The organization of women into target groups, such as the zero-grazing women groups, bring with them the benefits cconomies of scale in the costs of provision of extension services by many agents. This

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facilitates better information dissemination and adoption rate.

Multiple regression results showed that there was a positive relationship between socio-economic characteristics of the respondent and productivity.

Labour costs had strong influence on the gross income from zero-grazing which, as an intensive enterprise, requires considerable expenses on labour for income miximization. Age as a social zariable was found to have a strong influence on income. Thus older farmers tended to have higher gross incomes per year compared to younger farmers. On the other hand households with large family size tended to have lower gross income per year from zero-grazing operations compared to households with smaller family size. This finding was consistent with the *aprior* expectations.

to of land under fodder and crops had positive and strong influence on the number of mature ?adecows, that respondents owned. This implied that the respondent was able to use fodder •^{To}ps plus food crops as feeds to the grade animals. Thus food crops had a dual purpose, family ^sistence and animals feeds. Two social variables, education of the husband and age of the I ^Pondent had a strong positive influence on the number of grade cows owned by the Pendent. The implications of the findings were that respondents with better educated husbands ^more likely to own larger numbers of mature grade cows than respondents with less N^{e}d husbands and that older respondents tended to have large numbers of mature grade

covvs than younger respondents as indicated by the empirical data analyzed.

Results of Path Analysis concurred with those of other quantitative analysis outlined above. The path Model findings supported the findings that respondents who were above middle age were found to have positive and direct effect on productivity. Similarly, belter educated spouses were more likely to be influenced towards increasing productivity. Education of the respondent (woman) was found to have a negative and direct effect on annual gross income. Also owning mature grade covvs had negative impact on income. These results were unexpected and interesting.

Implications for further Research

Since the husband's educational level contributed to the practice of zero-grazing, further research is needed to investigate what aspect of the husband's education flows into the zerograzing operations.

There is need for further research on the findings in Vihiga District, and probably in other areas in ^ea ya and other developing countries that older farmers (women) are more likely to adopt new ec hnologies than younger farmers (women). Youth or young age was not a factor in determining ^adoption of zero-grazing enterprise.

education is expected to prepare women for more income, property ownership (dairy animals) and instill a sense of achievement. The negative and direct effect of women's education on income and grade cows ownership calls for further research in this area.

fo pursue this research, there is need to specify more elaborate causal models that would explain additional possible sources of variation in productivity, especially income.

Policy **Implications**

Ihefindings from the study showed that effort to improved dairy husbandry, increased milk roduction and household income should be geared towards encouraging women groups. Group membership creates awareness among farmers on the relevant technologies for adoption and :rengthens social economic base of women farmers. Voluntary local organizations and social etworks are significant for enabling women to better control their own means of production, emale- headed households and other vulnerable landless women can organize and mobilize their -sour into support networks in difficult times and work sharing. The adoption of zero-grazing -hnology was rated high. Costly inputs, channels of delivery of information, customs and editions, were some of the reasons given as constraints to adoption. These and other problems solved through intensification of extension service to farmers and more importantly, oving efficiency in input supply services through community-based, self-help and voluntary zations. Groups of smallholder farmers which have organized themselves into networks Militate exchanges of information, ideas and techniques have unlimited opportunities to

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Militate exchanges of information, ideas and techniques have unlimited opportunities to

exploit economies of scale achievable in joint action compared to dispersed individual farmers. Technical oUlcers work more easily with organized entities and also know where to turn in case of disagreement or misunderstanding. This is because group members can interact frequently in assessing the technology. They get a sense of belonging to something. Since they promote collective welfare and appeal to the less fortunate in airal areas, the main challenge is for the researchers, extension statYand policy makers to work with organized groups in implementing the recommended technologies.

The study showed that women farmers command detailed knowledge about soil erosion, maintenance of soil fertility, environment degradation and the practice of agroforestry I technologies. Appropriate policy in the dairy industry should emphasize the women as channels I for introducing new technologies in rural communities. To achieve this, there is need to focus on 1 women's education so as to increase their knowledge of environmental conservation. Such a I policy should encourage the hiring of more women as agricultural extension agents, thereby providing rural farm women with wider access to information.

results further showed that the decision to adopt zero-grazing enterprise was either made
L
'•"dependently by the respondent or by both the respondent and spouse. The implications of the
•'"dings are that self-sufficiency in food production at the household level cannot be achieved if
.JO"cy makers marginalize rural women and their organizations in the formulation, execution and Storing of policies. The household should be involved in decision -making to avoid

persistence of poverty, the narrow food production base and lopsided rural development. Further, t^e data suggests that increased household income based on the commercialization of smallscale dairy holdings can make a major contribution to household food security. Since milk is a basic food commodity, enabling conditions for women farmers should be improved in tandem with agricultural policies and programs in order to maximize the nutritional efTets of income generating policies. The Kenya Government has stated clearly in the current development plan that women **are** among the agents of our development whose hard work and determination in the struggle against hunger deserve attention. No one is unaware of the role women play in Kenya's economic and social development, and how actively they participate in production activities. However, the role of women in livestock production, and their contributions in dairy farming remain jnrecognized and unremunerated. Women allocate their labour toward food production activities etlheir participation in decision-making is lacking at the farm level. This confirms gender stratification which is the extent to which women are systematically disadvantaged in their access oopportunities relative to the men in society. There is need for new strategies and policies limed at strengthening the organizational tools available to women so that production and management of the fruits of their labour occur on a collective, cooperative basis. Women can be and equal participants with men at all levels of societal life. Carefully formulated policy could "?ate women's sections in development programs and projects. Thete is an urgent need to the policies in relation to gender stratification which encourage biases towards men and off women or regard women as mere homemakers.

Contributions to Scholars

The major contributions of this study to other scholars lie in the identification of the special roles
women play in the agricultural sector of Kenya's economy. The study brings out a concrete

picture on actual women participation and the need to integrate them 'in technological

development. A female theory but not necessarily feminist is likely to be postulated from this

study. Further, contributions to scholarly work is seen through the way the study has addressed

gaps on the topic. Most studies on this topic fail to show the level at which socio-economic

characteristics influence women's adoption and diffusion of technology; gaps exist in role of

women in livestock farming systems; there is lack of information on Government support in

addressing illiteracy, skills, extension services and unequal access to and governance of

productive resources by women. There is paucity of information on small scale women farmers'

concerns and/or opinions on adoptions of zero-grazing technology and its impact on the women

fanners. Few studies have identified constraints and future prospects for women in zero-grazing.

Several analytical techniques such as Duncan's Structural Model that examined socio-economic

enables was form men only. 1 he Vihiga study has made a good effort in addressing these gaps.

Since no empirical studies on women in dairy zero-grazing has been carried out in the district,

'tare is need for more studies in the area on the topic to supplement this study especially using

^sal models to test with women for direct effects of exogenous variables on endogenous

tables. The study has shown that the organization of women into^rget groups bring with

the benefits of economies of scale on the costs of provision of extension services by any

I   This in addition to women groups being vehicles of technological transfer is a

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ontribution to the study. However, scholars analyze the socio-economic model for women
chievement in Fig. 1 and come up with alternative approaches for women to achieve their goals
[i the use of new technologies. Of great concern in this model is the issue of technological
[intension. There is need to re-assess the viability and re-adoption of indigenous technology by
>ur small-scale rural farmers especially women groups who have shown to be the medium of
echnological transfer.

3ne of the major contributions by the government has been through different policy measures
whose broad objective of dairy Developemnt are embedded within the framework of the national
food policy. Smallholder dairy sector development policies have been implemented through a
combination of promotion of increased rural production of milk and improvements in the dairy
marketing system. The dairy sector is now liberalized but the Government has maintained major
goals to ensure development, improvement of efficiency and productivity in the sector. Lately,
however, the long drought has been a severe blow to the sector.

depopulation pressure and encroachment on marginal areas coupled with drought call for
Pessary adjustment in management, feeding and breeding to cope with changing ecological
Nations. Additionally, scholars need to focus on environmental destruction, deforestation and
1* agricultural practices which characterize land use in most catchment areas of the country.
Wpriate technology such as zero-grazing should help people in rural areas to switch to more
^lcient agricultural practices and reduce dependence on large cattle/herds while at the same time

ng farmers how to conserve their soil and use agroforestry-based production systems.

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APPENDIX 1:   CORRELATION MATRIX (I)

	ZEDUWIFE	ZEDUHUS	ZAGE	ZTOTAL	ZINCOME	ZGRDCOWS
ZEDUWIFE	1.0000					
ZEDUHUS	.6468	1.0000				
ZAGE	-.3491	-.4759	1.0000			
ZTOTAL	.1214	.1287	.0886	1.0000		
ZINCOME	-.1506	-.1048	.2254	.0781	1.00000	
ZGRDCOWS	.1423	.2007	.1576	.2457	-.0523*	1.0000
ZCHILDRE N	-.2124	-.2387	.4445	-.0075**	-.0402*	.0094**
ZTTVT	.2154	.1779	-.1818	.2430	.1514	.0251
ZTTLBR	.2047	.2323	-.0726	.2810	.4840	-.0362*
ZTTFD	.0025**	-.1641	.1179	-.0470*	.3455	-.0358*
ZAREAFOO U	.0874	.1877	-.0049**	.4275	.0306*	.3659
ZAREAFOD D	-.0575*	-.0368*	.1334	.5459	.0171*	.2884

* a < .05

»

ZCHILD	ZTTVT	ZTTLBR	ZTTFD	ZAREFOOD	ZAREAFOD D

1.0000

-.0021**	1.0000				
.0392*	.3838	1.0000			
.0140*	.2361	.2453	1.0000		
-.0643	.1891	.1526	-.2301	1.0000	
.1526	.1218	.1542	-.0180*	.1503	1.0000

APPENDIX 2: SUMMARY OF STATISTICAL AND ECONOMETRIC ANALYSIS ON SOCIO-ECONOMIC FACTORS WHICH INFLUENCE PRODUCTIVITY (INCOME) IN VIHIGA DISTRICT, 1997.

'E Q	EXPLANATORY VARIABLE	SIGN NOTATION	T-TEST	F TEST	R-'
	Xi			S	0.332
	x₂	- (W)	-.35		.273
	X₃	+ (R)	1.88	NA	NA
	x₄	- (W)	-1.87	NA	NA
	xe,	- (R)	-2.16	NA	NA
	X*	+ (R)	0.30	NA	NA
	x₇	+ (R)	4.74	NA	NA
	x₈	+ (R)	0.15	NA	NA
	x₉	- (W)	-0.40	NA	NA
	Xio	+ (w)	2.51	NA	NA
	Xn	- (W)	-0. 38	NA	NA
	X12	+ (R)	0.36	NA	NA

NOTE   = Rightly signed   S = Statistically Significant   W = Wrongly signed

 NA = Not applicable.

APPENDIX 3: SUMMARY OF STATISTICAL AND ECONOMETRIC TESTS ON FACTORS WHICH INFLUENCE PRODUCTIVITY (NUMBER OF MATURE GRADE COWS) IN VIHIGA DISTRICT,1997.

'EQ	EXPLANATORY VARIABLES	SIGN NOTATION OF ESTIMATE	T-TEST	F-TEST	R^{-i}
'2				S	0.208
	X_i	- (W)	-0.35	NA	NA
'—	X_2 (DEP)		. . .	NA	NA
	x_3	+ (R)	1.10	NA	NA
	x_4	+ (R)	0.52	NA	NA
	x_5	- (R)	-0.47	NA	NA
	X_b	+ (R)	3.04	NA	NA
	x_7	- (W)	-1.30	NA	NA
	X_8	- (W)	-0.27	NA	NA
	$X_,$	+ (R)	2.42	NA	NA
	X_{io}	+ (W)	2.22	NA	NA
	X_n	- (W)	-0.53	NA	NA
	X_{12}	+ (R)	2.07	NA	NA

NOTE: R= Rightly signed S= Statistically significant W= Wrongly signed NA= Not applicable

APPENDIX 4: SUMMARY OF FINAL SOCIO- ECONOMIC FACTORS INFLUENCING PRODUCTIVITY (INCOME) IN VIHIGA DISTRICT ,1997.

EQUATION	EXPLANATORY VARIABLES	SIGN NOTATION OF ESTIMATE	T-TEST	F TEST	R
					0.273
	(dep:				
	X_S	- (R)	-1.8	NA	NA
	X_7	+ (R)	5.7	NA	NA
	X_{io}	+ (W)	2.7	NA	NA

NOTE: NA= Not applicable S= Statistically significant R= Rightly signed W= Wrongly signed

APPENDIX 5: SUMMRAY OF FINAL FOUR SOCIO-ECONOMIC VARIABLES (AREAFOOD, AREAFODD, AGE, EDUHUS) INFLUENCING PRODUCTIVITY (GRDCOWS)IN VIHIGA DISTRICT, 1997.

EQUATION	EXPLANATION VARIABLES	SIGN NOTATION OF ESTIMATE	T-TEST	F-TEST	R
2	X_2 (DEP)			S	0.254
	x*	+ (R)	3.2	NA	NA
	X_9	+ (R)	3.2	NA	NA
	Xio	+ (W)	2.1	NA	NA
	Xi2	+ (R)	2.5	NA	NA
«					

NA =Not applicable R= rightly signed W= Wrongly signed

S= statistically significant.

APPENDIX 6

FINAL QUESTIONNAIRE

DAIRY CATTLE HUSBANDRY AMONG WOMEN FARMERS

IN VIIIIGA DISTRICT: PROSPECTS AND CONSTRAINTS

JUNE-JULY, 1997

Name of women zero-grazing group: —

Name of woman farmer:

Division:. . . . . .Location:. . . . . .Sublocaiion:.

HUSBANDRY (PERFORMANCE) /QUALITY

1. (a) Do you keep cattle?

    . 0 = No   1 = Yes

  (b) If"Yes" indicate the following

                                    Grade Traditional How Obtained

    1. Number of mature cows

    2. Number of bulls

    3. Number of heifers_____• -

    4. Number of heifer calves

    5. Number of bull calves

  (c) Do you feed your cattle on your farm-grown fodder crops?

      0 = No   1 = Yes

2. Who manes the cattle?

  (a) Wife   (b)   Husband

' (c) Hired labour. . . . .(d)   Others (specify)-

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3. For how many years have you owned and looked after livestock?............years

4. Indicate the grazing system you practice for your cattle on your farm.

   (a) Animals graze on your farm throughout the year.

   (b) Animals graze on roadside, communal grazing or public utilities throughout the year.

   (c) Animals put on pasture fields divided into paddocks.

   (d) Animals fully confined in a unit and not allowed into fields (zero-grazing)

   (e) Others (specify)

EXPOSURE TO EXTENSION SERVICE INFORMATION

5. Please indicate your major source(s) of information about cattle keeping.

   (a) Text books   (e) Administration

   (b) Experts (Extension Agents)   (0 Students

   (c) Magazines   (h) Others (Specify)

   (d) Local resource people

6. How did you become aware of zero-grazing technology?

   (a) Through media channels (Radio, Newspapers, Posters, Extension Circulars and farm

       Magazines).

   (b) Fellow Women Farmers

   (c) Government Extension Agencies

*   (d) Non-Governmental Organizations

   (e) Others (specify)

7. Have you adopted zero-grazing technology?

            0 = No   1 = Yes

8. If "Yes", which of the following was most influential in helping you adopt zero-grazing

   technology?

   (a) Visits by Government Extension agencies

(b) Farmer's visits

(c) Fellow women farmers' groups

(d) Demonstrations

(e) Field/Farmers' day

(f) Others (specify)

9. Have you attended a livestock seminar or any other form of agricultural/livestock

training? (Please indicate)

Type of training	**Duration**	**Year attended**

ADOPTION OF ZERO-GRAZING

10. (a) Do you operate a zero-grazing unit for grade cattle?

    (b) If "Yes", where did you get construction details (please ii licate)

        (i)   Ministry of Agriculture, Livestock Development and Marketing

        (ii)   Ministry of Energy and Regional Development

    (c) Fellow farmers

    (d) Own plan

    (e) Other source (specify)

11. When did you construct the Unit . . . .(years ago)

12. How many grade animals are kept in the unit

13. How much area is available per animal in (m^2) for the following?

(a) Resting (m^2)

(b) Feeding (m^2)

(c) Watering   •(m^2)

*   (d) Milking parlour (m^2)

(e) Store (m^2)

(0 Total area (m^2)

14. Describe the construction

(a) Roof covered with: i)   Iron sheets

ii)   Thatch

iii)   Others (specify)—

(b)   **Sides open**   **Side; closed**

i)   All sides

ii)   One side

iii)   Two sides

iv)   Three sides

(c)   Materials used on pacing

i)   Concrete

ii)   Murrain

iii)   Quarry chips

iv)   Rammed earth

15. (a) Do you have the record for the cost incurred in putting up the unit?

0 =   No   1 = Yes

(b) If "Yes", what was the cost   (Kshs.)

(c) If "No", can you estimate the current cost . . . .(Kshs.)

16. Who made the decision to have zero-grazing on your farm?

(a) I

(a) Resting -. . . . .(m²)

(b) Feeding (m²)

(c) Watering 【ᵐ 】

» (d) Milking parlour (m²)

(e) Store (m²)

(0 Total area. ... ...(m²)

14. Describe the construction

(a) Roof covered with: i) Iron sheets

ii) Thatch

iii) Others (specify) -

(b) **Sides open** **Side; closed**

i) All sides

ii) One side

iii) Two sides

iv) Three sides

(c) Materials used on pacing

i) Concrete

ii) Murrain

iii) Quarry chips ϟχ

iv) Rammed earth

15. (a) Do you have the record for the cost incurred in putting up the unit?

0 = No 1 = Yes

(b) If "Yes", what was the cost .. .. (Kshs.)

(c) If "No", can you estimate the current cost . . . .(Kshs.)

16. Who made the decision to have zero-grazing on your farm?

(a) I

(b) My husband

(c) Both of us

(d) Agricultural Extension Agent

(e) Others (specify)

17. Who usually makes the decisions concerning the operations of the zero-grazing?

(a) i

(b) My husband

(c) Both of us

(d) Agricultural Extension Agent

(e) Others (specify)

18. Which of the following specific types of decision making do you take part in?

(a) Those regulating the work pattern

(b) Those concerning the overall running of the zero-grazing ✍

(c) Those dealing with discipline............................-

(d) Others (specify)

19. (a) Are you a member of a zero-grazing women group?

              0 = No   1 = Yes

(b) If "Yes", what were the reasons for joining zero-grazing women's group[9] (Indicate)

    (i)   Improve living standards of the family.......................-

    (ii)   To avoid lowering family's living standards

    (iii)   To raise enough income

    (iv)   To obtain a grade calf

    (v)   Others (specify)

20. (a) What help have you received from the group

(b) If group provides calves on rotating basis, how long has it taken you to get one

(c) Do all members in your group agree to the system of calves distribution described in

(b) above.   0 = No   1 = Yes

21. what would you say your zero-grazing operation with regard to the following:

(a) Helps one to acquire a skill

(b) Allows one to put to use one's skills

(c) Aids one to improve on one's skills

(d) Does not encourage acquiring of a skill

(e) Does not encourage developing of a skill

(t) Does not offer opportunities for putting one's skill to use

22. How many grade cows are in

(a) Milk   (cows)

(b) Dry....................................(cows)

23. What are the major constraints in producing milk?

(a) Availability of adequate napier/bana grass

(b) Availability of concentrates

i

(c) High cost of concentrates

(d) Poor price of milk

(e) Poor marketing of milk

(0 Disease problems

(g) Any other reasons (specify)

24. There are many things which might have influenced you to adopt zero-grazing practice.

Below are listed some values and beliefs. How important is t$ch you? "Not at all

important" or "most important" (circle the number).

Values, beliefs		Important to you				
		None	Little	Soirn,	More	Most
1.	Work		2	3	4	5
2.	Getting ahead in life		2	3	4	5
	Rural development		2	3	4	5
4.	Family labour input		2	3	4	5
5.	Other sources of income		2	3	4	5
6.	Family goals		2	3	4	5
7.	Access credit		2	3	4	5
8.	Making independent decisions		2	3	4	5
9.	Gender equality		2	3	4	5
10.	Other (specify)					

25. Do you give supplements to your grade dairy animals? How much and how often

(indicate as follows)

	Do you give	How often	Amount per animal
	0 = No 1 = Yes		

i) Mineral (salt)____

ii) Concentrates

   dairy meal____

iii) Bran____

iv) On-farm compound

   feed

26. Have you established fodder?

(a) 0 = No   1 = Yes

(b) If "Yes", indicate.

(i) Cut and carry fodder

(ii) Fruit stress

(iii) Tree shrubs

(iv) Napier

(v) Others (specify) —

27. How is the fodder harvested?

   (a) Manually

   (b) Machine

   (c) Other (specify)

28. How is fodder transported?

   (a) Manually

   (b) Wheel barrow

   (c) Donkey cart

   (d) Tractor trailer

   (e) No transport

   (f) Other (specify)

29. What is the distance between fodder plots and the feeding yard?

   (a) Over 2 km

   (b) 1 to 2 km

   (c) 0.5 to 1 km

   (d) 0.25 to 0.5 km

   (e) Less than 0.25 km

AGROFORESTRY

30. Do you practice Agroforestry, i.e. a close association of trees or shrubs with food crops, animals and/or pasture

    0 = No   1 = Yes

31. Which of the following agroforestry systems do you practice on your farm?

    (a) Trees with crops

    (b) Trees with pasture

    (c) Trees with animals

    (d) Trees nested into special places in the landscape

    (e) Others (specify)_

32. Why do you practice agroforestry?

    (a) To improve soil fertility

    (b) To obtain valuable tree products

    (c) Increase the production of the surrounding crops

»   (d) To provide useful fodder for animals

    (e) Other (specify)

33. List (in Kiswahili) some of the most common trees you intercrop with pasture and crops for animal feed_

PERSONAL CHARACTERISTICS

34.   (a)   What is your age. . . . . .Years

       (b)   What is your marital status?

(i) Married

(ii) Single

(iii) Divorced

(iv) Widowed

(v) Separated

(c) Are you the only wife of your husband?

0 = No   1 = Yes

(d) If "No", how many co-wives do you have

(i) 0   (ii) 2

(iii) 3   (iv) 4 or more

(e) How many children do you have?

(f) Other relatives living with you on the farm?

(i) Male(s)

(ii) Female(s)

34. Indicate the distribution in the family. (Circle the appropriate number on the scale for each age group).

Number of persons

	0		2	3	4	5+
Below ten years			2	3	4	5	6
10 to 20 years			2	3	4	5	6
21 to 30 years			2	3	4	5	6
31 to 40 years			2	3	4	5	6
41 to 50 years			2	3	4	5	6
51 to more years			2	3	4	5	6

36. (a) What is gender distribution in the family? (Circle the number on the scale for each gender category).

Number of persons

	0	1	2	3	4	5+
Female (Children)	1 2		3	4	5	6
Male (children)	1	2	3	4	5	6

(c) Is your husband living on the farm?

0 = No   1 = Yes

37. How many members of the family live on the farm? (Circle a letter)

(a)   Less than 3 persons

(b)   Three to five persons

(c)   Six to eight persons

(d)   None of the above

38. Of those living on the farm, how many are available for farm work?

Number of Persons   **Number of Hours/Day**

39. How often do family members help you with zero-grazing work?

(a)   Frequently

(b)   Now and then

(c)   Others (specify)

40. If some family members left the farm, why did they leave the farm? (Circle a letter)

(a)   In search of better income

(b)   Due to lack of land

(c)   Bough land elsewhere

(d)   Others (specify)

41.   Indicate your educational status by circling the number of highest education level

completed.

Wife   **Husband**

1. No formal schooling   1. No formal schooling

2. Class 1 - 4   2. Class 1 - 4

3. Class 5 - 7 / 8   3. Class 5 - 7/8

4. Form I - I I   4. Form I - II

5. Form III-IV   5. Form III-IV

6. Form V - V I   6. Form V - V I

7. University   7. University

Other educational/technical institution (specify)

42.   What is the total area of your farm(s) in acres.

Average

(i)   Farm unit visited

(ii)   Others

(iii)   Total

43.   Please indicate total area under the following:

(a)   Food crops. .. .. (acres)

(b)   Cash crops (coffee, tea, pyrethrum, horticulture. . . . . (acres)

(c) **Area under grass**   **(acres)**

(d) **Area under fodder crops (napier, lucerne, etc.)**. . . . .**(acres).**

PRODUCTIVITY AND INCOME

TABLE 1:   MILK PRODUCTION, FARM INPUT COST AND INCOME FOR

JANUARY - DECEMBER, 1996

NAME OF FARMER: NUMBER OF ANIMALS

MONTH	MILK	SALES (KSHS.)				COSTS (KSHS.)			PR FT/LOSS	
	CSD	MILK	ANML	HDS	MNRE	LBR	FD	VT	SH	SH
JAN.										
FEB.										
MARCH										
APRIL										
MAY										
JUNE										
JULY										
AUG.										
SEPT.										
OCT.										
NOV..										
DEC.										
TOTAL										

KEY: Value in the first two rows indicate revenue from milk sales in litres and

monetary value of milk consumed in a month.

CDS = Consumed; ANML = Animals;   HD = hides; MNR = Manure; LBR = Labour;

FD = Feed; VT = Veterinary.   -

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