Quantitative Livelihood Profile Analysis of Rural Households in Zambia

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Abstract:

The asset base, income and livelihood strategies of rural households in Zambia differ widely. For this reason, a one-size-fits-all strategy will not be effective. Therefore, there is need for empirical evidence of how different policy instruments in agriculture and social protection and combinations of these can be targeted to different population groups. This could also help orient public expenditure into more impactful and cost effective interventions in agriculture and social protection. Using Principal component analysis and Cluster analysis, Zambia's 1.4 million smallholder farming households fall into five broad livelihood groups. While crop and non-crop agriculture plays a dominant role in the livelihoods of most rural households, off-farm activities are also important. Poor rural households need both income and productive support, which can be provided through social protection and smallholder agricultural development programmes. Agricultural development programmes need to be adjusted to different crop and non-crop agricultural activities. Support also needs to be provided to off-farm income-generating activities. For the wealthiest clusters, policy should consider private sector led down and upstream agricultural supply and/or value chain inclusion and development.

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Abstract

The asset base, income and livelihood strategies of rural households in Zambia differ widely. For this reason, a one-size-fits-all strategy will not be effective. Therefore, there is need for empirical evidence of how different policy instruments in agriculture and social protection and combinations of these can be targeted to different population groups. This could also help orient public expenditure into more impactful and cost effective interventions in agriculture and social protection. Using Principal component analysis and Cluster analysis, Zambia's 1.4 million smallholder farming households fall into five broad livelihood groups. While crop and non-crop agriculture plays a dominant role in the livelihoods of most rural households, off-farm activities are also important. Poor rural households need both income and productive support, which can be provided through social protection and smallholder agricultural development programmes. Agricultural development programmes need to be adjusted to different crop and non-crop agricultural activities. Support also needs to be provided to off-farm income-generating activities. For the wealthiest clusters, policy should consider private sector led down and upstream agricultural supply and/or value chain inclusion and development.

1. Introduction

Addressing poverty, particularly in rural areas, is one of the main challenges facing the Zambian government (Chapoto et al., 2011). Currently, rural headcount poverty stands at about 77 percent (CSO, 2016). Agricultural rural households use limited inputs, basic production technologies, depend on rainfed agriculture and have poor access to markets, all of which affects their food security.

Reducing poverty and food insecurity are the chief objectives of agricultural and social protection interventions, as reflected in the Second National Agricultural Policy and the National Social Protection Policy of the Government of the Republic of Zambia (GRZ). In the context of the current economic crisis, it is of paramount importance for the GRZ to, first, enhance the delivery of social protection to avoid the deterioration of food security and, second, to stimulate farm production through agricultural interventions.

While GRZ is making considerable efforts to increase the scope of non-contributory social protection programmes[1], the vast majority of poor and vulnerable households remain uncovered by any kind of social protection. Moreover, a number of poor and vulnerable households do not directly benefit from the largest[2] agricultural intervention, the Farmer Input Support Programme (FISP), although one of the objectives of the programme is to improve food security. The GRZ faces the need to tap the productive potential of the poor and protect their livelihoods, but with a limited budget capacity.

Evidence on how different policy instruments and their combinations should be targeted to different population groups can help to direct public expenditure into more impactful and cost-effective interventions in the agricultural and social protection sectors. Quantitative livelihood profiling is an analytical tool that can help to inform interventions aimed at reducing poverty and food insecurity.

Quantitative livelihood profiling provides a more nuanced picture of vulnerability than do simple classifications based on only one or two dimensions, such as income or landholding size. In addition, quantitative livelihood profiling does not impose restrictions on the sizes of the groups like poverty quintiles. The objective of this quantitative livelihood profile analysis is to inform policy dialogue as to the most appropriate mix of policy interventions for rural households. In particular, the study determined the livelihood asset combinations that characterize different rural livelihood profiles and the strategies and resources that rural households use according to these profiles. It further informs the development of agricultural and social protection programmes so that appropriate interventions can be implemented for different clusters of rural households.

Identifying the combination of assets and livelihood strategies of rural households allows for more specific recommendations on policies to match the needs of different types of households. These might include income assistance to relieve immediate food security needs or improve the use of existing productive capacity, or the provision inputs for increasing agricultural production.

The remainder of the paper is organized as follows: section 2 reviews Zambia's main agricultural and social protection policies/programmes, followed by the conceptual framework for the analysis which is presented in section 3. Section 4 presents the data and methods, while section 5 presents the study findings where

[1] Such as the Social Cash Transfer (SCT): the Minister of Finance's 2017 budget speech stated that beneficiary households would increase to over 500 000 from the current 242 000 household beneficiaries.
[2] In terms of budgetary allocations

the different livelihood clusters are identified and their differences by key livelihood strategies are described. The report closes with a conclusion and recommendations in section 6.

2. Zambian agricultural and social protection policy/programmes

Zambia has programmes seeking to both increase agricultural productivity and provide social assistance to disadvantaged rural populations. Several of programmes have both of these goals. However, the design and targeting of some of programmes raise questions as to how efficiently they manage to accomplish these aims. In this chapter, the main social protection and agricultural policy instruments (in terms of budget share) are described, along with the challenges they face and a consideration of how the livelihood profiling exercise can help to overcome these challenges.

For almost two decades, Zambia's key agricultural policy instruments, which claim over two-thirds of annual budgetary allocations to the sector, have been maize input and marketing subsidies through FISP and the Food Reserve Agency (FRA) respectively (MoFNP, various years). Critical drivers of agricultural growth, such as research and development, extension, irrigation development and rural infrastructure development, receive significantly smaller budgetary allocations (see budget presentation, various years[3]). For example, 52.6 and 17.3 percent of the current budget that has been allocated to the Ministry of Agriculture (MoA) has gone to FISP and FRA respectively.

Although these two subsidy programmes are intended to be instruments of agricultural growth and rural poverty reduction, they are often only accessed by better-off smallholder farmers, who can purchase inputs from the private sector and use private sector markets to sell their agricultural outputs. Hence, they do not contribute efficiently to poverty reduction but have, however, contributed to increases in total maize production by farmers over the years[4]. The FRA is supposed to maintain strategic reserves of the staple food maize and to stabilize its price in the market. It buys significant quantities of the marketable maize surplus from farmers, which it often sells later at a subsidized price to millers.[5]

The GRZ has been piloting new modes of delivery of the FISP by distributing inputs using an electronic voucher (e-voucher), which allows purchase of a wide range of agricultural inputs instead of a more restricted and predefined package of fertilizer and seed. The objectives are to reduce distribution costs, crowd-in the private sector, improve targeting and increase agricultural diversification, among others. However, only 13 and 39 out of the country's 104 districts were covered by the e-voucher programme in the 2015/16 and 2016/17 pilot seasons respectively.

Vulnerable but viable smallholder farmers are targeted for input support through the Food Security Pack (FSP) under the Ministry of Community Development and Social Welfare (MCDSW), but the resources allocated to this programme have been perpetually scarce as will be demonstrated later. The MCDSW has been piloting the distribution of FSP inputs since the 2012/13 season through an e-voucher under the Expanded Food Security Pack (EFSP) in three districts targeting about 30 000 beneficiaries. The EFSP consists of the standard FSP, supplemented with a cash transfer in the month of January when household resources are at their lowest. An assessment of the EFSP during the baseline survey conducted in its second season of implementation by the Indaba Agricultural Policy Research Institute (IAPRI) in 2013 showed

[3] http://www.parliament.gov.zm/publications/budget-debates

[4] See Tembo and Sitko, 2013.

[5] Quite often, FRA will buy maize at above-market prices from farmers and later sell it to millers at below-market prices.

promise in terms of impact on various programme indicators, such as increased maize productivity of the beneficiary households (see Hichaambwa et al., 2014[6]).

On a broader social protection front, there are programmes that aim to help the most disadvantaged vulnerable households (for example, extremely poor, the disabled, elderly, widows and orphans) without the primary objective of providing support to agriculture. An example is the Social Cash Transfer (SCT) programme under the MCDSW. Notwithstanding the beneficial social and productive impacts of Zambia's SCT (Van Ufford et al., 2016; Handa et al., 2015; AIR, 2013; Daidone et al., 2014; Thome et al., 2014), the targeting of social protection programmes always risks both inclusion and exclusion errors. This analysis seeks to reaffirm that the SCT targeting mechanism successfully identifies the most vulnerable households. Furthermore, evidence suggests that in order to generate sustainable improvements in livelihoods and maximize the impact of social protection, social protection needs to be combined with agricultural interventions (Soares et al., 2017). The scope for pursuing such complementary impacts is also assessed in this study.

The Ministry of Education runs the Home-Grown School Feeding[7] (HGSF) programme, which distributes food to pupils attending primary school in selected districts in rural Zambia. Apart from providing food, through its local procurement of legumes, the programme also links local farmers to markets through institutional procurement of pulses and vegetables.

3. Conceptual framework

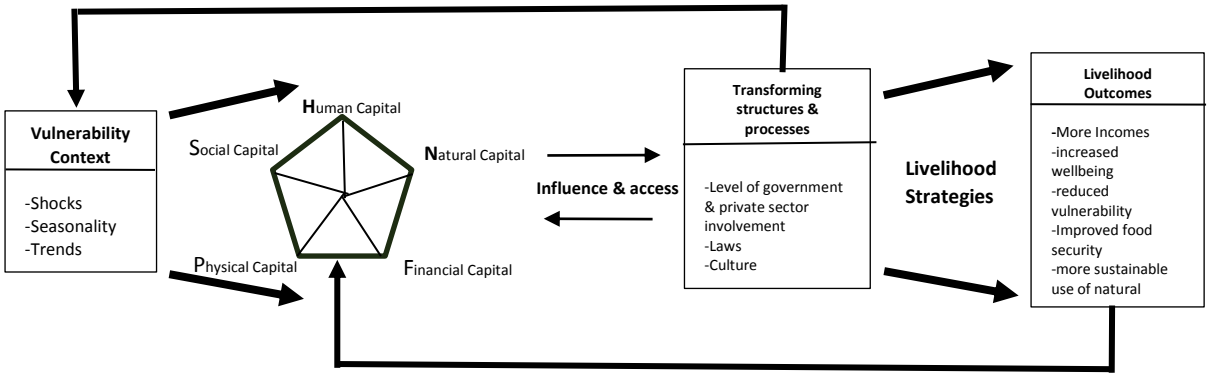
The profiling of smallholder farm households in Zambia is based on the Sustainable Livelihoods Framework (SLF) developed by DFID (see Ashley and Carney, 1999 and DFID, 1999). It is commonly used to inform policy and programming in poverty analysis. The SLF can provide information on how polices affect livelihoods and how these polices can be changed if necessary (Ashley and Carney, 1999). Livelihoods depend on institutional as well as social environments, while the framework emphasizes the relationships between a household's livelihood strategies and its resources (Ansoms and Mckay, 2010).

The SLF Framework can help to conceptualize how farming households cope with vulnerability in the face of factors such as floods and droughts or the death of the household breadwinner. It also helps us to understand how households use their assets/capital to achieve positive outcomes by building on a variety of livelihood strategies (DFID, 1999). Figure 2 summarizes the SLF framework that guides our profiling methodology.

[6] Hichaambwa, M., A. Kuteya and S. Tembo, 2014. *Baseline survey of the Expanded Food Security Pack Programme*. Lusake, IAPRI/Norwegian Embassy (unpublished).

[7] The government plans to increase the number of pupils on the HGSF from 1 million in 2016 to 1.25 million in 2017. See http://www.parliament.gov.zm/sites/default/files/images/publication_docs/2017%20Budget%20Speech.pdf

Figure 1. Schematic presentation of the Sustainable Livelihoods Framework



Source: Adapted from DFID, 1999

As can be seen in Figure 2, the capacity of rural households to improve their food security or income or to reduce their vulnerability is affected by their external environment and their levels of human, social, natural, physical and financial capital. The relationships are largely bidirectional, since these assets both affect livelihood goals and are affected by external impacts such as shocks, which can destroy or create assets. Structures and processes, such as institutions, organizations, policies and legislation, affect access to assets, the vulnerability context and the livelihood goals of rural agricultural households. For example, land tenure and access to land is largely determined by laws and institutions. Access to customary land is, in addition, dependent on practices and informal institutions. Access to financial services, such as formal and informal credit, depend on private sector and the presence of providers of financial services, which are regulated by laws, but also on informal institutions and cultures within social networks.

The SLF, together with consultations with key stakeholders involved in social protection and agricultural programmes in Zambia, guided the selection of variables to use in this study. The variables were classified according to the five livelihood assets listed above.

4. Data and methods

a. Data

The study used the Rural Agricultural Livelihoods Survey (RALS) data from 2015 to generate livelihood profiles based on rural smallholder farming households' livelihood strategies and resource use. The RALS was the second wave of a nationally representative panel survey of rural farm households in Zambia. It was conducted by the Central Statistical Office (CSO) and the Ministry of Agriculture and Livestock (MAL), in collaboration with the Indaba Agricultural Policy Research Institute (IAPRI). The first wave of sampling was conducted in 2012 and provides comprehensive information on 8 090 smallholder farm households, focusing on the 2010/11 agricultural season. The second wave was conducted in 2015 during which 7 934 households were interviewed, of which 7 254 households where successfully re-interviewed while 680 new households were added. This wave focused on the 2013/14 agricultural season. The survey derived its sampling frame from the 2010 Zambia Population and Housing Census and it is statistically representative at the provincial level in all the provinces in Zambia.

The information needs of potential users were identified before the analysis was done. Users included representatives from government institutions, development partners and NGOs. There is an increasing

need for detailed information on the beneficiaries and potential beneficiaries of social protection and agricultural programmes to underpin the design of schemes that match the needs of the population and to better define the groups that should be targeted by such programmes. For example, information on income, land size, education level, market engagement, crop and livestock sales, and whether households participate in wage and income activities can help establish whether households should have access to certain programmes.

b. Description of variables

The variables used in the analysis were grouped by natural, social, human, financial and physical capital, and by geographical context. The human capital variables also included demographic characteristics that contributed to household capabilities.

Natural capital variables included total cultivated land in hectares and Tropical Livestock Units (TLU). These are livestock numbers converted to a common unit (in 2005). Conversion factors are: cattle = 0.7, sheep = 0.1, goats = 0.1, pigs = 0.2, chicken = 0.01. The cultivated land variable is used as one of the selection criteria for beneficiaries for the FSP and FISP programmes.

Under the ***human capital*** variables, we included gender and age of the household head as well as the highest level of education of the most educated household member; whether the household had a chronically ill/disabled member and the number of household members in different age categories. The variables representing chronically ill/disabled household members as well as the different age categories contributed to selection for the SCT.

Social capital variables included participation in cooperatives/economic associations; kinship ties to local chiefs and/or headmen; migrant status (considered non-local), and whether any household member is a civil servant.

Under ***financial capital***, the study used disposable income and identified households that obtained credit for agricultural purposes. Disposable income is an estimated value of the income available to the household to spend from different sources, including net off-farm income (sum of income from employment activities and remittances and net income from business) as well as sales from field crops, fruits and vegetables, and livestock and livestock products.

Physical capital variables selected for the analysis included the value of productive assets such as farm implements and livestock. Ownership of a mobile phone, radio or a television set was used as a proxy for access to information. The quality of housing variable used information on the different types of materials used to construct the household's main dwelling, particularly the floor, wall and roofing materials. A household was seen as having a good quality house if either the floor of the main house was made out of concrete or tiling as opposed to mud, if the wall was made out of concrete blocks or burnt bricks as opposed to mud bricks or poles and mud, or if the roof was made of iron roofing sheets as opposed to grass thatching

Under ***geographical context***, distance to the Boma[8] was included as a measure of remoteness. In addition, we included a variable to measure access to urban markets and other urban-based services proxied by GIS-estimated hours to the nearest urban centre with at least 500 000 inhabitants in each SEA in the RALS data.

[8] A Boma is the administrative centre of a district.

The distances to schools, markets and clinics were used to indicate proximity to public services. Distances to the nearest cell phone network services and agro-dealer were also included as was distance to the nearest tarmac road, which were used as proxies for access to services. Agro-ecological Zone (AEZ) variables were used to capture rainfall ranges and the soil type.

The number of months without adequate food (food insecurity) and a measure of crop diversification (measured by the Simpson Index) were included in the analysis due to their links to livelihood strategies. Also included in the analysis were variables on participation by any household member in wage employment or business activity and the crop-based Household Commercialization Index (HCI). HCI is a measure of household market orientation measured as the value of crop sales divided by the value of production.

C. Classification of livelihood profiles

The cluster analysis method was used to implement the SLF using the RALS household-level data. Cluster analysis categorizes observations, in this case households, into different groups that are homogeneous within the groups and are heterogeneous between the groups. Descriptive analysis is used to describe the identified livelihood clusters (See Everitt et al., 2011 and Hair et al., 1998 for a discussion of cluster analysis techniques). Due to multicollinearity and the advantage of using fewer variables for the cluster analysis, principal component analysis (PCA) was used on: i) the livelihood asset variables adopted from the SLF; ii) the variables used to target households for different agricultural and social protection programmes in rural Zambia, which were collected in the 2015 RALS.

This study follows the method used by Ansoms and Mckay (2010). Using the latent root criterion, only principal components with eigenvalues greater than one were included in the analysis. This gave an 11-component solution and accounted for 60 percent of the variance in the data. The components generated were then rotated using the orthogonal varimax rotation for easy of interpretation of the PCA results. PCA generates principal component scores, which were used as the variables for cluster analysis.

Using cluster analysis to generate household profiles reveals distinct groupings of households with the same characteristics. This study used both hierarchical and non-hierarchical cluster analysis methods.

The second step employed Ward's method for hierarchical cluster analysis using squared Euclidean distances. Hierarchical cluster analysis was used to determine the number of clusters to use in the non-hierarchical cluster analysis. This was done by using a dendrogram (Hair et al., 1998). Five clusters were identified by visually examining the dendrogram. The results were validated using the agglomeration schedule stopping rule method. Hierarchical cluster analysis has a weakness in that it may allow the misclassification of households (Jenson et al., 2006). For this reason, non-hierarchical cluster analysis was used to form the final clusters.

In the third step, the k-means non-hierarchical cluster analysis method was used. T-tests were used to test the statistical significance of the pair-wise differences between the means of the variables in the clusters. The sampling weights were applied to the data when carrying out the tests.

5. Key findings

a. Identification of livelihood clusters

Five distinct clusters were identified through the analysis[9] with the majority of the 1.4 million smallholder farming households in Zambia falling under Cluster 1 (57 percent) followed by Cluster 2 (13 percent), Cluster 3 (4 percent), Cluster 4 (26 percent) and Cluster 5 (less than 1 percent).

Tables 1 and 2 show the characteristics of the livelihood clusters with regard to the different types of livelihood capital as well as their contextual environment. First, household income was ranked into two quantile categories, which were classified as low and high-income groups. It is clear from the tables that Clusters 1 and 2 are largely composed of relatively poor households, about 60 percent of all households, while in the other clusters more than 70 percent of the households falling in the high-income group. Apart from being poorer, Clusters 1 and 2 have the highest proportion of female-headed households, high dependency ratios, the fewest school-age children attending school, least valuable assets, lowest income

[9] Table A1 in the appendix shows the cluster analysis solution.

(both on and off-farm), lowest participation in crop markets and two or more months of inadequate food in a year. More than 80 percent of the households fall below the poverty line of USD 1.25 per capita per day. The most important difference between the first two clusters is their accessibility to district centres or urban areas. Cluster 1 is much more accessible than Cluster 2, with an average distance of 34 km from the district centres compared to 100 km for Cluster 2, and a travel time of 14 hours to the nearest urban centre with a population of at least 500 000 inhabitants compared to 22 hours for Cluster 2. Thus, we refer to these clusters as the **poor accessible households** (Cluster 1) and **poor remote households** (Cluster 2).

Table 1: Human, social and physical capital characteristics of the livelihood clusters

	Average value by livelihood cluster				
Characteristic	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Income group					
Percent in low income group	60.7[a]	58.5[a]	3.1[c]	30.1[b]	0.5[c]
Percent in high income group	39.3[c]	41.5[c]	96.9[a]	69.9[b]	99.5[a]
Human capital					
Percent female headed	30.8[a]	23.3[b]	14.2[c]	11.5[c]	19.8[abc]
Average household size	5.7[d]	6.1[c]	7.0[b]	7.0[b]	8.7[a]
Average age of household head	47.4[a]	43.6[c]	44.9[bc]	46.6[ab]	53.4[a]
Average household dependency ratio	39.4[a]	40.4[a]	28.8[c]	37.5[b]	31.9[bc]
Maximum level of education of household members	7.3[d]	7.1[d]	14.0[a]	8.7[c]	10.9[b]
Percent school age children attending school	62.4[c]	59.0[c]	86.5[a]	66.6[b]	78.7[a]
Number of chronically ill members	0.17[b]	0.10[a]	0.19[a]	0.10[a]	0.09[ab]
Social capital					
Percent related to the village authorities	53.3[c]	69.8[a]	14.0[d]	60.7[b]	50.0[bc]
Percent with membership in co-op/any economic association	40.5[c]	41.8[c]	63.4[b]	77.1[a]	75.8[ab]
Percent migrant households	8.7[b]	7.8[b]	42.6[a]	8.6[b]	12.6[b]
Physical capital					
Average cultivated land (ha)	1.5[e]	2.3[c]	1.9[d]	3.3[b]	7.9[a]
Average Tropical Livestock Units	0.9[d]	1.4[c]	1.7[c]	5.5[b]	66.7[a]
Percent with good quality housing	10.1[d]	6.4[e]	89.1[a]	30.1[c]	73.2[b]
Average value of livestock and equipment assets	4,906[d]	5,168[d]	97,955[b]	23,338[c]	385,423[a]
Average per capita value of livestock/equipment asset	1,003[d]	898[d]	15,214[b]	3,498[c]	86,162[a]

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent. Source: CSO/MAL/IAPRI 2015.

Table 2: Financial capital and contextual characteristics of the livelihood clusters

	Average value by livelihood cluster				
Characteristic	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
Financial capital					
Average household income	10,053[d]	12,299[c]	77,907[a]	23,466[b]	108,573[a]
Average per capita household income	1,929[c]	2,125[c]	12,454[a]	3,560[b]	25,719[abc]
Average off-farm income	5,518[d]	6,127[d]	67,185[a]	10,719[c]	34,399[b]
Average per capita off-farm income	1,037[c]	963[c]	10,766[a]	1,649[b]	12,162[abc]
Average on-farm income	4,535[d]	6,173[c]	10,722[b]	12,747[b]	74,174[a]
Average per capita on-farm income	891[d]	1,162[c]	1,687[b]	1,911[b]	13,557[a]
Average disposable income	5,018[d]	6,502[c]	64,462[a]	14,575[b]	90,923[a]
Average per capita disposable income	980[c]	1,077[c]	10,586[a]	2,186[b]	21,671[abc]
Percent employed in public sector	0.3[b]	0.4[b]	76.3[a]	0.7[b]	1.9[b]
Percent employed in private sector	5.7[b]	3.5[c]	15.5[a]	6.0[b]	3.1[bc]
Percent obtaining credit	4.3[c]	16.2[b]	11.0[b]	41.8[a]	13.7[b]
Average HCI	20.1[d]	34.4[c]	37.3[c]	53.4[b]	65.7[a]
Geographical Context					
Kilometres to the nearest Boma	34.1[b]	100.3[a]	23.5[d]	37.1[c]	36.9[bc]
Hours to the nearest urban centre	13.81[b]	21.61[a]	10.63[c]	10.50[c]	8.61[d]
Others					
Simpson index of crop diversification	0.38[c]	0.48[a]	0.26[d]	0.45[b]	0.32[d]
Average months without adequate food	2.14[a]	1.93[a]	0.44[c]	0.86[b]	0.58[bc]
%below the poverty line ($1.25/day)	86.1[a]	85.2[a]	10.5[c]	69.7[b]	18.9[c]
Long range average rainfall	1,009[b]	1,031[a]	991[b]	887[c]	829[d]

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent. Source: CSO/MAL/IAPRI 2015.

Cluster 3 can be referred to as the **wage-earning households** cluster**.** Over 90 percent of the households in this cluster have at least one member who receives wage income, while 76 percent have at least one household member who is a civil servant. Forty three percent of the Cluster 3 household heads are migrants and 63 percent (compared to about 40 percent for Clusters 1 and 2) have at least one household member who is a member of an economic grouping or association, such as a farmers group or a savings group. Almost all of the households have access to information (99 percent) while the proportion of households with access to good quality housing is the highest at 89 percent. Households in this cluster have high disposable income (ZMW 64 000), are close to urban areas and are largely food secure and male-headed (only 14 percent are female-headed). The most educated household member has, on average, a tertiary level of education (i.e. 14 years of formal education).

Cluster 4 comprises the **outgrowing households**, 42 percent of which have obtained credit (compared to the weighted sample average of 16 percent in rural Zambia); this can largely be attributed to credit received from the outgrower schemes. Compared with Clusters 1 and 2, Cluster 4 households are relatively food secure, with almost three times as much annual disposable income, almost six and four times as much TLU, about nine and five times as much livestock and other assets respectively. Furthermore, Cluster 4 has a greater proportion of households with members in economic associations (77 percent compared to about

40 percent in Clusters 1 and 2), access to information (93 percent compared to 73 and 65 percent), access to good quality housing (30 percent compared to 18 and 10 percent for Clusters 1 and 2) and are just as accessible to urban centres as the wage-earning household cluster (both clusters are 11 hours from the nearest urban centre). Like the wage-earning households, the outgrowing households cluster largely comprises male-headed households (only 12 percent are female-headed).

Cluster 5, which we call the **market-participating households** cluster, is composed of largely better-off households headed by relatively older people (53 years compared to 47 years and below in the other clusters) and a crop based-HCI of 66 percent compared to the weighted sample average of 31 percent (the outgrowing households cluster had the second highest HCI at 53 percent). The highest educated members have, on average, a secondary level of education. They cultivate an average of eight hectares of land, have the most livestock assets (67 TLU with an average value of ZMW 123 000), other assets (ZMW 263 000) and disposable income (ZMW 91 000). The proportion of market-participating households with members in economic associations is similar to that of the outgrowing households cluster, while access to information is slightly higher (99 percent compared to 93 percent); access to good quality housing is better (73 percent compared to 30 percent).

It is useful to remember that the households belonging to these five categories can be dispersed spatially. This might pose challenges in terms of targeting/implementing interventions tailored to the needs of specific households, which may be part of the same livelihood cluster but are not located in the same part of the country. The mapping of clusters across districts is presented in Figures A1-A5.

b. Linking clusters to livelihood strategies

Main income sources

In order to discern the main livelihood strategies in the livelihood clusters, we separated household income into farm and off-farm income contribution, agricultural sales into horticultural, field crops and livestock sales and off-farm income into business, wage and remittance income. The contribution of these different types of income to the total income of the households in each cluster is shown in Table 3. Based on the farm income as a proportion of total household income, only the market-participating and outgrowing households have farm activities as their main source of income, accounting for 68 and 54 percent respectively. As expected, the wage-earning households have off-farm income as their main source, accounting for 86 percent. This implies that households in this cluster use farm income to supplement their off-farm income. The opposite is true for the market-participating and outgrowing households.

The poor accessible and remote households clusters get about half of their total income from farm and off-farm activities. Most of the off-farm income for these households comes from business activities as opposed to wages. Only the wage-earning households receive most of their off-farm income (two-thirds) from wages.

Selling field crops is the main source of agricultural sales for the poor accessible, remote and outgrowing households, accounting for 59, 82 and 63 percent respectively. Livestock sales account for only about 24, 11 and 18 percent, respectively, of the agricultural sales for these household clusters. A considerable proportion of the poor accessible and outgrowing households' agricultural sales income comes from horticultural sales, accounting for 17 and 19 percent respectively. This implies that support for market gardening in land-constrained households with reasonable access to urban markets is a viable option for improving rural livelihoods.

The main source of agricultural sales income for the market-participating households is livestock. We saw earlier that this cluster owns an average of 67 TLU as compared to 2 for the whole weighted sample. Linking to private sector output markets could be a key development strategy that would further benefit households in this cluster as well as the private sector.

Table 3. Total income shares by cluster

	Income share (percent) by household type					
Income type	All	Poor accessible	Poor remote	Wage-earning	Outgrowing	Market-participating
Gross farm income	44	45	50	14	54	68
Gross off-farm income	56	55	50	86	46	32
Gross household income	100	100	100	100	100	100
Gross business	69	78	85	33	88	80
Gross wage	28	17	13	66	10	18
Remittances	3	5	2	1	3	2
Total off-farm income	100	100	100	100	100	100
Gross value of horticultural sales	15	17	7	11	19	4
Gross value of field crops sold	56	59	82	45	63	20
Gross livestock sales	28	24	11	43	18	76
Total agricultural sales	100	100	100	100	100	100

Source: CSO/MAL/IAPRI 2015.

Farm production

In terms of productivity, it can be seen in Table 4 that the average yield per hectare of maize was lowest among the poor accessible and remote households. This could be partly due to their use of local maize (instead of using improved or recycled improved seed), which is grown by about 40 percent of these households.

TABLE 4: USE OF LOCAL MAIZE AND YIELD BY CLUSTER

	Poor Accessible	Poor Remote	Wage Earning	Outgrowing	Market Participating
Percent planting local maize	40[a]	39[a]	11[c]	27[b]	22[bc]
Average maize yield (kg/ha)	1882[d]	2217[c]	2804[a]	2521[b]	2616[ab]

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent.
Source: CSO/MAL/IAPRI 2015.

Fertilizer is one of the most important inputs in crop production. The level of its use has implications for crop yield, production and, ultimately, household income. Table 5 shows the average amount of fertilizer acquired by the livelihood clusters from different sources during the 2013/14 season as captured by the RALS of 2015. The market-participating households acquired the most fertilizer at an average of 1 400 Kg. The outgrowing and wage-earning households only acquired about 35 and 33 percent of this amount respectively. The poor accessible and remote households only managed to acquire about 8 and 11 percent respectively of the total fertilizer acquired by the market-participating households.

TABLE 5: FERTILISER ACQUIRED BY THE DIFFERENT LIVELIHOOD CLUSTERS FROM DIFFERENT SOURCES

	Average amount acquired by household type					
Source	All	Poor Accessible	Poor Remote	Wage Earning	Outgrowing	Market Participating
Subsidies (kg)	95	60[c]	77[b]	144[a]	172[a]	195[a]
Cash purchases (kg)	120	43[d]	71[c]	289[b]	266[b]	1,179[a]
Loans (kg)	13	1[c]	9[b]	24[abc]	39[a]	18[abc]
Other sources (kg)	4	2[b]	2[b]	10[ab]	7[a]	9[ab]
Total	232	106	159	467	485	1,400

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent.
Source: CSO/MAL/IAPRI 2015.

Participation in agricultural and social protection programmes

Table 6 gives the rates of participation of smallholder households in SCT, FISP, FSP and FRA programmes by livelihood cluster. Table 7 shows the percentage of beneficiaries of each programme that fall within the different livelihood clusters. The following points emerge:

- As expected, participation in SCT is highest among the poor households; the majority of the recipients of SCT belong to the poor accessible cluster. Currently, however, the coverage of SCT is nationwide.
- Most FSP recipients are from the poor accessible cluster and the outgrowing cluster but the coverage of the programme is very low and the differences in participation are not statistically significantly different between the poor clusters and the outgrowing cluster.
- Participation of the wage-earning, the outgrowing and the market-participating clusters in FISP is higher than that of the poorer clusters.
- Participation in maize sales to FRA is the highest among the outgrowing and the market-participating clusters. This is expected because these households are most often net sellers of maize. The poor remote cluster is better represented among FRA beneficiaries than is the poor accessible cluster that is underrepresented compared to its share of the total smallholder population.

TABLE 6: PARTICIPATION IN THE DIFFERENT AGRICULTURAL AND SOCIAL PROTECTION PROGRAMMES BY CLUSTER

Type of participation		Household type				
	All	Poor Accessible	Poor Remote	Wage Earning	Outgrowing	Market Participating
%Participation in SCT	1.73	2.50[a]	0.82[b]	0.45[bc]	0.68[b]	0.00[c]
%Participation in FISP	37.24	27.78[b]	31.33[b]	51.89[a]	58.72[a]	51.33[a]
%Participation in FSP	0.53	0.54[a]	0.37[ab]	0.12[b]	0.62[a]	1.10[ab]
%Selling maize to FRA	33.45	24.24[b]	38.75[a]	37.17[a]	41.57[a]	47.62[a]
Average Maize sold to FRA (kg)	1,449	450[d]	1,067[c]	2,796[b]	2,334[b]	9,639[a]

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent.
Source: CSO/MAL/IAPRI 2015.

TABLE 7: PROPORTION OF BENEFICIARIES WITHIN EACH CLUSTER BY PROGRAMME

	Household type				
	Poor Accessible	Poor Remote	Wage Earning	Outgrowing	Market Participating
% of smallholders	57.26	12.60	3.85	25.69	0.60
% of SCT beneficiaries	82.91*	5.96*	1.01*	10.12*	0.00*
%of FISP beneficiaries	42.71*	10.60*	5.37*	40.50*	0.83
% of FSP beneficiaries	59.11	8.83	0.86*	29.95	1.25
% of FRA beneficiaries	31.98*	14.17	4.95	47.34*	1.56

Note: Stars indicate that the share of the cluster among the beneficiaries and non-beneficiaries of the programme are statistically significantly different.
Source: CSO/MAL/IAPRI 2015.

Due to their high levels of food insecurity, the poor household clusters require direct income support, such as social cash transfers. Furthermore, the poor clusters do not seem to be participating in production support to the extent that their share of smallholders would suggest. They could also benefit from FISP but the minimum requirements of making a contribution and being a member of a cooperative in order to access the subsidy may constrain these households from participating.

The wealthier household clusters, which probably could afford to purchase the inputs without subsidies benefit from FISP to a high degree. Efficiency considerations call for a careful review of the programme as subsidies to the wealthier households may not enhance overall productivity. The EFISP may reduce leakages of subsidized inputs to larger and wealthier farmers given that the programme targets farmers cultivating two hectares or less.

As stated earlier, it is obvious that large producers benefit disproportionately from the FRA. The poor remote households, however, are not underrepresented among FRA beneficiaries, probably due to the FRA presence in disadvantaged areas. Because more well to do households tend to grow maize as a cash crop, providing market access may prove useful in transitioning to higher levels of production and from being a net buyer to a net seller. Given the overall objectives of FRA it, however, the question arises as to whether the current extent of FRA activities is necessary, or if they could be replaced by private actors in the maize market in areas where there are no infrastructure constraints or other factors calling for public sector intervention. In order to further reach the most disadvantaged households, the implementation details and the effective selection criteria should be reassessed as they may be limiting access to the scheme.

As mentioned previously, the government is challenged by limited resources, making it difficult to reach households with more than one programme. On the other hand, combining complementary programmes could be a more effective way to combat poverty. For example, FISP and FSP can provide households with access to inputs for production support while SCT can be used for purchasing food and other basic needs, ensuring that the beneficiaries can use the inputs to increase agricultural production and do not need to sell them to meet liquidity needs. Table 8 shows the percentage of households benefiting from more than one programme among the FISP, SCT and FSP in each cluster. It can be seen that only a negligible proportion of households are taking part in more than one programme at one time. This indicates that opportunities for complementarities are being missed.

TABLE 8: PERCENTAGE OF HOUSEHOLDS BENEFITING FROM MORE THAN ONE PROGRAMME BY CLUSTER

	Household Type				
	Poor Accessible	Poor Remote	Wage Earning	Outgrowing	Market Participating
% overlaps between the FISP SCT and FSP					
Households that participated in SCT only	1.75[a]	0.54[b]	0.00	0.24[b]	0.00
Households that participated in FISP only	27.00[c]	30.99[b]	51.44[a]	57.88[a]	50.23[a]
Households that participated in FSP only	0.46[a]	0.31[a]	0.11[a]	0.14[a]	0.00
Households that participated in both SCT and FISP	0.71[a]	0.28[a]	0.45[a]	0.37[a]	0.00
Households that participated in both SCT and FSP	0.03	0.00	0.00	0.00	0.00
Households that participated in both FISP and FSP	0.05[a]	0.06[a]	0.00	0.40[b]	1.10[a]
Households that participated in all 3 programmes	0.00	0.00	0.00	0.06	0.00
Households that did not participate in any of the three programmes	69.98[a]	67.82[a]	47.98[b]	40.88[b]	48.67[b]

Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent

Source: CSO/MAL/IAPRI 2015.

6. Conclusions and recommendations

The objective of this study was to inform policy dialogues on the most appropriate mix of agricultural and social protection interventions for different categories of rural households. In particular, the study determined the livelihood asset combinations that characterize different rural livelihood profiles and the strategies and resources that rural households use according to these profiles. The study provides a more nuanced view of livelihood strategies and associated outcomes than would a simple poverty analysis. It also provides information to help policy-makers design and develop social protection and agricultural programmes.

The study used nationally representative household survey data from Zambia. It employed PCA and cluster analysis to categorize rural agricultural households into five different groups, based on asset/capital variables from the SLF and the variables used to target beneficiaries for the different agricultural and social protection programmes.

The results showed that there is a diversity of asset base, income and livelihood strategies among the rural households in Zambia. A majority or about 70 percent of rural households belong to two clusters that have a high rate of poverty (more than 80 percent of the households fall below the poverty line of US$1.25 per capita per day) and a low level of food security. The most important difference between the two poor clusters is their access to district centres or urban centres.

The poor household receive both farm and off-farm income, getting about half of their income from off-farm sources. The main source of agricultural sales for the poor accessible, poor remote and outgrowing households consists of selling field crops; livestock sales are less important for these clusters. Horticultural sales also constitute a non-negligible proportion of the agricultural sales income of the poor accessible and outgrowing household clusters as compared to the other clusters. The agricultural productivity of maize in terms of yield per hectare is lower for the poor clusters than for the other clusters. The Poor clusters also use less fertilizer on average and use the less-productive local seed, which suggests that with relatively small improvements in input use their productivity could be enhanced.

The better-off outgrowing and market-participating household clusters have more cultivated land than the other clusters. The outgrowing household cluster also has a non-negligible poverty rate, but, unlike the poorest groups, it seems to have access to economic associations and credit, which are associated with more intense cash crop production and higher productivity. While the analysis does not trace causal relationships, obviously such assets support income generation although these households are also geographically accessible and regionally fairly concentrated. The most well to do clusters, the wage-earning and market–participating household clusters, largely participate in wage employment and market-oriented agriculture respectively. The wage-earning household is highly involved in government employment, which is consistent with their advanced educational level.

The analysis of the existing policies showed that SCT reaches the poor accessible household cluster, and currently the programme has nationwide coverage. Most FSP recipients are from the poor accessible cluster and the outgrowing cluster but the coverage of the programme is very low and the differences in participation are not statistically significantly different between the poor clusters and the outgrowing cluster. A significant proportion of households in the poor clusters are not reached by any of the social protection or agricultural subsidy programmes. Therefore, there is a need to consciously extend the reach of these programmes.

A higher proportion of households in the better-off clusters were able to benefit from FISP than in the poor clusters. The poorest clusters also need this type of production support to improve their agricultural production but the minimum requirements for accessing the subsidy may constrain them from participating.

Although Zambia faces a challenge of limited resources, there is scope for combining cash transfer and agricultural support programmes to boost productivity in the poorest clusters. For example, input subsidy schemes can provide household with inputs for production while SCT can be used for purchasing food and other basic needs to ensure that the beneficiaries use the inputs for increasing agricultural production and do not need to sell them in order to meet their basic needs. This for example, is being done with the current EFSP. During the 2013/2014 season, however, only a negligible number of households took part in more than one programme at the same time.

FRA provides market access to farmers, but the sellers mostly come from the better-off clusters, especially the outgrowing household cluster. This may be due by the fact that the poor clusters do not have surplus maize to sell. When total maize sales are taken into account, it is obvious that the better-off clusters benefit disproportionately from FRA. The poor remote cluster is not underrepresented in sales to FRA like the poor accessible cluster. Hence, to some extent FRA does accomplish its goal of providing market access to smallholder farmers in remote areas. Nevertheless, in terms of the amount of purchases, FRA benefits the better off livelihood clusters more than the poor clusters.

In addition to reassessing the existing social protection and agricultural subsidy programmes, further policies should be considered. Given that the poor clusters obtain a significant portion of their income from off-farm activities, empowerment programmes, such as business training, could help to grow their asset base. Interventions such as the livestock pass on NGO projects can help to promote livestock production (especially small animals) in rural poor households. Schools in areas where many poor households live could be potential targets for the HGSF because of the high dependency ratios. Poor remote households would be greatly assisted by improving access to markets and services through strengthened infrastructure, such as better roads which would also benefit the other clusters.

Other policies could be targeted to the three better-off household clusters. The outgrowing households cluster and the market-participating households cluster could be a target of a projected pension scheme because of their level of participation in outgrower schemes and somewhat higher disposable income respectively, although the outgrowing households cluster still has a relatively large number of households living below the poverty line, which needs to be taken into account in setting contribution rates. These clusters could also be a target for farm insurance due to their high dependence on agriculture.

The better-off clusters should be considered for programmes concerned with private sector-led down and upstream agricultural supply and/or value chain inclusion and development. For example, the market-participating households cluster could be helped to participate more in cattle supply/value chains. Deliberate efforts could be made to encourage or facilitate formal loans or credit for increased participation in agricultural activities where access to credit is low. A warehouse receipt system that allows farmers to deposit crops in a warehouse so they can sell produce at a later date when prices are higher, could work well for the market-participating household cluster because of their high participation in the markets.

We recommend that monitoring and evaluation of livelihoods are done over time. This is to ensure that an analytical basis is provided to inform interventions that are aimed at reducing poverty and food insecurity. The current study could be used as the baseline.

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Appendices

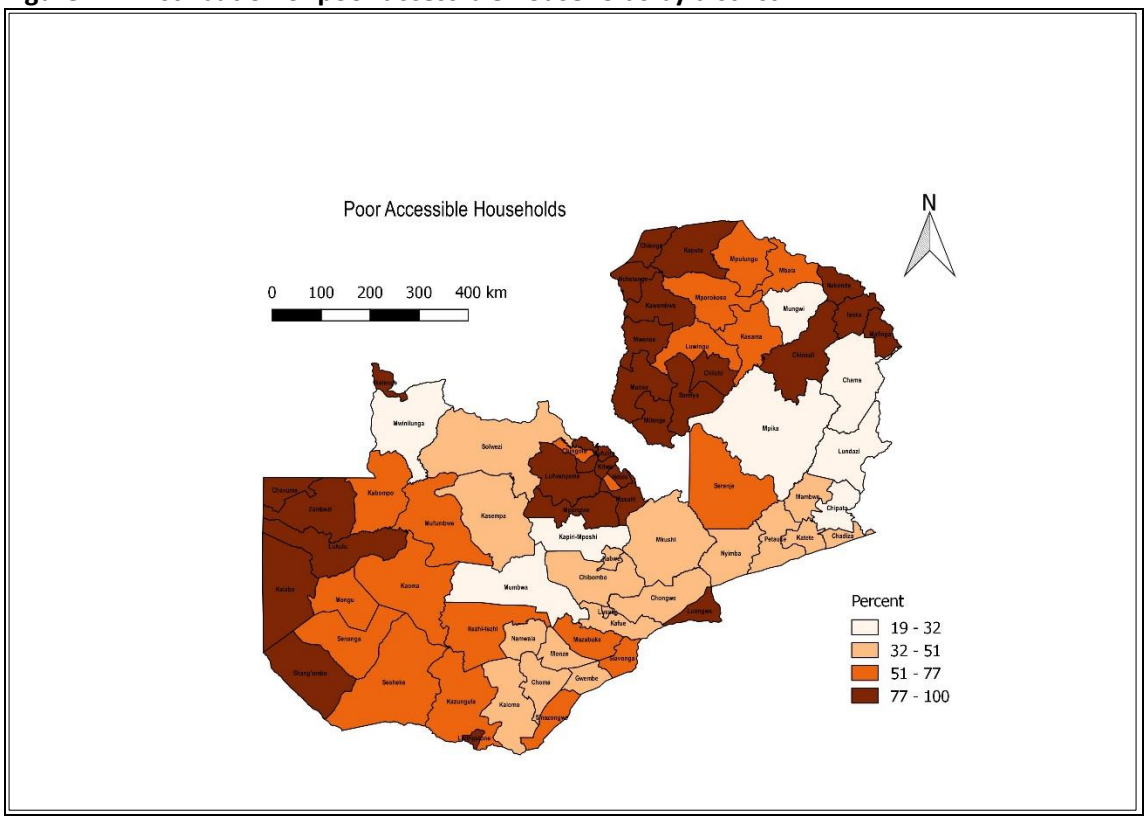
Table A1: Cluster Solution Results

	Cluster					
	All	1	2	3	4	5
Number of households	1,397,808	800,393	176,092	53,849	359,101	8,374
Variable						
Natural capital						
Cultivated land (Ha)	2.14	1.53^{e}	2.25^{c}	1.90^{d}	3.34^{b}	7.93^{a}
TLU	2.55	0.86^{d}	1.35^{c}	1.70^{c}	5.53^{b}	66.71^{a}
Human Capital						
Gender of household head(=1, male)	76%	69^{c}%	77^{b}%	86^{a}%	88^{a}%	80^{abc}%
Age of the household head	46.63	47.38^{a}	43.59^{c}	44.89^{bc}	46.57^{ab}	53.42^{a}
Highest level of education of the most educated household member	7.91	7.31^{d}	7.11^{d}	14.02^{a}	8.66^{c}	10.91^{b}
Number of household members below 19	3.47	3.25^{b}	3.62^{b}	3.42^{b}	3.88^{a}	4.57^{a}
Number of household members above 65	0.86	0.86^{b}	0.62^{c}	0.95^{b}	0.99^{b}	2.32^{a}
Number of household members between 15 and 65	2.50	2.27^{c}	2.33^{c}	3.45^{a}	2.92^{b}	3.70^{a}
Percentage of chronically ill/disabled household members	14%	17%^{b}	10%^{a}	19%^{a}	10%^{a}	9%^{ab}
Social capital						
Any household member involved in co-op/any economic association	51%	40^{c}%	42^{c}%	63^{b}%	77^{a}%	76^{ab}%
kinship ties(=1,head/spouse related to village authorities	56%	53^{c}%	70^{a}%	14^{d}%	61^{b}%	50^{c}%
Migrant (=1, considered non-local)	10%	9^{b}%	8^{b}%	43^{a}%	9^{b}%	13^{b}%
Household has a member who is a civil servant (=1,yes)	3.07%	0.04^{bc}%	0.32^{b}%	77.71^{a}%	0.00^{c}%	2.47^{bc}%
Financial capital						
Disposable Income (ZMW)	10,464.74	5,018.03^{d}	6,502.33^{c}	64,462.16^{a}	14,574.56^{b}	90,923.13^{a}
Access to credit (=1, yes)	16%	4^{c}%	16^{b}%	11^{b}%	42^{a}%	14^{b}%
Physical capital						
Value of assets (except livestock assets)	11,612.09	3,816.78^{d}	3,391.01^{d}	95,272.40^{b}	14,615.58^{c}	262,810.01^{a}

Value of livestock assets	3,926.39	1,089.70[c]	1,776.59[c]	2,682.28[a]	8,722.27[b]	122,613.08[a]
Access to information (=1, yes)	73%	65[c]%	59[d]%	99[a]%	93[b]%	99[a]%
Quality of housing	18%	10[d]%	6[e]%	89[a]%	30[c]%	73[b]%
Geographical context						
Distant to the Boma (km)	42.80	34.10[c]	100.26[a]	23.55[d]	37.05[b]	36.88[bc]
Agro ecological dummies						
AEZ 1	8.50%	10.00[b]%	4.20[c]%	7.90[ac]%	7.20[a]%	10.40[abc]%
AEZ 2A	40.54%	24.67[c]%	32.27[b]%	38.51[b]%	79.64[a]%	67.90[a]%
AEZ 2B	7.77%	10.45[a]%	9.81[a]%	2.09[b]%	1.58[b]%	9.29[ab]%
AEZ 3	43.22%	54.86[a]%	53.76[a]%	51.50[a]%	11.58[b]%	12.37[b]%
Participation in wage income (=1, yes)	30%	30[b]%	20[c]%	95[a]%	23[c]%	9[d]%
Participation in business income	50%	52[a]%	43[b]%	47[ab]%	50[a]%	45[ab]%
Household Commercialization Index	31.40	20.10[d]	34.45[c]	37.26[c]	53.43[b]	65.74[a]
Months without food	1.71	2.14[a]	1.93[a]	0.44[c]	0.86[b]	0.58[bc]
Simpson index of crop diversification	0.41	0.38[c]	0.48[a]	0.26[d]	0.45[b]	0.32[d]

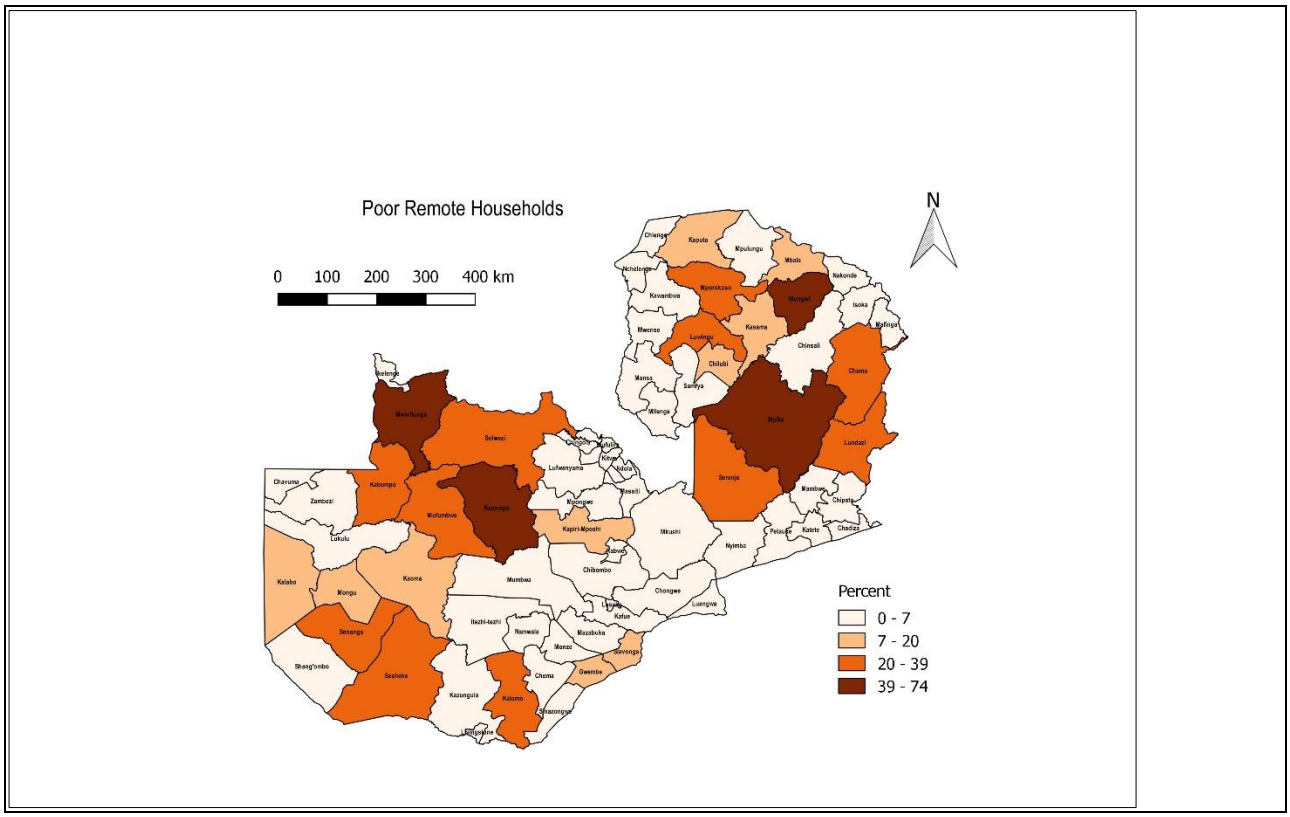
Note: A different superscript means that all values are significantly different from each other which have been ranked in the order of their size. Values with the same superscript are not significantly different from each other but are different from the other values at 5 percent.
Source: CSO/MAL/IAPRI 2015.

Figure A1. Distribution of poor accessible households by district



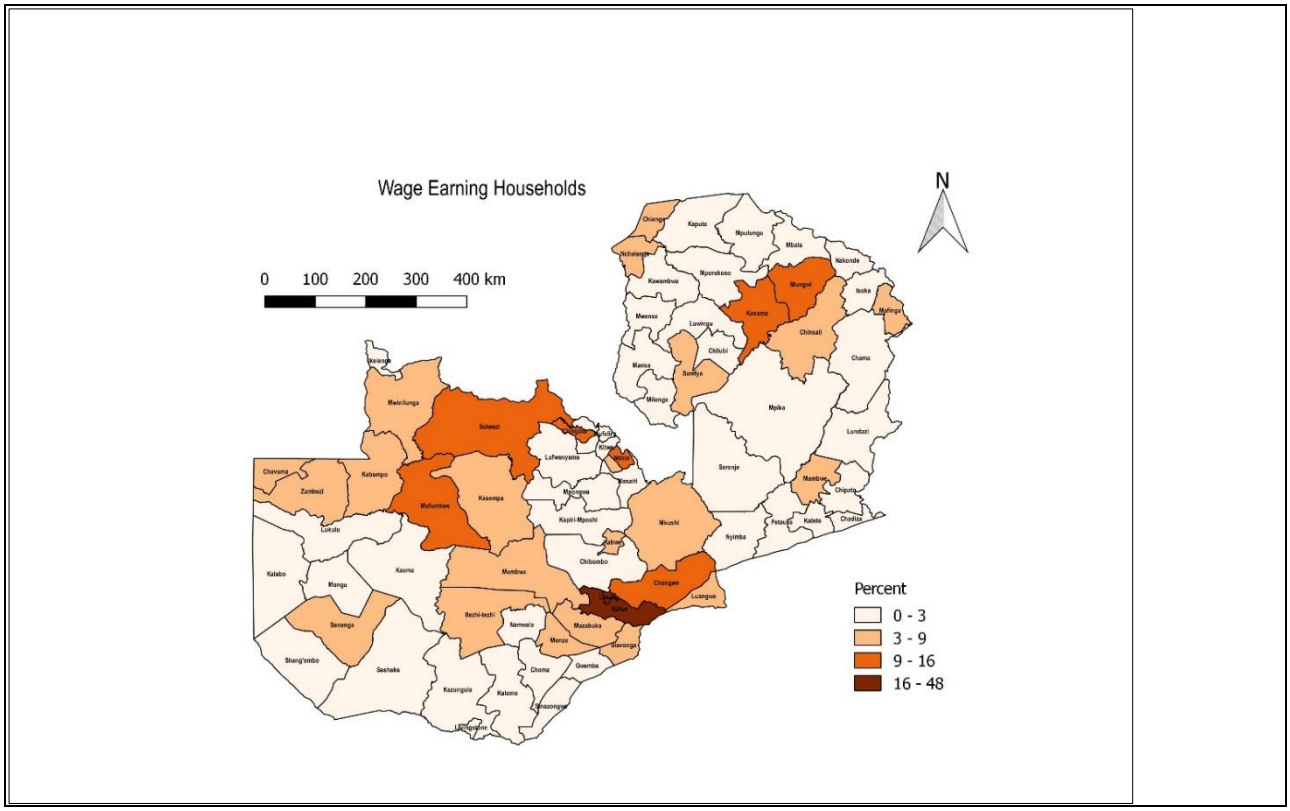
Source: CSO/MAL/IAPRI 2015.

Figure A2. Distribution of poor remote households by district



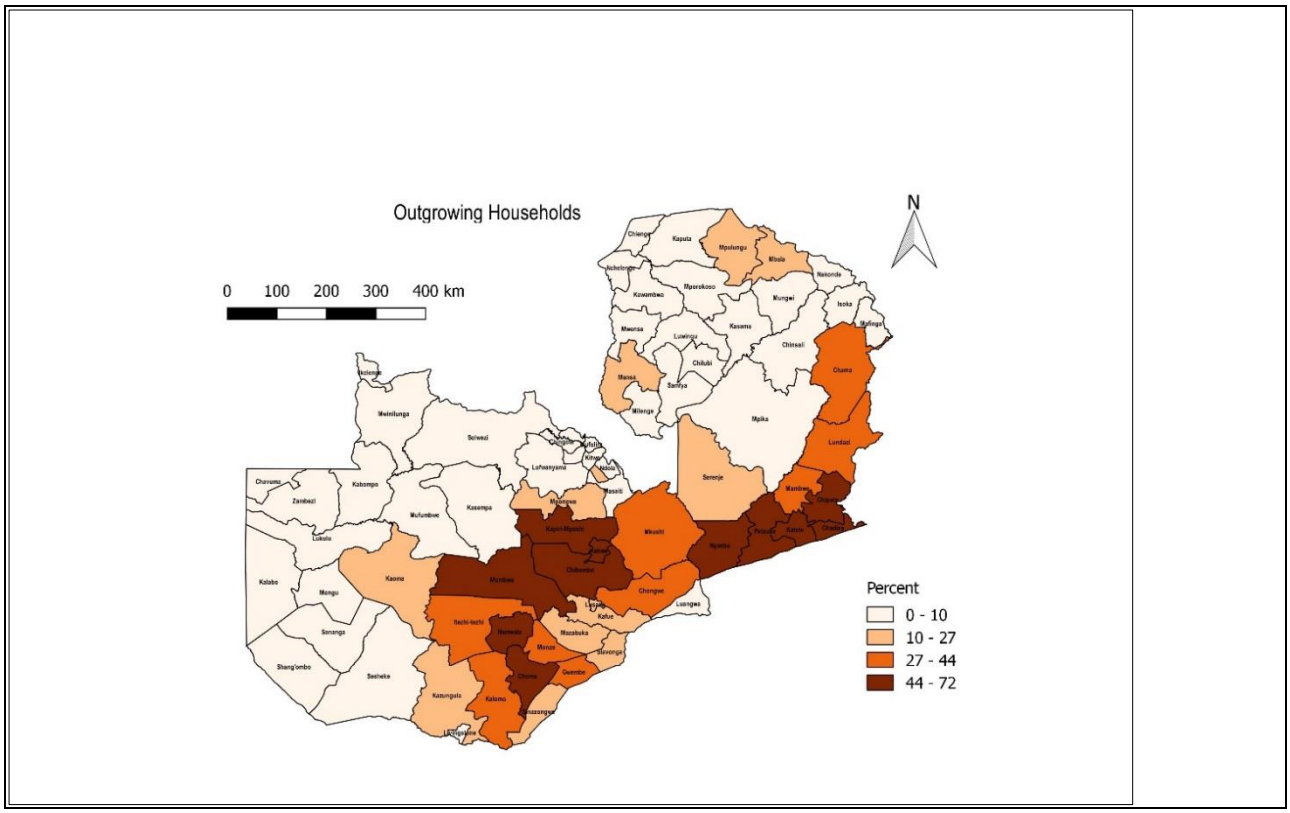
Source: CSO/MAL/IAPRI 2015.

Figure A3. Distribution of wage-earning households by district



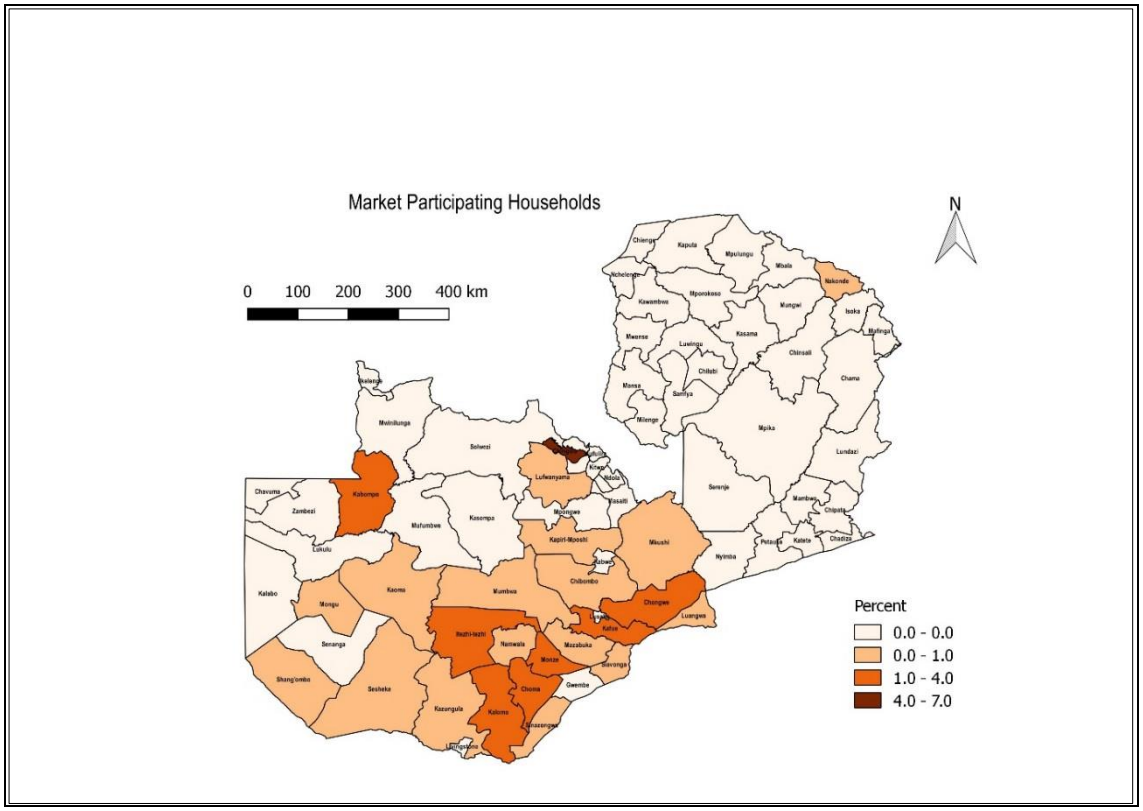
Source: CSO/MAL/IAPRI 2015.

Figure A4. Distribution of outgrowing households by district



Source: CSO/MAL/IAPRI 2015.

Figure A5. Distribution of market-participating households by district



Source: CSO/MAL/IAPRI 2015.