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A Comparative Analysis of Poverty Incidence in Farming Systems of Tanzania

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Table of Contents

List of tables

List of figures

List of abbreviations

ALP	Agricultural and Livestock Policy
ASDP	Agricultural Sector Development Programme
CDP	Cooperative Development Policy
FAO	Food and Agriculture Organisation
FSA	Farming Systems Approach
GDP	Gross Domestic Product
HBS	Household Budget Survey
IFAD	International Fund for Agricultural Development
MAFS	Ministry of Agriculture and Food Security
NBS	National Bureau of Statistics
NSGRP	National Strategy for Growth and Reduction of Poverty
REPOA	Research on Poverty Alleviation
SAPs	Structural Adjustment Programmes
URT	United Republic of Tanzania

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Abstract

Pro-poor growth has inevitably become a topical agenda for policy research. After many years of emphasis on rapid economic growth as a solution to poverty, income distribution is now acknowledged as an important factor in poverty reduction. One way of facilitating greater income distribution is to stimulate development in the sectors that provide livelihoods to a large proportion of the poor. In Tanzania, the agriculture sector is the main provider of livelihoods for around 80% of the population. Hence, progress in this sector will be central to national poverty reduction.

To inform the design and implementation of agricultural policy, this study analysed poverty incidence in relation to Tanzania's major farming systems utilising data from the Agriculture Sample Census 2002/03. The analysis found that poverty incidence differed considerably by farming system. The study also confirmed that agriculture is the principal economic activity for rural households in all major farming systems, but that utilisation of agricultural inputs by households, such as irrigation, extension services, draft animal power and fertilisers, was generally low. The main conclusion from the findings is that farming system sensitive policies will be required to improve agricultural productivity, enhance livelihoods and reduce poverty levels in rural Tanzania.

1 Introduction

1.1 The Context

Since the late 1990s, GDP growth in Tanzania has averaged over five percent. However, this economic growth has not led to substantial poverty reduction as indicated by the 2007 Household Budget Survey (HBS). This raises questions over the role of economic growth in poverty reduction and reinforces the view that GDP growth is not a sufficient factor for poverty reduction. HBS 2007 confirmed that most Tanzanians are still smallholder farmers, but agriculture is the least remunerative sector of the economy. The poverty rate among households in rural areas continues to be very high at 38% of the total number of households compared with 16% in Dar es Salaam and 24% in other urban areas. As a result, almost three-quarters (74%) of the poor are dependent on agriculture. Clearly, poverty reduction in Tanzania means confronting the problems that farmers face in generating income. As Mellor (2000) observes, agricultural growth must be accelerated if poverty is to decline rapidly.

Given the widespread participation, the agriculture sector will continue to play a central role in the Tanzanian economy, and, with an enabling policy framework and strategic investment, has the potential to advance the country's goals of growth and poverty reduction. Dixon et al. (2001) found that agricultural growth can reduce urban poverty more rapidly than urban growth itself, largely due to the reduction in urban food costs and lower rates of migration from rural areas to towns and cities. The challenge, therefore, is how to overcome constraints within farming systems to sustainably increase household incomes.

To better understand the constraints in rural areas, this study examined the factors responsible for poverty incidence in the different farming systems in Tanzania.[1] The National Strategy for Growth and Reduction of Poverty (NSGRP) 2005-2010 acknowledges the disparities in poverty status across regions and districts, and that these disparities are explained by patterns in the distribution of population, endowment in natural resources, climatic conditions, as well as infrastructure such as transport and health facilities. This research, therefore, seeks to inform the implementation of the new phase of NSGRP by exploring how poverty can be reduced using a farming systems approach.

1.2 The Study

Many studies indicate that broad-based agricultural development provides an effective means for both reducing poverty and accelerating economic growth (Hammond, 2005; Dixon et al., 2001; Amani, 2005; Treichel, 2005). To date, however, the agricultural sector in Tanzania has contributed little to poverty reduction. The studies point to numerous reasons for this situation. One of the reasons relates to low natural resource utilisation explained by extremely low land-labour ratios. Despite the abundance of unutilised land, Tanzanian agriculture is dominated by small-scale subsistence farming (MAFS, 2001). Smallholders, operating between 0.2 and 2.0 hectares (Tulahi & Hingi, 2006) and traditional livestock herders who keep an average of 50 heads of cattle utilise approximately 85% of the arable land (MAFS, 2001). Tulahi et al. (2006) also found that the major limitation on the size and utilisation of land holdings is the lack of access to modern farming methods and heavy

[1] FAO (2001) defines a farming system as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Ker (1995) denotes that depending on the scale of the analysis, a farming system can encompass a few dozens or many millions of households.

reliance on the hand hoe as the main cultivating tool. They found that 70% of farmers still used a hand hoe for tilling the land, 20% used animal draft ploughs and only 10% used tractors.

The second reason why agricultural development has had limited impact on poverty reduction relates to low productivity in the sector. Not only are farmers cultivating small plots of land, but yields are low relative to countries with similar natural resource endowments and climatic conditions, indicating inefficient use of the land available. Furthermore, agriculture is never going to be as dynamic or remunerative as the services or manufacturing sector. A historically prolonged and deep urban bias led to a distorted pattern of investment. Greater public and private capital was invested in urban areas than in rural areas, with too little capital directed towards raising rural productivity. Such distortions have resulted in strikingly different marginal productivities of capital in urban and rural areas.

Therefore, new growth strategies are needed that prioritise rural growth. A revolution in the agriculture sector is required, centred on identifying specific agricultural and rural development needs and opportunities, and focusing investment in areas where the greatest impact can be achieved. This process can be facilitated by first identifying and analysing farming systems as a route to understanding the local factors and linkages that will facilitate growth.

1.3 Study Objectives

The principal objective of this research was to determine the poverty incidence in different farming systems in Tanzania. The specific objectives were:

- To describe the patterns of poverty incidence in relation to farming systems;
- To quantify farming system factors that have an influence on poverty incidence and poverty reduction;
- To identify alternative policy options and strategies regarding pro-poor growth; and
- To highlight specific priority areas for further research attention.

1.4 Organisation of the Report

The remaining part of the report is structured as follows: Section 2.0 provides the theoretical background and literature review for the study; Section 3.0 presents the research hypotheses and significance of the research; Section 4.0 outlines the methodology; Section 5.0 presents the results of the analysis; and Section 6.0 discusses the conclusions and policy implications based on the study evidence.

2 Literature Review

2.1 Theoretical Background

The use of the Farming System Approach (FSA) as an analytical framework became common in the 1970s, and it has contributed to a paradigm change in rural development thinking. FAO (2001) indicates that over the past 30 years, the FSA has evolved markedly. Essentially, the scope of the analysis has gradually expanded, placing increasing emphasis on horizontal and vertical integration, on multiple sources of household livelihoods, and on the role of the community, the environment and support services.

The impact of rapid and sustained agricultural growth in a farming system on aggregate poverty is highlighted in literature. According to Dixon et al. (2001), factors determining a farming system's growth potential include: (i) suitable resource endowments; and (ii) favourable access to infrastructure and services, including markets, agricultural inputs and land tenure. Although there is limited flexibility in the choice of farming systems in relation to agro-climatic conditions and natural resource endowments, farmers can vary their cropping patterns.

In these lines, for poverty reduction, households can adopt a number of strategies within a farming system to improve livelihoods. These include:

- Intensification of existing production patterns;
- Diversification of production and processing;
- Expansion of farm or herd size;
- Increasing off-farm income, both agricultural and non-agricultural; and
- Exiting from the agricultural sector within a particular farming system.

These options are not mutually exclusive. Even at the individual household level, households will often pursue a mixed set of strategies.

Other researchers have gone further to cement the critical role of using farming system approach when determining specific investment and policy initiatives. Dixon et al. (2001) asserts that the challenge for developing countries is to identify specific agricultural and rural development needs and opportunities, and to focus investment in areas where the greatest impact on food insecurity and poverty will be achieved. This process of identification and resource allocation can be facilitated by analysing farming systems in order to develop an understanding of local factors and linkages. As part of this analysis, it is also extremely helpful to aggregate locations with similar development constraints and investment opportunities through the application of a farming systems framework.

2.2 Studies on Farming Systems in Tanzania

A recent study by Ellis and Mdoe (2003) investigated livelihood patterns and experiences with different sub-farming systems in rural areas of Morogoro region. The farming systems examined by Ellis and Mdoe (2003) included small-scale, farmer-managed irrigation; rain-fed maize production; intensive upland fruit and vegetable production. The study focused on

differential ownership of assets such as land and livestock, as well as household activities and incomes. Land ownership was found to vary across the study areas reflecting the relative severity of land scarcity in different places. In some places, a striking proportion of households owned no land, though they were able to rent land for farming. In contrast, in study areas where land was relatively abundant, the proportion of households that owned land was higher. With respect to crop production, the research found that the types of crops and intensity of production also varied with farming system. Maize was found to dominate cultivation across all villages. Maize has a dual function of being both food and cash crop. Rice was popular in areas with sufficient water, particularly Kilosa and Selous, while villages in Mgeta specialised in fruit and vegetable production, with large areas under green peas, beans, green vegetables and tomatoes.

In his study on two farming systems—dairy cattle and irrigated rice farming—in Dodoma region, Kisusu (2003) concluded that the introduction of different breeds of improved dairy cattle and improved rice varieties in these farming systems had a positive impact on household income and food security, and significantly contributed to poverty reduction at the household level.

Applying an income approach, Kadigi et al. (2004) compared household incomes in four types of farming systems in the Usangu Basin: (i) smallholder rain-fed paddy cultivation using hand hoes and family labour; (ii) rain-fed paddy cultivation using tractor, fertiliser and hired labour; (iii) smallholder irrigated paddy production using tractor, fertiliser and hired labour; and (iv) smallholder irrigated paddy production in hired plots using tractor, fertiliser and hired labour. The results indicated that household incomes[2] varied among the four types of farming systems. The households that practiced irrigated paddy production using tractors, fertiliser and hired labour had the highest income per hectare and per unit of labor used. The authors concluded that although irrigated paddy production is considered to utilise too much of the available water in the Usangu basin, it is also playing an important role in enhancing food security, incomes and livelihoods of rural households.

In his study on farming systems in two areas of Kwale District in Kenya, van Oosten (1989) examined the relationship between farming systems and household food security and savings. The study identified three types of systems in the district:

- Households which depend primarily on the cultivation of food crops (maize, rice, cassava) for their livelihood with very limited access to tree crops and livestock as well as modest income from off-farm activities;

- Households which have a large agricultural production base with large areas under food crop cultivation, livestock and tree crops but very modest access to off-farm income; and
- Households which have tree crops and livestock with little food production but have access to regular off-farm income.

[2] Net income after deducting costs from farm revenues

The study found that households in the first farming system suffered from periodic food shortages and had no savings because all income was spent on basic needs including food. The opposite was the case for households in the third farming system; they never experienced food shortages and savings were common because of their stable source of income. In the second farming system, the results were mixed. Some households experienced food shortages while others were food secure throughout the year with some income saved.

Van Oosten(1989) also found that food security and savings were influenced by other factors including environmental and socio-cultural factors. The role played by off-farm income was important. Results suggested that agriculture and related activities were generally not paying compared to off-farm activities.

Data from the 2007 Household Budget Survey show increased migration of people out of agricultural activities. Overall, there has been a rise in the proportion of Tanzanians who are employed, and in the proportion of adults who are self-employed, while at the same time, there appears to have been a decline in adults involved in farming and related activities in rural areas.

Apart from the above studies which have linked livelihoods to farming systems, a study by Mwakalobo and Kashuliza (1999) looked at the impact of structural adjustment policies (SAPs) on smallholder farming systems in Rungwe and Mbozi district, Mbeya region. The study showed that SAPs had a considerable impact on economic activities in smallholder farming systems. High input prices and lack of credit were among the major constraints that compelled farmers to using lower quantities of purchased inputs in their farms. To cope with this situation farmers responded by abandoning /switching some crops and reducing crop area under cultivation/management.

The study also shows that poverty incidence is influenced by socio-cultural and gender factors. Gender problems such as polygamy and gender inequality in the control and use of in household resources have a bearing on the participation of women in agricultural development. Despite over a decade of research that documents the significance of gender within agricultural production, the basic questions of access for all household members to land, labour and other resources for agricultural production remain unanswered (Cleaver, 1987). The premise of a production unit controlled by a male household head leads to extension workers frequently ignoring women even in areas where women not only do much of the field labour but also may be managing farms completely on their own, whether customarily or due to male migration (FAO, 1994). Towo (2004) points out that the proportion of women employed in the agricultural sector is relatively higher than men, and that women are the main producers of food, responsible for 60% of all harvesting, 70% of all weeding and 90% of processing activities. Commonly, men's labour exceeds women's only in turning the soil and clearing the fields. Apart from these activities, women are also responsible for household chores and animal husbandry. In many African countries, women do many activities apart from agriculture production as compared to men, including collection of water and fuel as well as childcare. All of these tasks impose a heavy burden on women and also reduce the time available for women to work in their fields for agricultural production (Sirima, 1993). The central issue arising from these studies is that women's contribution to food security is huge but they are commonly underestimated and ignored in development

strategies and trade negotiations processes (Hernandez, 2005). These findings necessitate taking a gender perspective in examining how poverty incidence and farming systems are linked.

2.3 Gaps in the Literature

Based on the literature reviewed, most research has tended to be either generalised or limited in terms of geographical coverage. Moreover, most studies on the patterns of poverty incidence have tended to examine particular administrative areas with limited focus on farming systems. The implication is that poverty and farming systems are widely but separately covered in the literature. Scant data are available on the link between poverty incidence and farming systems, especially research that takes a nationwide approach to farming systems.

3 Hypotheses and Significance of the Research

3.1 Hypotheses

This study was guided by the following hypotheses on the link between farming systems and poverty incidence:

- There is great variability in poverty incidence in relation to farming systems in Tanzania.
- Farming system factors account greatly for the variability in economic growth patterns in the various farming systems.
- The present policy options and strategies do not adequately take into account the specific requirements of the different farming systems in the country.

3.2 Significance of the Research

In Tanzania, a knowledge gap exists regarding the pattern of poverty incidence with respect to farming systems nationally. Questions regarding the relationship between farming systems and poverty incidence, farming system factors that are critical for poverty reduction, and specific policy options and strategies regarding pro-poor growth, are not yet answered. The lack of information on the link between farming systems and economic growth is believed to have greatly contributed to agricultural policies and strategies not adequately addressing the specific requirements of different farming systems. Farming systems differences are apparently not taken into account in designing development programs for pro-poor growth, perhaps due to the dearth of information on the positive effects of farming systems variables on pro-poor growth.

The current study aims to fill these information gaps. The findings are intended to inform policy makers, stakeholders and farmers on the link between poverty incidence and farming systems in Tanzania. In doing so, the research seeks to contribute to improvements in policies and practices in the agricultural sector to accelerate growth and the reduction of poverty at both farming system and national levels.

4 Methodology

4.1 Conceptual Framework

This study is based on the assumption that poverty incidence is associated with household characteristics and farming systems factors. In many cases, the factors reinforce each other. For instance, the size of farm operations, type of crops grown, and adoption of modern farming methods are closely inter-related. The adoption of improved farming methods can augment the size of operations through increased production, while increased production may provide the additional resources needed to adopt the new farming methods more effectively. Similarly, the adoption of improved farming methods and the types of crops grown typically influence each other.

On the other hand, poverty incidence can be related to lack of technical knowledge and skills, information services, and economic infrastructure. Technical know-how and up-to-date information enhance farmers' capabilities to implement appropriate farm management practices (for example, fertiliser use, crop protection, irrigation harvesting and product handling) leading to positive outcomes in both increased quantity and quality of production.

The farming system approach addresses the geographical distribution of poverty by facilitating the development of specific strategies and solutions for problems facing individual agricultural communities. To inform the national poverty reduction strategy, this study undertook a comparative analysis of poverty incidence and the probability of being in poverty in different farming systems in Tanzania.

4.2 Scope of Study and Data Used

Tanzania has ten major farming systems. Each system and the regions in which they are found and the main crops grown are shown in Table 3. The study covered all ten systems. The research team combined available information on farming systems and data from the Agricultural Sample Census 2002/03 conducted by the National Bureau of Statistics (NBS). The survey was conducted to:

1) Identify structural change in farm size holdings, crop and livestock production, use of agricultural inputs, as well as changes in infrastructure and the living conditions of the agricultural population;

2) Provide benchmark data on production and productivity and on specific problems like gender, poverty, food security, and services; and

3) Establish baseline data for an impact assessment of the Agricultural Sector Development Programme (ASDP) for the NSGRP.

Table 1 presents information on the survey population of the Census. The Census collected information from smallholder households as well as large-scale farms and communities.

Table 1: Agricultural Sample Census 2002/03 - Survey Population

	Mainland	Zanzibar	Total
Households	48,315	4,755	53,070
Villages	3,221	317	3,539
Districts	117	9	126
Regions	21	5	26

Source: Agriculture Sample Census 2002/03

In the mainland, the primary sampling units were 3,221 villages. In each village, 15 households were selected for a total sample of 48,345 smallholder households (Table 1). Data collected included household characteristics, land access, crop production, livestock production, fishing, support services and poverty.

4.3 Data Analysis

Two types of analysis were carried out by this study: (i) descriptive analysis; and (ii) multivariate analysis. The descriptive analysis focused on the pattern of poverty in the farming systems, while the multivariate analysis examined the factors that influence poverty in the different farming systems.

As noted in the conceptual framework, one of the study objectives is to measure the probability of being in poverty in different farming systems, which can better be determined using probit models. Therefore, a logistic regression was chosen for the analysis of poverty incidence.[3]

Poverty incidence was expressed in terms of a household welfare[4] index. In this paper, house construction materials were used as a proxy for welfare. Construction materials were grouped into improved and primitive ones. Households with abodes made of improved materials were described as rich and coded '1'; those built with primitive materials were described as poor and coded '0'. A binary choice logit model was estimated with micro-level regressors. The logistic regression model assumes the probability of being poor defined by a latent variable y* as presented by the relationship in equation 1:

$$Y_i^* = \beta' x_{ik} + \mu_i \qquad (1)$$

[3] There was a problem in deciding which indicator to use for poverty levels as the Agriculture Sample Census database has no information on absolute incomes. The research team decided to use the type of house construction materials as a proxy for poverty levels. Households with houses constructed using iron sheets, tiles, concrete, asbestos, etc. were classified as rich, while households with dwellings constructed of thatch, mud, leaves and similar materials were classified as poor. Housing is an important element in human development. While houses can provide shelter, they can also contribute to income generation when premises are used for business and/or rented as accommodation. Houses can also be used as collateral to secure loans for productive purposes that can have a positive effect on peoples' welfare (IFAD, 2001; Moser, 10098).

[4] In this study welfare is defined as well-being or a 'good' form of human life (Clark, 2005).

Where x_i we assume μ_i are *N(0,δ2)*. However, in practice we observe y defined by $y_i = 1$, if $y_i * > 1$, y = 0 otherwise. The likelihood of the logit model is as shown in equation 2:

$$\Pr ob(Y_i = 1) = \frac{\exp\left[x_i'\beta\right]}{\left\{1+\exp(x_i'\beta\right\}} \quad (2)$$

If we let x_{ik} equal the k*th* element of the vector explanatory variables x_i and βk the k*th* element of β, then the expression for the derivatives of the probabilities given by the logit model is given in equation 3:

$$\frac{\partial L}{\partial x_{ik}}(x_i'\beta) = \frac{\exp\left[x_i'\beta\right]}{\left[1+\exp(x_i'\beta)\right]^2}\beta_k \quad (3)$$

And the elasticities of the probability of belonging to the group of poor are given by equation 4:

$$\varepsilon(x_{ik}) = \frac{(\partial L/\partial x_{ik})x_{ik}}{\exp(x_i'\beta)/\left[1+\exp(x_i'\beta)\right]} \quad (4)$$

The aim is to identify micro-level determinants of relative poverty. Thus, the logit model is specified in equation 5 as follows:

$$\begin{aligned} \text{POVT} = P = {} & b_1x_1+b_2x_2+b_3x_3+b_4x_4+b_5x_5+b_6x_6+b_7x_7+b_8x_8b \\ & + b_9x_9+b_{10}x_{10}+b_{11}x_{11}+b_{12}x_{12}+b_{13}x_{13}+b_{14}x_{14}+b_{15}x_{15}+u \end{aligned} \quad (5)$$

The methodology for both household characteristics and farming systems applied maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent variable). In this way, the probability of the poverty incidence was estimated. The explanatory variables were constructed as indicated in Table 2. Both household characteristics and farming system variables were used in determining the incidence of poverty.

Table 2 Explanatory Variables

POVT	=	Whether a household is poor or rich (1 = poor; 0 = rich)
b	=	Logistic regression coefficient representing the probability of being in poverty in relation to *x* variable standing for poverty factors.
Household characteristics		
x_1	=	Sex of household head (1=Male; 0=Female)
x_2	=	Household gender balance[5] (1=gender balance; 0=no gender balance)
x_3	=	Crops only farming practices (1=crops only; 0=others)
x_4	=	Livestock only farming practices (1=livestock only; 0=others)
x_5	=	Crops and livestock farming practices (1=crops and livestock; 0=others)
x_6	=	Cultivated land ownership class (1= above 2 acres; 0 = 2 acres and below)
Farming systems		
x_7	=	Banana/coffee/horticulture farming system (1= Banana/coffee/horticulture farming system; 0=other farming systems)
x_8	=	Maize/legumes farming system (1= Maize/legumes farming system; 0=other farming systems)
x_9	=	Cashew/coconut/cassava farming system (1= Cashew/coconut/cassava farming system; 0=other farming systems)
x_{10}	=	Sorghum/millet/livestock farming system (1= Sorghum/millet/livestock farming system; 0=other farming systems)
x_{11}	=	Tea/maize/pyrethrum farming system (1= Tea/maize/pyrethrum farming system; 0=other farming systems)
x_{12}	=	Cotton/maize farming system (1= Cotton/maize farming system; 0=other farming systems)
x_{13}	=	Horticulture-based farming system (1= Horticulture-based farming system; 0=other farming systems)
x_{14}	=	Wet rice/irrigated system (1= Wet rice and irrigated system; 0=other farming systems)
x_{15}	=	Pastoral/agro-pastoralist farming system (1= Pastoral/agro-pastoralist farming system; 0=other farming systems)

Other factors such as access to services such as extension services, irrigation facilities, infrastructure, and marketing systems may also be valuable to include in the model. For example, households that grow sorghum and millet are far less likely to have irrigation or to have received extension services than other households. Given that these factors are important determinants of poverty, omitting them from the equation could result in a spurious correlation between sorghum and millet farming and poverty, which means that the regression results would be misleading. However, the current analysis argues that the types and quantities of services are exogenous variables, neutral to farming systems and dependent largely on the choices of policy makers. The major argument of this study is that the planning of these services has not considered the farming systems dimension of poverty.

[5] Whether a female member in a household had land and/or had customary rights to land or not was used as a measure of gender balance. Households which reported ownership of land or existence of customary rights to land for their household female members was considered to have gender balance while households without ownership of land and/or customary rights to land for their female members were considered to have no gender balance. Customary rights allow female members to access land and use it so long as they do not sell it.

5 Results

5.1 Description of the Farming Systems

Table 3 summarises the 10 farming systems in Tanzania. These farming systems are classified based on different criteria including:

- Natural resource base, including water, land, grazing areas and forest;
- Climate, of which altitude is one important determinant;
- Landscape, including slope;
- Farm size, tenure and organisation;
- Dominant pattern of farm activities and household livelihoods, including field crops, livestock, trees, aquaculture, hunting and gathering, processing and off-farm activities; and
- Main technologies used, which determine the intensity of production and integration of crops, livestock and other activities.

Based on these criteria, ten broad categories of farming systems were distinguished. These are:

- Banana/Coffee/Horticulture (BC)
- Maize/Legumes (ML)
- Cashew/Coconut/Cassava (CC)
- Rice/Sugar cane (RS)[6]
- Sorghum/Millet/Livestock (SM)
- Tea/Maize/Pyrethrum (TM)
- Cotton/Maize (CM)
- Horticulture (HT)
- Wet rice and irrigated (WR)
- Pastoralist/Agro-pastoralist (PA).

[6] In the analysis that follows this faming system is combined with Wet rice and irrigated (WR) farming system as these are characteristically similar and are found almost in the same areas.

Table 3: Farming Systems of Tanzania

Farming system	Areas in which the farming system is found	Main crops produced and land characteristics
Banana / Coffee / Horticulture	Kilimanjaro, Arusha, Kigoma, Kagera and Mbeya	– Tree crops, banana, coffee, horticulture, maize – Land scarce, volcanic soils, high fertility
Maize / Legumes	Rukwa, Ruvuma, Arusha, Kagera, Shinyanga, Iringa, Mbeya, Kigoma, Tabora, Tanga, Morogoro, Kahama, Biharamulo	– Maize, legumes, beans and groundnuts intercropped, Arabica coffee – Shifting cultivation
Cashew / Coconut / Cassava	Coast, Eastern Lindi and Mtwara	– Cassava, coconut and cashew – Low rainfall, low soil fertility, shifting cultivation
Rice / Sugar cane	Alluvial river valleys	– Found in alluvial river valleys; – Rice and sugarcane
Sorghum / Bulrush Millet / Livestock	Sukumaland, Shinyanga and Rural Mwanza	– Sorghum, millet, maize and cotton, oilseeds and rice – Intense population pressure, declining soil fertility
Tea / Maize / Pyrethrum	Njombe and Mufindi districts in Iringa region	– Tea, maize, Irish potatoes, beans, wheat, pyrethrum, wattle trees and sunflower; – Has loamy and volcanic soils.
Cotton / Maize	Mwanza, Shinyanga, Kagera, Mara, Singida, Tabora, Kigoma, Morogoro, Coast, Mbeya, Tanga, Kilimanjaro and Arusha	– Cotton, sweet potatoes, maize, sorghum and groundnuts – Livestock kept – Intensive cultivation
Horticulture	Lushoto district, Tanga region, Morogoro region and Iringa Rural district in Iringa region	– Vegetables, (cabbages, tomatoes, sweet pepper, Irish potatoes, cauliflower lettuce and indigenous vegetables) and fruits, (pears, apples, plums, passion fruits and avocado) – Maize, coffee, tea and beans – Mainly characterised by volcanic soils
Wet rice and irrigated	River valleys and alluvial plains, Kilombero, Wami Valleys, Kilosa, Lower Kilimanjaro, Ulanga, Kyela, Usangu and Rufiji	– The farming system is mainly characterised by alluvial soils which are suitable for rice
Pastoralist / Agro-pastoralist	Semi-arid areas, i.e., Dodoma, Singida, parts of Mara and Arusha; Chunya district in Mbeya; Igunga district in Tabora	– Deep attachment to livestock and simple cropping system – Shifting cultivation of sorghum millet – Moderate population density 30 per sq. km Limited resourcebase; poor and variable rainfall

Table 3 indicates that more than one farming systems are found in one region and one farming system may extend to more than one region. The significance of farming systems is that they depict differences in economic growth potential and therefore call for different development strategies. Factors determining a system's apparent growth potential include:

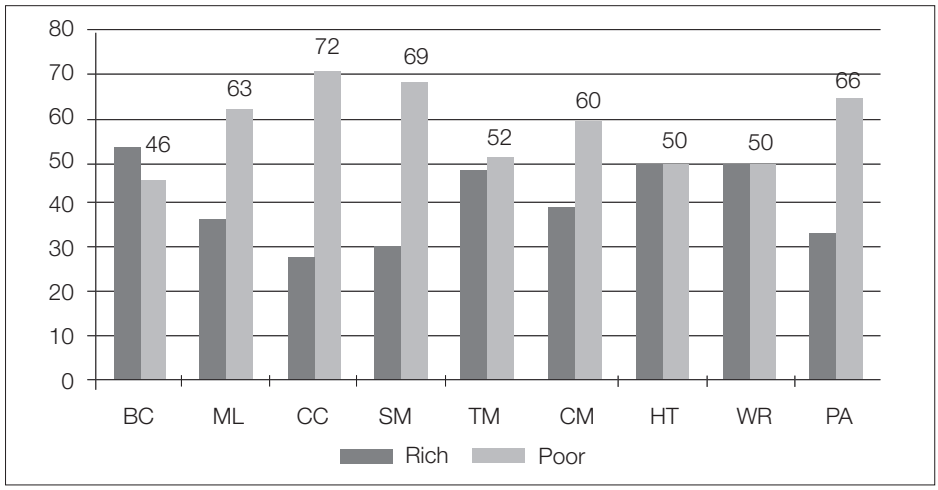
- Suitable resource endowments, including underlying agro-climatic and soil conditions, a relatively high ratio of land and other resources (water, forest) to human population, and a currently low intensity of exploitation;
- Favourable access to infrastructure and services, including markets; and
- The identification of broader development constraints that are feasible to remove or mitigate.

5.2 Poverty Incidence in Tanzania's Farming Systems

5.2.1 Poverty levels and farming systems

Figure 1 presents the pattern of poverty in Tanzania's farming systems. The figure shows that the proportion of households that were categorised as poor and rich varied by system. The Cashew/Coconut farming system had the largest proportion of poor households (72%) followed by Sorghum/Millet (69%) and Pastoralist/Agro-pastoralist farming systems (66%). In contrast, the Banana/Coffee farming system had the smallest proposition of poor households (46%). Other farming systems with lower poverty incidence included the Horticulture, Wet Rice and Tea/Maize/Pyrethrum farming systems.

Figure 1: Poverty incidence by farming system



Although the poverty rates varied substantially from one farming system to another, approximately 60% of all households fell into the "poor" household category. Since poverty is predominantly a rural phenomenon, and agriculture is a major economic activity for rural population, it follows that the level of poverty found rural areas can in no way be disassociated from the over-dependence of rural households on agriculture.

Table 4: Main Sources of Household Cash Income by Farming System (% of households)

Source of cash	BC	ML	CC	SM	TM	CM	HT	WR	PT
Sale of crops*	49.0	58.0	48.0	56.0	72.0	57.0	62.0	60.0	56.0
Sale of livestock**	4.0	4.0	7.0	2.0	3.0	6.0	5.0	5.0	10
Sale of forestry crops	4.6	3.9	6.3	11.4	2.2	3.5	1.8	2.1	3.0
Business income	12.3	9.4	12.3	8.9	9.1	9.3	8.0	9.3	9.1
Wages and salaries	5.3	4.5	2.7	3.8	2.4	4.6	3.7	4.1	4.1
Other casual cash earnings	15.6	12.7	18.3	11.3	7.5	13.1	12.3	14.5	11.6
Fishing	4.9	3.9	4.1	4.3	2.1	3.8	2.8	3.0	3.6
Others	4.5	3.1	2.3	2.3	1.0	3.0	4.4	2.4	2.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

* = Includes food and cash crops

** = Includes live animals and livestock products

The extent of dependence of rural households on agriculture was assessed by comparing income sources in each farming system. Table 4 shows that the sources of household income varied by farming system. Crop production (food crops and cash crops) was the most important source of cash income for the majority of households. Overall, 53.5% of respondent households in the Agricultural Sample Census indicated that crop revenue was their most important income source. By farming system, the proportion of households that reported cash income from crops ranged from 48% of households in the Cashew/Coconut farming system to 72% of households in the Tea/Maize farming system.

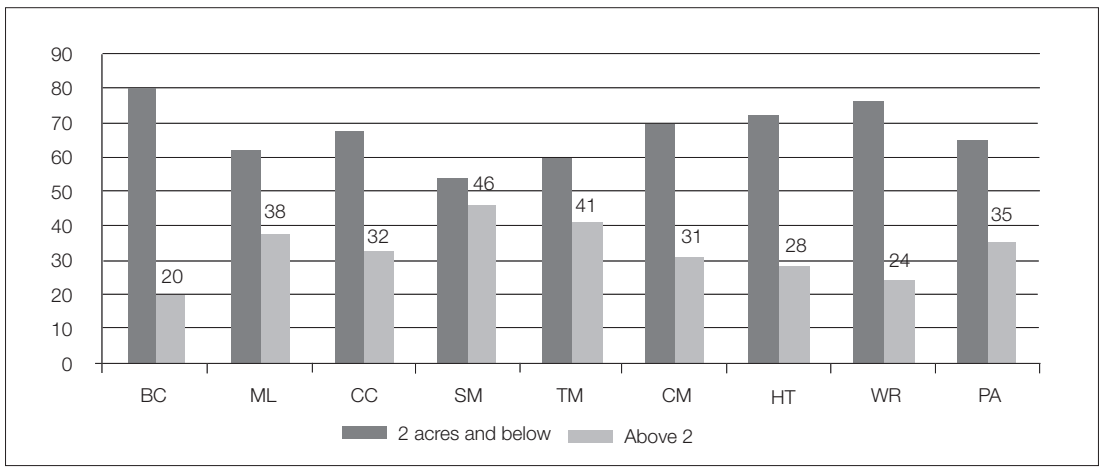
Livestock was also important for households, providing cash income of between 4% and 10%. Other sources of cash income included non-farm businesses as reported by between 9% and 12% of households, and casual cash earnings cited by between 8% and 18% of the households.

5.2.2 Cultivated land ownership and farming systems

Land is one of the important resources for farmers in all farming systems. Land provides the area for cultivation of crops, grazing, and collection of other resources such as firewood, fruits and roots. Thus, the availability and accessibility to land is crucial to farmers' livelihoods. Census respondents were asked to indicate the size of their cultivated land.

Figure 2 presents data on cultivated land ownership by farming system. It indicates that most households (67%) in Tanzania owned between zero and two acres of cultivated land. This implies that only one-third of households were utilising more than 2 acres. Further analysis of the data revealed that the size of cultivated land varied greatly by farming system.

Figure 2: Household Cultivated Land Ownership by Farming System



The Sorghum/Millet and Tea/Maize farming systems had larger proportions of households with land holdings above two acres (46% and 41% respectively). Whilst in the Banana/Coffee, Horticulture and Wet Rice farming systems, only between 20% and 28% of households reported land holdings above two acres. As outlined in the Introduction, the major limitation on the size of land holdings and utilisation is the heavy reliance on the hand hoe as the main cultivating tool However, small holdings in some farming systems are a product of land scarcity and population pressure. Although Tanzania has a low overall population density, averaging about 39 persons per km2, some areas are more densely populated with over 100 persons per km2, e.g., Zanzibar, Kilimanjaro, Mwanza and Dar es Salaam (URT, 2003). Most of these areas coincide with the farming systems in which large majorities of households have land of less than 2 acres.

The important issue here is that, in areas where farmers have inadequate access to land, the government will need to design and implement innovative ways to improve land tenure in these farming systems. Increased productivity goes with a certain level of investment in land, which in turn depends on the security of land tenure. One obvious strategy would be to involve local institutions involved in land use planning and management. Community participation and its influence on the access to and development of land are critically important for implementing growth strategies in the agricultural sector.

5.2.3 Household characteristics and farming systems

The association of farming systems and selected household characteristics was also analysed across the different farming systems. The characteristics included sex of the household head, gender balance in the household, and utilisation of various agricultural inputs. Table 5 summarises the findings. Overall, 20% of the rural households are female headed, though this proportion varied from 15% in the Sorghum/Millet system to 30% in the Tea/Maize/Pyrethrum system. The proportion of households with gender balance, i.e., those households which reported that female members held customary rights, varied between 13% in the Sorghum/Millet system and 26% in the Tea/Maize/Pyrethrum system.

Table 5: Selected Household Characteristics by Farming System (% of households)

	BC	ML	CC	SM	TM	CM	HT	WR	PT
Male household heads	79	80	79	85	70	81	77	79	79
Female household heads	21	20	21	15	30	19	23	21	21
Gender balance	17	18	25	13	26	19	22	22	18
Irrigation	13	10	4	4	18	8	14	65	8
Extension services	20	25	28	38	62	36	43	40	38
Draft animals	16	24	0	49	27	22	13	10	32
Fertilisers	36	23	10	22	33	30	28	29	30

Regarding the utilisation of agricultural inputs, the analysis focused on irrigation, extension services, draft animals and fertiliser. The Tea/Maize/Pyrethrum system had the largest proportion of households using irrigation and extension services, while the Banana/Coffee farming system was found to have the largest proportion of households applying fertilisers. Generally, the use of agricultural inputs by households was generally low, particularly fertilisers and irrigation except for the Wet Rice and Irrigated Farming System of which 65% of the households practiced irrigation.

5.3 Multivariate Analysis of Poverty Incidence

The probability of a household being in poverty in relation to household characteristics and farming systems was determined using a logistic regression. Table 6 presents the results of the regression analysis. The factors found to be significant were primarily the farming practices, i.e., whether farmers are practicing crop production only; livestock production only, or a combination of both crops and livestock. Sex of household head, gender balance and land size were found to have insignificant effect. The data further show that selling of crops had a negative relationship with poverty levels. This implies that households which sold crops had a higher probability of not being poor.

Table 6: Regression Results – Probability of Households Being in Poverty in Relation to Household Characteristics and Farming Systems

Independent variables	B	Std. Error	Beta	t	Sig.
Constant	0.69	0.01		102.07	0.00
Household characteristics					
Sex of household head	0.01	0.01	0.01	1.18	0.24
Gender balance	0.00	0.01	0.00	-0.20	0.84
Farming practice – crops only	-0.24	0.17	-0.23	-1.44	0.15
Farming practice – livestock only	-0.33	0.17	-0.06	-1.97	0.05
Farming practice – crops and livestock	-0.37	0.17	-0.36	-2.23	0.03
Did household sell crops?	-0.06	0.00	-0.06	-12.75	0.00
Cultivated land ownership class	0.00	0.00	0.00	0.67	0.51
Farming System Variables					
Banana/Coffee	-0.20	0.01	-0.17	-31.78	0.00
Maize/Legumes	0.15	0.01	0.15	27.88	0.00
Cashew/Coconut	0.13	0.01	0.10	15.67	0.00
Sorghum/Millet	0.07	0.01	0.18	10.24	0.00
Tea/Maize/Pyrethrum	-0.04	0.01	-0.11	-6.49	0.00
Cotton/Maize	-0.05	0.01	-0.06	-9.63	0.00
Horticulture	-0.06	0.01	-0.06	-8.91	0.00
Wet rice and irrigated	-0.09	0.01	-0.08	-13.56	0.00
Pastoralist/ Agro-pastoralist	0.13	0.01	0.12	24.29	0.00

Regarding the probability of being in poverty relative to the farming systems, Table 6 shows that four systems—Maize/Legumes, Cashew/Coconut, Sorghum/Millet and Pastoralist / Agro-pastoralist—had significant positive correlation with poverty. Households which live in these farming systems have a higher probability of being poor. On the other hand, Banana/Coffee, Tea/Maize/Pyrethrum, Cotton/Maize, Horticulture and Wet Rice farming systems were negatively correlated with poverty levels, which implies that households living in these farming systems have greater chances of reducing poverty.

While farming system factors[7] pose challenges and opportunities for farmers, they are not the only factors which are responsible for poverty. Other factors such as the condition of infrastructure (especially roads), and access to extension services, capital and markets play a very big role in influencing the magnitude of poverty incidence. In areas where these factors are poor it is likely that poverty levels will be higher. Unfortunately, infrastructure, extension services, financial services and markets are not equitably distributed across farming systems, and, more importantly, their distribution is largely influenced by policy priorities. For instance, it was surprising to find that the incidence of poverty is so high amongst households in the cashew/coconut farming system given that cashew is a high value crop. But the long history of low prices to cashew farmers and the inadequate processing industry for cashew nuts could be responsible for this.

[7] Natural endowments and climatic conditions

6 Conclusions and policy implications

The results have shown that poverty is found in all farming systems in Tanzania, but the incidence differs remarkably by system. Households living in the Banana/Coffee, Tea/Maize/Pyrethrum, Cotton/Maize, Horticulture and Wet rice farming systems were better off than households in Maize/Legumes, Cashew/Coconut, Sorghum/Millet, Pastoralist / Agro-pastoralist farming systems. The analysis also confirmed that agriculture is the principal economic activity for rural households in all major farming systems. The study also revealed that utilisation of agricultural inputs by households, such as irrigation, extension services, draft animal power and fertilisers was generally low across all farming systems.

The overall policy implication from the findings is that specific strategies are required to enhance productivity in the different farming systems. In today's integrated world economy, agricultural growth depends on the improvement of the competitiveness of Tanzania's agricultural products in international, regional and domestic markets. Strategies to improve productivity and product quality will have to address the constraints in access to inputs and delivery of services in each farming system.

This study has also revealed that non-farming systems factors still exist. Transport cost is still the major constraint for improving market efficiency in Tanzania. Transport cost shares 84% of market cost. The government is advised to intensify its efforts to promote improved productivity in agriculture by investing in infrastructure; supporting adoption of technology packages and inputs; reduce input price; promote public and private partnership; supporting research and extension or farmer-farmer approaches.

Poverty reduction is the dominant priority objective in Tanzania, and the NSGRP, now beginning its second phase, recognises that agriculture is critical to poverty reduction. The NSGRP has achieved some impressive macroeconomic progress, however, growth in productive sectors such as agriculture has been limited and rural poverty remains very high. In implementing the second phase of NSGRP, a core challenge for the government will be working out how to translate the country's macroeconomic success into practical solutions at the local level to accelerate agricultural development in Tanzania. That the robust economic growth in recent years has not resulted in poverty reduction is a demonstration of disconnects between macro, meso and local policy. Sectoral policies such as the Agriculture and Livestock Policy (ALP) of 1997 and Cooperative Development Policy (CDP) of 1997 are not farming systems sensitive.

Even the recent initiative, KILIMO KWANZA, seems not to take farming systems factors seriously. By emphasising on the use of technologies such as power tillers and tractors without testing them in various farming systems is an indication that farming systems factors are not an important issue to KILIMO KWANZA. For sectoral policies and other initiatives such as KILIMO KWANZA to function more effectively there must be strong and practical interventions specific to farming systems.

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Patricia Mbughuni

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Adolfo Mascarenhas

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Fidelis Mtatifikolo

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Brian Cooksey

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J. Semboja

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Project Briefs

Brief 22 Challenges in data collection, consolidation and reporting for local government authorities in Tanzania

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Brief 11 Citizens Demand Tougher Action on Corruption in Tanzania

Brief 10 Outsourcing Revenue Collection: Experiences from Local Government Authorities in Tanzania

Brief 9 Children and Vulnerability in Tanzania: A Brief Overview

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Brief 7 Mawazo ya AZISE za Tanzania Kuhusu Uhusiano Wao na Serikali

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Brief 5 Children Participating in Research

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Brief 1 Governance Indicators on the Tanzania Governance Noticeboard Website

TGN1 What is the Tanzania Governance Noticeboard?

LGR 12 Trust in Public Finance: Citizens' Views on taxation by Local Authorities in Tanzania

LGR 11 Domestic Water Supply: The Need for a Big Push

LGR10 Is the community health fund better than user fees for financing public health care?

LGR 9 Are fees the major barrier to accessing public health care?

LGR 8 Primary education since the introduction of the Primary Education Development Plan

LGR 7 Citizens' access to information on local government finances

LGR 6 Low awareness amongst citizens of local government reforms

LGR 5 Fees at the dispensary level: Is universal access being compromised?

LGR 4 TASAF – a support or an obstacle to local government reform

LGR 3 Councillors and community leaders – partnership or conflict of interest? Lessons from the Sustainable Mwanza Project

LGR 2 New challenges for local government revenue enhancement

LGR 1 About the Local Government Reform Project

Research on Poverty Alleviation, REPOA, is an independent, non-profit organization concerned with poverty and related policy issues in Tanzania. REPOA undertakes and facilitates research, enables monitoring, and promotes capacity building, dialogue and knowledge sharing.

REPOA's research agenda is concerned with poverty and its alleviation. Our objectives are to:

- develop the research capacity in Tanzania;
- enhance stakeholders' knowledge of poverty issues and empower them to act;
- contribute to policy dialogue;
- support the monitoring of the implementation of poverty related policy;
- strengthen national and international poverty research networks, and forge linkages between research(ers) and users.

It is our conviction that research provides the means for the acquisition of knowledge necessary for improving the quality of welfare in Tanzanian society.

REPOA's Research Reports contain the result of research financed by REPOA. Our Special Papers contain the findings of commissioned studies conducted under our programmes of research, training and capacity building. The authors of these research reports and special papers are entitled to use their material in other publications; with acknowledgement to REPOA.

REPOA has published the results from this research as part of our mandate to disseminate information. Any views expressed are those of the authors alone and should not be attributed to REPOA.

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