

Analyzing the Agricultural livelihood Strategic Components in the Zambezi region, Namibia: A Chi-Square Test

Abstract

While urban dwelling is increasingly becoming common across the world, in Namibia, the population settlement pattern is skewed towards rural areas. In the Zambezi region, the majority of the population is found in the rural areas. The main livelihood strategy is agriculture, which is subsistence in nature and practiced on communal land. The objective of this paper is to investigate changes in the agricultural livelihood strategy in rural Zambezi. The paper is premised around the hypothesis that the agricultural livelihood strategy has improved since 2002 to 2010. Parametric sampling approaches were considered for 253 respondents and a Chi-Square method was applied for analytical purposes. The results proved otherwise in favour of the alternative hypothesis that changes have occurred but in an adverse manner. The declining livestock numbers and crop harvests among the marginalized households require some long term policy interventions. Other than encouraging sustainability of livelihoods, anything less is unlikely to be appropriate for a rural household in the Zambezi region.

1. INTRODUCTION

1.1 Background

In every community, there are various ways and means by which people command their livelihoods. Various livelihood options may exist but not all can be taken at once. In rural Zambezi region, few livelihood options are available to rural communities and those that are practiced from a conventional perspective.

The geographic location of the Zambezi region makes it an attractive place for tourists. The region is surrounded by rivers and has the highest annual rainfall in Namibia. Wild animals move uncontrollably across the Zambezi region from Angola to Botswana and back and forth. While conservancies are imperative as income generating sources, their upsurge in the Zambezi region offers a placebo type of relief to the unsustainable livelihoods there. During the period 2002/3 to 2007/8, climate risk factors became rampant and the provision of food aid became the immediate solution to poor harvests. In the same era, community conservancies were gradually established. Livestock diseases also increased while the demand for meat across Namibia, as an exportable good for the overseas markets escalated. Of late, new vistas are emerging with regards to the increasing commercially driven agricultural practices in that region.

Over time, climate risk factors have devastated economic fabrics of rural communities with no or poor early warning systems. Failure to have a skilled workforce active in early warning systems could expose rural communities that rely heavily on subsistence agriculture to serious repercussions of a climate risk nature. Any study about rural livelihoods in the Zambezi region needs to consider the element of climate factors given that the mainstay of the rural economy is natural resource-based enterprises particularly agriculture. Climate risk in this study refers to rainfall-related issues such as droughts and floods, which have a direct effect on agricultural outputs. It is in line with such understanding that Erasmus et al. (2000) shared that complexity of atmospheric chemistry gives rise to rainfall, and then suggested that predicting changes in atmospheric temperature could be more rewarding than predicting hydrological developments.

Like in other north and northern regions of Namibia, land in rural areas in the Zambezi region is controlled by traditional leaders. Even though this is the case, land is owned and is vested with the government. The type of land tenure system that applies in the Zambezi region is communal. Such a system provides one with the right to cultivate the land but selling of it is prohibited by law. Therefore, the land on which rural communities operate is without private title deeds. The lack of title deeds entails that communal land is not a private property as such is not exchangeable as collateral when engaging in financial transactions that requires some form of security.

Since grazing is treated on a communal basis, farming is also subsistence. The farmers' primary objective is to produce for own consumption while surplus harvest is cleared by the price at a market. On marketing, it is increasingly becoming apparent that informal markets become vital to livestock marketing. With regards to bulk buyers for grain includes Kamunu Supermarket, Namib Mill and Rings/Kalinka and in some cases Likwama Farmers Association. However, the organised market is still preferred especially for marketing of livestock. The main buyer of livestock in the Zambezi region is the Meat Corporation (Meatco).

As the informal market is left to thrive, the spread of animal diseases poses more dangers for livestock breeders. In view of this difficult to control situation, it is clear that trans-boundary transmission of diseases is the main threat to maintaining a healthy livestock sub-sector in the Zambezi region. At times, wild animals from neighbouring countries transmit diseases such as Foot and Mouth Diseases, and Rift Valley Fever (Thomson and Venter, 2012).

What warrants this study is the fact that so far, nowhere in any existing literature one captured changes in the agricultural livelihood strategic streams in the Zambezi region. This comes is necessary given the frequency of climatic risk factors. What also worsens is the existing agricultural policy that is biased towards compensating commercial agriculture in an event of climate risk factors taking their toll. Whereas in the communal areas, rural farmers are left to recover on their own when similar climate factors have triked. This study is probably the first to report on such matters in a quantitative manner. Therefore, this paper contributes to the existing literature on livelihoods in the Zambezi region in particular and in Namibia in general.

2. Literature Review

Barrett *et al* (2001) point out two major factors that compel people to diversify their livelihoods, namely, push and pull factors. With push factors, diversification is influenced by a weakness in the risk-bearing capacity that exists in a weak financial system. Such a situation creates an incentive to choose a portfolio of activities for the sake of stabilising income flows and household consumption. Further, diversification that arises reflects some existing limitations in the labour and land markets, as well as uncertainty regarding climate. With regards to pull factors, the influence of local economic activities such as agriculture is important. Proximity to an urban area is another pull factor that compels rural communities to create opportunities for income diversification (Barrett *et al*, 2001).

What makes rural livelihoods unsustainable is a variety of factors including climate risk, income risk, harvest failures, diseases and death of livestock (Dercon, 2002). A livelihood is sustainable

if it is able to cope with and recover from various shocks and continues to maintain its capabilities while maintaining the environmental balance (Chambers and Conway, 1992 as cited by Scoones, 1998).

It is against this backdrop that Arndt and Bacou (2000) believe that reliable rainfall prediction is essential to rural communities. There is no theory of livelihood and coping strategies, As demonstrated by Deressa and Hassan (2009), the Ricardian model can be used to capture the effects of climate change and farm net revenue. In the context of this model, farm revenues could be treated as a proxy for income (Kurukulasuriya *et al*, 2006).

The degree to which poverty confronts a particular household can be perceived as a threat that also affects access to food. Although poverty is the main cause of food insecurity, it also has an impact on the ability of the affected to secure food for their households. Other causes of food insecurity do exist but some are secondary in nature and they include natural causes (drought and flood disasters), locust infestation, high food prices and political instability (Nwonwu, 2009).

It is due to the uncertainty of rural livelihoods that rural people keep on looking better opportunities that can increase but also stabilize their incomes (Olawuyi and Rahji, 2012). Market-led diversification and the need to develop enterprises are now seen as ways that can boost and expand income opportunities for rural communities (Borbora, 2014). In South Africa, remittances that Mozambicans earn from other engagements and sends home to Mozambique were seen as vital forms of livelihoods (Golooba-Mutebi and Tollman, 2004).

In South Africa, rural livelihood composure seems to be deviating away from an agricultural based livelihood rural economy. The existence of government grants have a changing effect on how livelihoods are managed in that country (Daniels et al, 2013). In Ethiopia, it was discovered that microcredit that could be expected to improve livelihoods, various results were found. Thus better off households benefited from microcredit while those in the poor position were made worse off (Siyoun et al, 2012).

It is also understood that rural-urban migration is one of the ways in which rural dwellers sustain their livelihoods. Remittances sustains many in rural areas in South Eastern Nigeria and such are sent mainly for educational support of relatives and funeral services, buying of food and building and maintenance of houses (Ajaero and Madu, 2014).

3. Materials and Methods

This paper is a product of a stratified random sampling approach that yielded 253 respondents whose livelihoods are mainly agriculturally based and operates in the flood plains. The analytical approach is the Chi-Square method which aims to test the pre-set hypothesis. The Chi-Square test is applied on a fixed-ratio hypothesis that will be stated now. H_0 states that the agricultural livelihood strategy has remained the same from 2002/3 to 2007/8. This means that $\beta = 0$. While the H_1 posits a contrast position of a change to have occurred which, can be expressed as $\beta \neq 0$. Chi-Square (χ^2) is a statistical method that is helpful when analysing small observations and also where the population may not be well distributed. This method used in this study is adapted from

the works of Gomez and Gomez (1984), Spiegel (1992) and Wagner (1993) and mathematically Chi-Square can be written as follows:

$$X^2 = \frac{(|a_1 - b_1| - \sqrt{2})^2}{b_1} + \frac{(|a_2 - b_2| - \sqrt{2})^2}{b_2} + \dots + \frac{(|a_i - b_i| - \sqrt{2})^2}{b_i} \dots \dots \dots (1)$$

So, the short version for the Chi- Square formula can be written as:

$$\gamma_i = \frac{(|a_i - b_i| - \sqrt{2})^2}{b_i} \dots \dots \dots (2)$$

Where: n is the number of classes, a represents the number of observed units, and b is the number of units expected to fall into respective classes with an assumption that the hypothesized ratio is confirmed. Furthermore, || represents absolute values.

Therefore:

$$\chi^2 = \sum_{i=1}^n \gamma_i$$

4. RESULTS and DISCUSSION

4.1 Agricultural Livelihood strategic components

4.1.1 Agronomic livelihood strategic component

Since this paper considers agriculture as the imminent livelihood strategy, it means that challenges of hunger and unemployment in the informal sector in rural areas could be found in the dynamics that occurs within the rural agricultural sector. When dealing with agriculture, two classifications are necessary and these are the agronomic and the animal husbandry components. These two agricultural livelihood enterprise components are essential and are treated in the context of conducting the hypothesis test.

Although rural households in the study area breed cattle, goats and chickens, they also engage in crop production. Common agronomic crops in the study area are maize, sorghum and millet. Maize is dominant over the other crops. Vegetables are also grown but are very rare. As a result of the rarity of vegetable enterprises I which is mainly due to total absence of irrigation systems, such enterprises were excluded from the analysis.

With regard to agronomic crops, some rural households often sell surplus maize to meet the income needs of the household. Income generated from selling surplus maize, millet and sorghum goes a long way, among others in supporting children to pay their school fees, paying for medical expenses and procuring other necessities. Marketing of surplus grains takes place at the urban market situated at Katima Mulilo, where three formal buyers, namely Kamunu Supermarket, Namib Mills and Kalinki Supermarket are found. Sometimes surplus produce is

offered for sale at informal rural markets. Below is a graphic portrait of two harvesting scenarios influenced by environmental factors, namely a harvest when conditions were abnormal in 2002/3 and the actual harvests in 2007/8, which are considered because of recorded average annual rainfall.

The terms harvesting under ‘normal conditions’ and under ‘abnormal conditions’ should be understood to mean that there are times when annual rainfall received reaches the average of 653 mm and abnormal times when annual rainfall received is extremely low or extremely high and causes floods. Despite average annual rainfall, however, the 2006/7 harvesting season was poor. This is attributed to various factors, which will be further deliberated on in this chapter. Recall questions were not used for the 2007/8 harvesting season since information at the disposal of the heads of the households was still fresh in mind, but recall questions were used to track the events of 2002/3. The 2002/3 harvesting season was subject to drought caused by uneven spread of rainfall and it became even worse in 2003/4 when heavy floods ravaged most of the crop fields and wiped away the hope for a potential crop harvest.

Maize harvest under abnormal conditions (maize I) recorded 39% farming households who produced maize in the output category of 11 to 20 of 50 kg maize bags. Of the target population, 26% harvested at least 20 of 50 kg maize bags under normal conditions. In 2007/8, denoted by maizej, 46% of respondent households harvested one to five 50 kg bags of maize. With regards to millet, the highest performing category during abnormal conditions is that of those who harvested between one and five 50 kg bags. It is in the same category in which sorghum producers scored highly as well. The two crops are not very different under normal conditions. However, there are genetic differences which go with various cultivars too. Sorghum (sorgi) producers again performed well in the output category of six to 10 bags with 22% respondents, different from millet (denoted by milleti), where only 6% of the producers were recorded. As a result of drought resistance and the easy-to-adapt traits of millet, in the 2007/8 harvesting season some pockets of millet producers were recorded in the output category of 11 to 20 and beyond, while sorghum producers failed to register their presence.

The striking observation is that while 2007/8 recorded an average annual rainfall, maize II producing households were more prevalent than those producing other crops in the study area. Reasons for this include the fact that in the Zambezi region, maize is regarded as marketable good and maize producers may have worked hard in anticipation of a surplus harvest. The currency used in this study is Namibian dollars (N\$). The N\$ is pegged to the South African rand (R). Thus N \$1 = R1. In October 2007, the price of maize at Katima Mulilo stood at N \$170 for a 50 kg bag of maize not milled and for a milled one, the price stood at N \$300 which is an equivalence of US\$23. This price was astronomical because of an excess demand for maize, not only in Zambezi but also in Namibia at large. However, it should not be confused with the fact that prices of maize and millet are at variance in the Zambezi region when compared to the regions of Kavango, Ohangwena, Omusati, Oshana and Oshikoto. Unlike in these regions where millet is extensively consumed and preferred as staple food, in the Zambezi region maize is the staple food.

As a result, the price of maize will be expected to surge quickly when the demand is high and at times when there is an import restriction. Further, maize is a strategic commodity given that it is

consumed by many people in Namibia. As a result, annually the Namibian Agronomic Board imposes a moratorium on the importation of maize grain and maize-meal until the local supply has been absorbed into the market. Once a deficit is anticipated resulting from excess demand, imports are then permitted by an official announcement in the print media and on radio. Imports are only allowed when the consumption of the locally produced maize has reached a critical low level. This step has a price-escalating effect on locally produced maize. The price effect comes in because often, the demand outstrips the supply and as maize becomes increasingly scarce before the borders are re-opened for imports, the price of maize-meal could have become much higher, and inhibitive to the purchasing power of many poor rural households.

From a strategic rural livelihood point of view, the dire situation of rural households having to face serious food shortages can be attributed to climate change that has brought changes to the natural environment. The changes are such that rural farmers have now abandoned one of the crucial and traditional coping strategies of engaging in a dual harvesting approach in a year. Historically, rural households whose fields were close to rivers used to plant and harvest twice across the usual planting season. Locally this practice is called *kulima litapa*. *Kulima litapa* is a Lozi statement, which entails planting early and it suggests a provision for the second planting scenario. *Kulima* simply means to cultivate while *litapa* is the early cultivation practice. The first case scenario of *litapa*, would assist the household in meeting its food requirements when the usual ploughing takes place late in November-December. *Kulima litapa* used to take place around September. By the month of October, consumption of pumpkin leaves and related crop-field vegetables would usually take place. Late in November, consumption of sweet corn resulting from *litapa* would then follow.

As indicated, the second planting season usually started late in November to early December for a good reason that school children were on holiday. This timing was crucial for two reasons, namely for accessing the required labour from the presence of school pupils; and the conduciveness of environmental factors, given that reliable rainfall would be received during the month of December to escalate ploughing activities. The findings show that all rural households in the study area have since abandoned such practices. This explains the switching from *litapa* to a single harvesting approach. Some of the reasons are annual flood water that would still be found in river-based fields, unlike before; reduced labour supply to rural households due to migration and deaths in families; and increased occurrence of terminal diseases such as HIV and AIDS in rural households. These factors have rendered it difficult to access household labour in attempting to meet the food and income needs of the affected household.

4.1.2 Animal husbandry livelihood strategic component

Goats

Goats are highly prized for slightly bigger get-together parties in rural areas of the Zambezi region. Overall, goats provide rural households with meat and milk. However, goat milk is not commonly consumed in the study area. Goats are cheap to rear, are resistant to diseases and can multiply more quickly than cattle. This study found that some households own goats. However, there was a shift in the ownership trend between 2002/3 and 2007/8.

From a sample of 253 respondents, 68 households reported that in 2003 they owned goats I. Of the 68 respondents who owned goats, about 46% owned between 1 and 5 goats. The next big cluster of respondents forms 38% and includes respondents who owned between 6 and 10 goats. Ownership declined as bigger categories were considered. For example, in the same period, in the ownership categories of 21 to 30 and 31 to 50, there were only 2% and 1% of respondents respectively. In 2007/8 the situation changed with the highest number of respondents, i.e. 26%, owning between six and ten goats II. The decline with progression to high goat ownership categories remained steady for the 11 to 15 and 16 to 20 categories, compared to the same categories in 2003. The trend is high in subsequent categories of 21 to 30 and 31 to 50 compared to the ownership trend in 2002/3. The overall picture shows that goat ownership declined generally, since only 58 respondents owned goats in 2007 compared to 68 in 2003.

Cattle

There are quarantine facilities in which cattle are confined. Quarantine facilities are used as gatekeepers for observing, inspecting, treating diseases and feeding animals in preparing them for marketing. The duration of confinement is 21 days before slaughtering can take place. Cattle are considered mobile investments for rural households. Cattle are valuable assets and are popularly a means of payment to the family of the bride (*malobolo* in Lozi) when marital negotiations are concluded between two families. Many school-going children including the author of this study have benefited from the sale of cattle to pay for their education. Since these are communal areas, known for subsistence farming purposes but with rising need, cattle can be marketed to meet the immediate income needs of the household.

The year 2002/3 was characterised by high ownership of cattle (denoted as cattle I) in the category 1 to 5. Cattle owners comprised about 40% of the respondents and this category was followed by those who owned 6 to 10 cattle. Five years later (2007/8), the trend in cattle ownership (denoted as cattle II) for the 1 to 5 and 6 to 10 categories had declined, registering lower percentages of 20% and 19% respectively. The ownership trend is comparatively high for the categories 11 to 15, 16 to 20, 21 to 31 and >50 compared to the 2002/3 figures. The difference is that there is a shift, with more cattle owners beginning to own more cattle than before and a salient reflection is for the category >51, which in 2007/8 stood at 15% compared to 2% five years before. Nonetheless, the overall number of rural households who owned cattle in 2007/8 is low (131) compared to 146 in 2003.

Chickens

Chickens are popular among rural households. Chickens are the most commonly used items for delicious dishes, especially when there are events involving family get-togethers. These birds are cheap to purchase and are also affordable to many rural households in that they cost effective to feed given that they freely range. In 2007/8, the price for a rural chicken ranged between N\$30 to N\$50, with cocks being more expensive than hens.

The 2007/8 chicken ownership (denoted as chickensj) trend shows that most of the respondents who owned chickens owned between 1 and 5 chickens. This is represented by about 47%. However, the highest number of chicken-owning respondents owned between 6 and 10 chickens. In 2003 none of the respondents owned more than 51 chickens (denoted as chickensi). Contrary to this, in 2007/8 about 5% of respondents owned at least 51 chickens. Despite this varying

ownership trend, it is noticeable that in 2007 more chickens in high categories were owned by rural households compared to the pattern of ownership in 2002/3. Broadly, chicken ownership declined, with a steady rise in ownership of chickens for higher categories. This is confirmed by the fact that of 154 respondents who owned chickens in 2003, only 105 owned chickens in 2007/8.

4.2 Other livelihood Strategies

4.2.1 Old age pension

There are other sources of livelihoods in the study area but which are not agriculturally related. Some of the livelihoods include; old Age Pension, remittances, formal employment, and natural resource harvesting.

In 2009, old age pension reached N \$400 per month. In 2010 it increased to N \$450 per month and in 2014 it stood at N\$600 before it was adjusted to N\$1000 in 2015. Pelham (2007) found that the provision of an old age pension in Namibia and South Africa is founded on the assumption that the elderly are economically vulnerable. There is a difference between this type of pension and one in which the beneficiary makes a contribution while s/he is employed. The one where an employee contributes is compensatory to the employee, while the old age one is more of a grant made in consideration of the economic challenges an old pensioner faces (Pelham, 2007).

Echoing the finding made by Pelham, it comes to light that pay points for old age pensions have turned out to attract entrepreneurs who follow pay masters to the pay points where they market various commodities to pensioners. Commodities that are marketed at pay points vary from clothes to food and camping tents. Although pay points have become attractive sites for merchandising, this may place pensioners at risks of being victimised by criminals, but they may also becoming trapped in debts. When this happens, more pensioners may become even more vulnerable and become slaves to their creditors. Pension amounts were low at independence in 1990 but the pension has gradually been adjusted to where it stands now, with the aim of meeting the very basic food needs of the pensioners.

4.2.2 Remittances

Remittances are also an important factor in the survival of a rural household. However, remittances are difficult to track, given that they come secretly, compared to old age pensions. Respondents tend to shy away from disclosing the monthly or regular amounts they receive from their relatives or children working in urban areas or even abroad. There may be good reasons to harbouring such fears. When classified as belonging to the haves, some rural households fear that if they were known to be better off, it would increase their chances of being denied food aid.

4.2.3 Formal employment

With Namibia's high unemployment rate of at least 28.1% (2015), it is not surprising that many people in the study area are not formally employed. Most of the unemployed are youths. A very small, insignificant fraction of respondents is employed. Informal jobs involve exchange labour practices where a person assists another household in return of the help of those s/he benefited

from their labour. With regard to formal paid labour, that happens only at urban centres with exceptions when there is construction of rural roads or de-bushing along the roads.

Of the 253 enumerated respondents, only 2% were formally employed. It shows that there is either lack of employment opportunities in the study area or a high level of skills shortage and probably more informal employment opportunities. The truth could be both and could also be associated with under-development in the study area. Katima Mulilo is the only developed urban centre, in the entire Zambezi Region, where people in the region can get better and/or a variety of job opportunities.

4.2.4 Natural resource harvesting

Since decades ago, rural households in the study area have been benefiting from the harvesting of natural resources. These activities include collecting firewood for their energy needs, cutting poles for building their houses and for selling to prospective buyers and cutting grass for thatching their houses, but also for selling to buyers who need grass. Mopani trees are mostly preferred for firewood. Other natural resource products which are in demand include reed, Nuphar lutea (yellow water lily) and weaved baskets using natural resource materials such as coconut leaves. Wild fruits are both consumed and sold. The findings are that 6% of respondents gather wild fruits and wild vegetables, which they sell but also consume. These two sources of food and income are seasonal and occur naturally. Wild vegetables are even sold at the urban community market at Katima Mulilo. Common wild vegetables include those that are locally called Mulendumuko, Tepe, Sinshungwa and Lihato. In Zulu and Xhosa the collective name is imfino.

4.3 Hypotheses Test: The agronomic strategic component

Maize, millet and sorghum are the main crops that are produced, consumed and/or marketed by rural households. Here the hypothesis that is tested is that there is a ratio of 1:1 of total harvest by sample households in 2002/3 and in 2007/7. Which also means that $H_0: = 0$, that there is no difference in the ratio of the total harvest by the sample households that cultivate maize, millet and sorghum. $H_1: \neq 0$, that the ratio of total crop harvested that is maize, millet and sorghum is different.

Table 1 presents the results of the survey.

Table 1: Aggregate contingency table for maize, millet and sorghum during 2003/3 and 2007/8

	<1 bag	1-5 bags	6-10 bags	11-20 bags	>20 bags	Total
Maize I	2	30	57	98	65	252
Maize II	70	89	31	2	2	194
Mille I	54	59	14	7	5	139
Mille II	30	17	5	1	1	54
Sorghum I	25	72	56	19	4	176
Sorghum II	47	53	7	0	0	107

Source: Own survey (2007)

The disaggregated contingency table is not included here, only an aggregated one. However, the results of the χ^2 test are based on disaggregated data, which was deduced from Table 1. Applying the χ^2 formula and using aggregated data in Table 1 yield the following results:

Chi-Square sample statistics for maize is 245.18, for millet 4.42, and for sorghum 54.23; the degrees of freedom are 4 for each of the crops; the critical Chi-Square cut-off for 9.488 for all crops respectively as determined by their equivalent degrees of freedom. Thus, at a 5% level of significance, H_0 is rejected that the ratio of the total maize harvested by rural households that cultivate it is different. This implies that there is independence of association between the 2003 harvest which is more than the 2007/8 harvest. As for millet, H_0 is accepted: that there is no difference in the ratio of the total millet harvested by rural households that cultivate it in 2003 to the one in 2007/8. For sorghum, H_0 is rejected: that the ratio of total sorghum harvested by rural households that cultivate it is different and it shows that more sorghum was harvested in 2002/3 compared to 2007/8. So there have been some changes in the proportion of total harvest of the sorghum crop.

4.4 Hypotheses Test: The animal husbandry strategic component

Over the years, but especially from 2002/3 to 2007/8, rural communities in the study area have received food aid. Something must have gone wrong for them to start receiving food aid. It is on this premise that after presenting current and past livelihood strategies, a need arises to test the hypothesis to determine whether the past livelihood strategy is no longer helpful. The hypothesis test is divided into two sub-tests on goats, cattle and chickens, and the maize, millet and sorghum harvests. Using the Chi-Square test, the first sub-test of the main hypothesis is specified on goat, cattle and chicken ownership as follows:

$H_0: = 0$, that there is no difference in the ratio of the number of goats, cattle and chickens owned by sample households in 2002/3 and in 2007/8. $H_1: \neq 0$, that the ration of ownership of goats, cattle and chickens by sample households is different for the two periods.

Table 2: Aggregate contingency table for cattle, goat and chicken ownership during 2002/3 and 2007/8

	1 to 5	6 to 10	11 to 15	16 to 20	21 to 30	31 to 50	>51	Total
Cattle I	59	35	12	16	10	11	3	146
Cattle II	27	25	16	25	11	8	19	131
Goats I	31	26	8	2	1	0	0	68
Goats II	12	14	12	11	3	1	0	53
Chickens I	72	42	19	10	8	3	0	154
Chickens II	16	23	16	20	13	12	5	105

As in Table 1, the same applies here that the disaggregated contingency tables are not included, but an aggregated one. However, the results of the χ^2 test are based on disaggregated data, which was deduced from Table 2. Applying the χ^2 formula using aggregated data in Table 2 yields the following results:

The Chi-Square sample statistics for cattle is 18.61, for goats 20.58, and for chickens 47.50; the degrees of freedom are 6, 5 and 6 respectively; the critical Chi-Square cut-off for cattle is 12.592, for goats 11.071, and for chickens 12.592. Therefore, at a 5% level of significance, H_0 is rejected for all types of livestock in favour of the alternative hypothesis. This means that the ratio of goats, cattle and chickens owned in 2002/3 is not the same as in 2007/8. Thus there is a difference in terms of the fact that there were more goats, cattle and chickens owned in 2002/3 compared to the ownership in 2007/8.

5. CONCLUDING REMARKS

The frequency of floods and drought in the study area often challenges the livelihoods of rural households. Mini grocery shops are proving to be an alternative livelihood strategy outside the usual agricultural and natural resource-based ones. This creates a need for more external supplies to avert serious hunger. Supplying food parcels has now developed into an annual activity in the study area. As demonstrated, agriculture, which used to be a conventional livelihood strategy, has been declining in terms of both ownership of cattle, goats and chickens, as well as harvest of crops such as maize and sorghum. Such a declining due to frequent climate risk factors especially drought and floods, confirms how inefficient this strategy is turning out to be with regards to sustaining rural households. The implication can be that rural households are increasingly consuming costly food commodities rather than their own.

On the policy side, the nexus is not well supported with needed interventions that can improve the lives of rural households. With annual floods becoming common, weaker households will find it difficult to survive outside external support. The government and donor community should assist in finding a permanent solution to the frequent disturbances to livelihood strategies. The solution lies as well in reforming the agricultural policy and its related interventions to become pro-poor and serve as enablers to the course of rural households. Such should be policies tools that provide for the rural households to have to depend on their own efforts.

Lack of dams in the Zambezi region makes it difficult for rural households to engage in sustainable vegetable production. If there were dams or water-catchment facilities, that water could be used to irrigate agronomic crops and vegetables during dry seasons. This would in turn improve the agricultural livelihoods of rural households. A decision to invest in water-catchment facilities requires strong political will at the level of political office-bearers to support efforts to invest more in rural roads, bridges and dams. Constituency councilors should also be held accountable for non-delivery when it comes to community support initiatives. This will speed up the desire to spur development of the needed infrastructure in the study areas. Further, such investments in rural infrastructure could play a multiplier role in livelihood strategies that seem to be interrelated.

It is also very important to do a similar study to find out the situation regarding rural livelihood strategies in Zambezi region from 2008 onwards as this study used data from 2003 to 2007.

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