

*Full Length Research Paper*

# Assessment of livelihoods of smallholder pig keepers in Mbeya rural and Mbozi districts, Mbeya region, Tanzania

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**This study investigated the livelihoods of 98 smallholder farmers keeping pigs in Mbeya rural and Mbozi districts in Mbeya region. The study found that respondents' characteristics influenced decision making on pig keeping and that pig keeping overall contributed 5-10% of the households' incomes. Pig keeping in Mbeya and Mbozi rural districts contributed to food provision and to accelerate technology scaling-up. However, two thirds of the respondents reported that they were not satisfied with the pig trade, and less than half of them knew the livestock extension agents, but two thirds said that they were not satisfied with their advisory and service delivery. Less than half of the respondents reported to having access to water for their pigs and in both districts, one third of the respondents indicated to facing problems of presence of pig diseases. This study recommends that livestock extension agents in the two study districts should educate pig keepers on good pig husbandry, assist them to form associations, and help them to find reliable markets for their pigs and secure loans.**

**Key words:** Smallholder pig keepers, livelihoods, livestock extension agents, Mbeya rural, Mbozi districts, Tanzania.

## INTRODUCTION

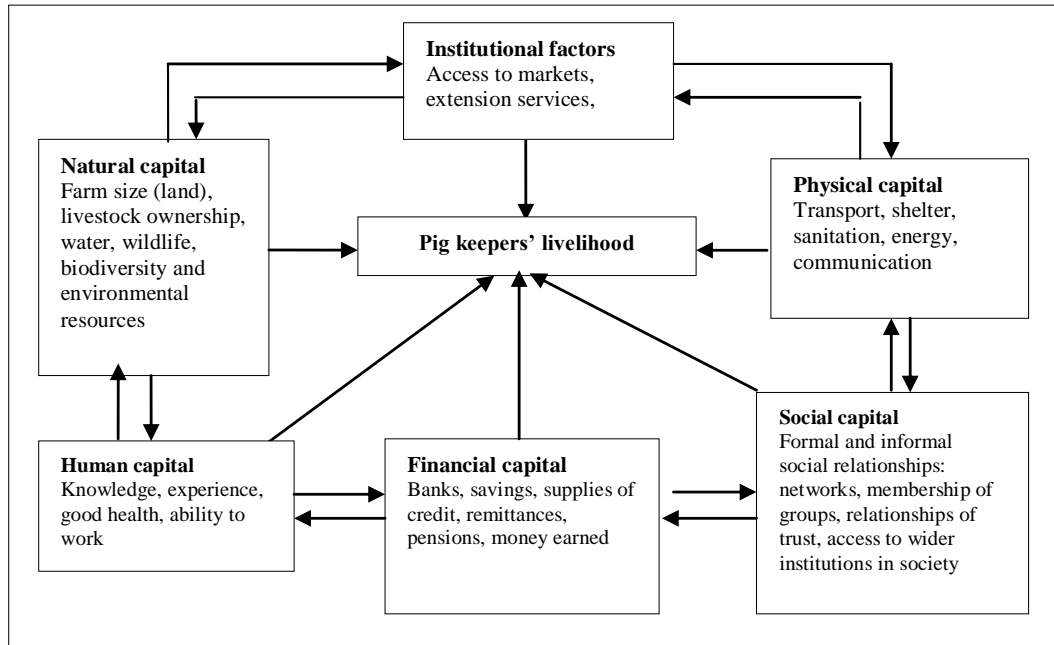
Tanzania is an agrarian country with 45 million people, of which about 80% of its labour force is engaged in agricultural production (URT, 2012). Out of the 5.8 million agricultural households in the country, about 40% keep livestock, which include cattle, goats, poultry and pigs. The number of pigs in Tanzania is approaching 2 million and pig production is the fastest growing livestock sub-sector in the last two decades primarily due to stimulated growth in pork consumption, especially in urban areas (FAO, 2005; URT, 2012; FAOSTAT, 2012). Similar developments in pig production have been observed in other parts of Eastern and Southern Africa (Phiri et al., 2003; Mutua et al., 2007; FAO, 2012), in Asia (Delgado et al., 1999), in Vietnam (Lemke et al., 2006) and in China (Cheng et al., 2011; Riedel et al., 2012).

In Tanzania, most pigs are kept in high human population areas in which land is of high agricultural

potential. About 54% of the pigs in the country are thus found in the Southern Highlands of Tanzania, more specifically the regions of Mbeya, Iringa, Rukwa and Ruvuma (URT, 2012). Moreover, pigs are produced in a traditional smallholder farming system involving over 500,000 rural smallholder households (URT, 2012). Pig production in these households is primarily a market-oriented activity, and the pigs are thus sold to secure finances for the family.

Pig production in smallholder systems is characterized by small herds, low productivity, low market off-take and poor food safety, which pose substantial limitations on

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**Figure 1.** Conceptual framework for assessing livelihoods of smallholder pig keepers in Mbeya rural and Mbozi districts (adapted from Carney et al., 1999).

the public health and economic viability of the smallholder farmers (URT, 2012). The rationale for choosing Mbeya rural and Mbozi districts is because they are located in the Southern Highlands of Tanzania, which are the two major sources of live pigs sold to Dar es Salaam city situated about 1,000 km away, and markets such as Iringa, Morogoro and Njombe. Secondly, pig keeping among smallholder farmers in these districts is a complementary livelihood activity and provides manure, which is used to fertilize crop fields. Thirdly, pig keeping in these districts utilize rural resource base that would otherwise remain unutilized (labor, river weeds, crop left-overs, maize bran, sunflower cake). Fourthly, through pig keeping, smallholder farmers may acquire knowledge and skills of intensive animal husbandry systems that are generally used for scaling-up improved livestock keeping activities in the districts.

The need for improving sustainable pig production, consumption, and public health in Tanzania is nevertheless still in great need. Basic information on the characteristics of smallholder pig production systems in Tanzania, and their livelihood indices are inadequate, though they are prime key indicators for developing the sector. This study, therefore, sets out to investigate livelihoods of smallholder pig keepers in Tanzania. Specifically, the study assessed the livelihoods of smallholder pig farmers in relation to each of the five capitals: human capital, social capital, natural capital, physical capital, and financial capital. Further, the study examined the contribution of the pig production to

smallholder farmers' livelihoods using the conceptual framework as shown in Figure 1.

## MATERIALS AND METHODS

### Study areas

The study was carried out in Mbeya Region, Tanzania, in Mbeya rural and Mbozi districts located between latitudes 8° 14' and 9° 24' S, and longitudes 32° 04' and 33° 49' E. Mbeya Region has a sub-tropical climate with bimodal rainfall from approximately October to December and March to May (URT, 2002). Both districts are rural areas with livestock production almost exclusively on a smallholder level. Main livestock species in both districts include cattle, goats, chicken and pigs. The number of pigs fluctuates significantly due to outbreaks of African swine fever. Administratively, Mbeya rural district had three divisions namely: Usongwe, Isangati, and Tembela covering 25 wards and 143 villages. The district covered about 2 432 km<sup>2</sup> of which almost 80% is suitable for agriculture and animal husbandry (URT, 2002). Mbozi district covers an area of 19,679 km<sup>2</sup> and had a total population of 515,270 people and the district had six divisions namely Igamba, Iyula, Kamsamba, Msangano, Ndalambo and Vwawa.

### Study design

This study was conducted from January to April in 2012

adopting a cross-sectional survey design. Five different survey tools also were used: structured questionnaire, participatory rural appraisal, focus group discussions, observation and transact walks. Fourteen villages which predominantly kept pigs were purposively selected for the study (that is, seven villages from each district). A sample size of 98 respondents was randomly selected from these villages using the Yamane (1967) formula. The selection involved two stages: Stage one involved selecting 14 wards (six and eight wards from Mbeya rural and Mbozi districts, respectively), from which seven villages per district were chosen. Stage two involved using a simple random sampling technique to select 98 respondents in the 14 selected villages in the two districts. Seven respondents were selected from each village. Also, a total of 14 livestock extension agents one per ward were purposively selected. Later, one livestock extension agent who specialised in livestock husbandry was selected from each district headquarter. Questionnaires were validated and pre-tested, and these were the main instrument used to collect the data reported in this article.

### Data collection

Data collection was of two types: primary data were collected using a face-to-face semi-structured questionnaire. Here, respondents' socio-economic and demographic data were collected. Also, the study collected five respondents' capital assets for livelihood measurement that included social, human, physical, financial and natural. The other data set collected using a questionnaire included the benefits and challenges that smallholder farmers endured in pig keeping. Further, for the primary data collection, participatory rapid appraisals (PRA), focus group discussion, observation and transact walks were conducted. For PRA, data collected included ways of keeping pigs, problems related to pig diseases and endo-parasites, perceived market problems and general pig benefits and challenges. For focus group discussions, data collected included the role of pigs in household livelihood strategies, which provide overall sustainability of families. For observation, data were collected on the pig sites, smallholder farmers' house conditions and environment, presence of physical capital, and conditions of pigs. For transact walks, data collected included other smallholder pig keepers' houses, environment, and physical capital available in the study areas. Secondary data collection involved government reports, websites, journal articles, theses, relevant reports, and other relevant documents.

### Data analysis

Data from the questionnaire survey were coded and entered into the SPSS computer programme version 16. Descriptive statistics included frequencies, percentages, chi-square, and Pearson's moment values. Data

collected from PRA, focus group discussions, observation and transact walks were thematically grouped together, compiled, and subjected to content analysis.

## RESULTS

### Respondents' characteristics

The dominant age of pig keepers in both districts ranged between 30 and 38 years of age (35% of all respondents). Overall, the respondents were equally distributed between males and females, with a slightly higher proportion of males (59%) in Mbeya rural compared to Mbozi district. Of all the respondents, 88 and 98% in Mbeya rural and Mbozi districts respectively were reported to have had completed primary education or higher (Table 1).

In the study areas, there were two major pig keeping systems: confinement and free range. Of all the respondents, 43 (89.6%) and 42 (87.5%) in Mbeya rural and Mbozi districts, respectively, kept pigs by confining. Further, 45 (93.6%) respondents in Mbeya rural and 45 (93.6%) in Mbozi districts were reported to had other occupations which included carpentry, weaving, teaching, nursing, and doing businesses (Table 1). Also, of all the respondents, 41 (85.3%) and 42 (87.5%) in Mbeya rural and in Mbozi districts, respectively reported that they paid for their health service fees. However, of all the respondents, 35 (71.4%) and 44 (89.8%) in Mbeya rural and in Mbozi districts, respectively reported that they did not grow crops specifically for feeding pigs. Of all respondents, 37 (77.1%) and 41 (85.3%) in Mbeya rural and Mbozi districts, respectively reported that they afforded to pay for school fees of their children (Table 1).

### Respondents' social capital

The social capital in the current study encompasses the social resources upon which the people utilized for seeking their livelihood outcomes (Figure 1). These include networks and connectedness that increased trust and ability to cooperate in more formalized groups and in their systems of rules, norms and sanctions. Respondents were asked their opinions about whether they belonged to social networks in the study area. Of all the 98 respondents, 21 (43.6%) and 14 (29.2%) in Mbeya rural and in Mbozi districts respectively, indicated that they belonged to social networks. However, 29 (59.1%) and 39 (81.2%) in Mbeya rural and Mbozi districts, respectively, said that the social networks did not strengthen their pig production. In both districts, approximately two-thirds of the respondents (66%) reported that they were linked to pig traders who facilitated their pig business. However, 27 (56.3%) and 35 (72.8%) of the respondents in Mbeya rural and Mbozi districts, respectively, indicated that they were not satisfied with their linkage with the pig traders.

**Table 1.** Respondents' socio-economic characteristics in the Mbeya rural and Mbozi districts (N=98).

Variable	District				$\chi^2$ - value	p- value
	Mbeya (n=49)		Mbozi (n=49)			
	Yes	%	Yes	%		
<b>Gender</b>						
Male	29	59.2	23	46.9	1.475	0.225
Female	20	40.8	26	53.0		
<b>Respondents' education level</b>						
No formal schooling	6	12.2	1	2.0	7.584	0.055
Primary education	40	81.6	39	81.2		
Secondary education	3	6.1	6	12.2		
Post-secondary education	0	0.0	3	6.1		
Pigs are confined	43	89.6	42	87.5	0.089	0.766
Other occupations	45	93.6	45	93.6	0.000	1.00
Production of food crops for the family	49	100	49	100	2.042	0.153
Working on the farm	46	95.7	33	67.3	11.034	0.001**
Access to health services	33	67.3	45	93.6	9.046	0.003**
Funds for health services	41	85.3	42	87.5	0.079	0.779
Producing crops for pig feeds	14	29.2	5	10.2	5.288	0.021*
Children attend school	41	85.3	46	95.7	2.560	0.110
Funds for school fees	37	77.1	41	85.3	1.005	0.316

\*Statistically significant at  $p < 0.05$ ; \*\* Statistically significant at  $p < 0.01$ .

Respondents said that most of the pig traders were not to be trusted as they did not pay them on time. Most respondents in both districts, 95.7% indicated that they knew the local livestock extension agent to contact when faced with pig problems. Yet, 40 (81.6%) and 32 (65.3%) of the respondents in Mbeya rural and Mbozi districts, respectively, reported that they were not satisfied with their livestock extension agents' advisory and service delivery. In Mbeya rural and Mbozi districts, 41 (85.3%) and 45 (93.6%) of the respondents respectively, indicated that they knew the medical personnel in their areas and were satisfied with their medical services (Table 1).

### Respondents' natural capital

Natural capital means the natural resource stocks such as land, water, forests, air quality, erosion protection, biodiversity degree, rate of change, etc., which are useful for livelihoods (Chambers and Conway, 1992) (Figure 1). Study results showed that 36 (74.9%) and 49 (100.0%) of the respondents in Mbeya rural and in Mbozi districts respectively, indicated that they had access to water for household uses. Observation revealed that water was used to water crops and livestock, and for home use. Furthermore, 44 (89.8%) and 47 (95.9%) of the respondents in Mbeya rural and Mbozi districts respectively, reported that they had access to water for pig keeping, mainly used for drinking, cleaning and body

cooling. Overall, majority of the respondents (87.5%) said that water had positive influence in pig keeping. Also, of all the respondents, most, 40 (81.6) and 44 (89.8%) in Mbeya rural and Mbozi districts respectively, reported that they had access to land and kept pigs on their own farms. Similarly, most respondents in Mbeya rural (75.5%) and Mbozi districts (95.5%) claimed that there were no conflicts over land use in their areas.

### Respondents' physical capital

Physical capital comprises the basic infrastructure and producer goods needed to support livelihoods such as affordable transport, secure shelter and buildings, adequate water supply, sanitation, clean water, affordable energy, and access to information (Chambers and Conway, 1992) (Figure 1). Of all the 98 respondents, most, 45 (93.6%) and 47 (95.9%) in Mbeya rural and Mbozi districts respectively, indicated that gravel roads were close to their homes, which facilitated pig trading (Table 2). Of all the respondents, 47 (95.3%) and 46 (95.7%) in Mbeya rural and Mbozi districts respectively, reported that access to roads had an influence on pig keeping as they facilitated the availability of various services such as medications, agents, treatment, feeds, and transportation of pigs to the markets. Yet, 39 (79.6%) and 37 (75.7%) of the respondents in Mbeya rural and Mbozi districts respectively, indicated that they had no

**Table 2.** Parameters characterizing respondents' physical capital present in the Mbeya rural and Mbozi districts (N=98).

Variable	District				$\chi^2$ - value	p- value
	Mbeya (n=49)		Mbozi (n=49)			
	Yes	%	Yes	%		
Access to roads	45	93.6	47	91.8	12.028	0.001**
Gravel road	45	93.6	47	97.8	12.028	0.001**
Tarmac road	4	8.2	2	4.0	9.524	0.002**
Road passable throughout the year	47	97.9	37	75.5	8.333	0.004**
Roads positively influence pig keeping	47	97.8	46	95.9	0.211	0.646
Access to electricity	10	20.8	12.5	24.9	0.234	0.628
Possession of a mobile phone	35	71.4	31	63.2	0.742	0.389
Possession of a radio	36	74.9	38	77.5	0.221	0.638
Possession of a television	6	25.5	11	44.9	1.779	0.182
Possession of a bicycle	26	53.0	23	47.9	0.367	0.544
Possession of a motorcycle	0	0.0	8	16.3	8.711	0.003
Possession of a car	1	2.0	3	6.3	1.043	0.307
House with corrugated iron sheet roof	46	95.7	39	81.2	4.346	0.037
House with cement floor	25	51.0	28	57.1	0.370	0.543
Pig manure used to improve soil fertility	42	87.5	47	97.8	3.059	0.080
Fertilizers used to improve soil fertility	38	77.5	43	89.6	0.445	0.505
Household latrine	49	100.0	49	100.0	1.010	0.315
Latrine cleaned daily	36	74.9	28	528.6	2.882	0.090
Purchased furniture for the household	46	95.7	48	97.9	1.043	0.307
Purchased utensils for the household	48	97.9	48	97.9	0.000	1.000
Sufficient for the household in 2010	38	77.5	39	81.2	0.061	0.806
Housing for pigs	43	89.6	36	73.4	3.199	0.074
Cleaning pig housing daily	26	53.0	13	26.5	28.698	0.007**
Mobile phone used to talk to pig buyers	22	44.9	35	71.4	7.087	0.008**
Pig house roofs has corrugated iron sheets	28	57.1	17	34.7	5.518	0.019*

\*Statistically significant at  $p < 0.05$ ; \*\*Statistically significant at  $p < 0.01$ .

electricity in their homes, and only 10 (20.8%) and 12 (24.5%) respectively agreed to having electricity.

Further, of the 98 respondents, 35 (71.4%) and 31 (63.2%) in Mbeya and Mbozi districts respectively, indicated that they had mobile phones. For instance, the study findings showed that 22 (44.9%) and 35 (71.4%) of the respondents in Mbeya rural and Mbozi districts respectively, reported that they used mobile phones to communicate with pig buyers (Table 2). Still, 36 (73.4%) and 38 (77.5%) in Mbeya rural and Mbozi districts respectively, reported that they owned radios, which they used, among other things, to get news about pig keeping (Table 2). Also, the study results showed that most, 43 (89.6%) and 38 (77.5%), of the respondents in Mbeya rural and Mbozi districts respectively, indicated they did not possess television sets, while six (12.2%) and 11 (22.4%) respectively, said they had television sets. Observation showed that having television sets in the homes was related to having electricity, which few (17%) respondents had. Yet, of all the respondents, few, 26 (53.0%) and 23 (47.9%) in Mbeya and Mbozi districts

respectively, mentioned that they possessed bicycles. Also, all the respondents in Mbeya district indicated to not having motorcycles, while eight (16.3%) in Mbozi district possessed motorcycles. Further, 1 (2.0%) and 3 (6.1%) of the respondents in Mbeya rural and Mbozi districts respectively had possessed cars.

Of the 98 respondents, 46 (95.7%) and 39 (81.2%) in Mbeya rural and Mbozi districts respectively, reported that their houses were roofed with corrugated iron sheets, which was a good indicator of improved livelihood. Observation showed that house quality in the study areas differed depending on materials used and wealth of individuals. Most houses were built using burnt bricks and soil mortar, while few had cement bricks and hatched by corrugated iron sheets. Further, of all the respondents, over half, 25 (51.0%) and 28 (57.1%) in Mbeya rural and Mbozi districts respectively, indicated that their house floors were concrete, and house windows were fitted with steel bars.

Also, of the 98 respondents, most, 42 (87.5%) and 47 (95.9%) in Mbeya rural and Mbozi districts respectively,

reported that they used pig manure to improve soil fertility. All the 98 respondents in the study areas indicated that they had latrines for family use in their homes, which were located about 15 m away from their living houses. Few of the respondents (10%) had self-contained toilets inside their houses. Observation showed that each household had a pit latrine. Some of the pit latrines were built by burned bricks, thatched with grass while others were built using tree logs and thatched with grass. Study results showed that few, 36 (73.4%) and 28 (57.1%) of the respondents in Mbeya rural and Mbozi districts respectively, reported that they cleaned their latrines daily. Observation showed that some respondents were seen cleaning their pit latrines before the interview although they did not know that they would be asked about having latrines. Of all respondents, 46 (95.7%) and 48 (97.9%) in Mbeya and Mbozi districts respectively reported that they had purchased furniture for home use (Table 2).

Observation showed that more than two-thirds of the households surveyed had furniture like chairs, cupboards, stools, bookshelves, and tables of different designs according to one's interest and wealth. Also, of all the respondents, less than half, 38 (77.5%) and 39 (81.2%) in Mbeya rural and Mbozi districts respectively, mentioned that they produced enough food for their families in the 2010 crop growing season. However, study findings showed that few, eight (16.3%) of the respondents each in Mbeya rural and Mbozi districts respectively, mentioned that they had tap water in their homes. Of all the respondents, 35 (71.4%) and 40 (81.6%) in Mbeya rural and Mbozi districts respectively, indicated that they drew water for home use and pigs from the rivers.

Observation revealed that respondents drew water from the rivers located about two kilometres away from their homes because tap water did not flow regularly (Table 2).

Further, of the 98 respondents, 43 (89.6%) and 36 (73.4%) in Mbeya rural and Mbozi district respectively, reported that they had built pig houses. Of those indicating to having built pig houses, few, 12 (25.5%) and 18 (36.7%) in Mbeya rural and Mbozi districts respectively, reported that their pig houses had cement floors (Plates 2 and 3). Observation showed that pigs were either kept on clean cement floors, muddy floors or on timber off-cuts slatted floors (*mabanzi*) (Plates 3 and 4).

Further, of all the respondents, 7 (14.3%) and 17 (34.7%) in Mbeya rural and Mbozi districts respectively, reported that their pig houses had roofs thatched with corrugated iron sheets. The rest were grass thatched. Observation showed that more than three-quarters of the surveyed households had pig houses built of timber off-cuts (*mabanzi*) thatched with either grass or corrugated iron sheets, and had cemented floors provided with feed and water troughs.

## Respondents' financial capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives and it comprises cash or its equivalent that enables people to adopt different livelihood strategies (Chambers and Conway, 1992) (Figure 1). Two main sources of financial capital can be identified as: (i) available stocks comprising cash, bank deposits or liquid assets such as livestock; and (ii) regular inflows of money comprising labor income, pensions, or other transfers from the state, and remittances, which are mostly dependent on others and need to be reliable. Of all the 98 respondents, less than half, 40 (81.6%) and 45 (93.6%) in Mbeya rural and in Mbozi districts respectively, reported that pig keeping was their main source of household income. Yet, few of all the respondents, 10 (20.4%) and 14 (28.6%) in Mbeya and Mbozi districts respectively, reported that they had bank accounts.

However, of the respondents with bank accounts, six (12.2%) and eight (16.3%) in Mbeya rural and Mbozi districts respectively, indicated that they got loans from the banks.

Still, of all the respondents, 19 (38.8%) and five (10.2%) in Mbeya rural and Mbozi district respectively, reported that they had ready markets for their pigs. But, observation showed that pig traders were seen going around in the study areas looking for pigs to buy. But prices that pig traders wanted paid to pig farmers were too low, hence deterring most of them to sell their pigs. Of all the respondents, most, 45 (93.6%) each in Mbeya rural and Mbozi districts indicated that they preferred to sell live pigs to pig traders.

Yet, few respondents, four (8.2%) each in Mbeya rural and Mbozi districts mentioned that they preferred to slaughter their pigs and sell pork. Of the 98 respondents, most, 46 (95.7%) and 45 (93.6%) in Mbeya rural and in Mbozi districts respectively, reported that they got profits from keeping pigs and derived benefits. Most reported that they used money earned to build living houses, improve pig houses, pay for children's school fees, buy pig inputs, food and clothes for the family, and agricultural inputs for crop farming.

## Challenges of keeping pigs

The respondents in both districts indicated that they faced several problems which limited the profitability of keeping pigs. Of all the respondents, each in Mbeya rural and Mbozi districts, 36 (73.4%) indicated that pig diseases had a negative influence on pig keeping, whereas 14 (28.6%) in each district mentioned poor transportation.

Poor livestock extension agents' advisory and service delivery and insufficient cash were reported by 29 (59.1%) and 20 (41.6%) of the respondents in Mbeya rural and Mbozi districts, respectively.

## DISCUSSION

Pig keeping by smallholder farmers in rural areas of Mbeya rural and Mbozi districts is an important sector that contributes to people's livelihood, food production and income generation. Of the 5.8 million agricultural households in Tanzania, about 40% of them keep livestock, which include cattle, goats, poultry, pigs, and the latter have in the last two decades increased due to stimulated growth in pork consumption, especially in urban areas. In Tanzania, most pigs are kept in high altitude areas where the human population density is high and the land is of high agricultural potential. Most pigs are produced within the traditional smallholder farming systems involving over 500,000 rural smallholder household (URT, 2012). Pig production can reduce rural poverty as in these households it is primarily a market-oriented activity with 95-99% of the pigs being sold.

The need for improving sustainable pig production, consumption, and public health in Tanzania is greatly needed. However, basic information on the characteristics of smallholder pig production systems in Tanzania, and their livelihoods indices are inadequate, which are prime key indicators for developing the sector. This study, therefore, sets out to investigate livelihoods of smallholder pig keepers in Mbeya rural and Mbozi rural districts in Mbeya region. A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living (Chambers and Conway, 1992). A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Carney et al., 1999). Livelihood is the activities, the assets, and the access that jointly determine the living gained by an individual or household, which this study investigated.

This study has confirmed that pig keeping has brought social and economic benefits. The study has shown that farmers' livelihood are diverse and are determined by their portfolio of assets, including social, human, financial, natural and physical capital. The indicators include improved social status, house construction, child education, affording to pay for health services and formation of social networks. The study has also shown that farmers had broadly improved their standards of living and purchasing power. Most respondents agreed that as a result of pig keeping, their food and pig consumption had increased. This study too has found that "factors such as accessibility and use of capital (cash), land (farm size per household), struggling against seasonal food insecurity, response to market forces and off-farm opportunities are the major influencing factors on agro-diversity status in the agro-ecological zones which in turn affect farmers' livelihood" (Mwalukasa et al., 2000). Further, this study has shown that the resource poor farmers possess or have access to and use assets

to gain a livelihood, but it takes a range of tangible and intangible assets/capital necessary to build a livelihood.

Farmers have benefited from greater cash income and indicated to continue keeping pigs in the future. Also, the study showed that water, land, roads, people's living houses, pig houses, pig feeds, bicycles, motorcycles and social networks were important aspects that influenced smallholder farmers' livelihoods keeping pigs in the study areas. However, pig keeping was limited by lack of technical knowledge, prevalence of diseases, particularly the African swine fever, high cost of feeds, inefficient livestock extension agents' advisory and service delivery, poor pig housing, poor transportation and lack of loans. Lastly, the study revealed that respondents did not keep pig records.

## Conclusion

This study has used the smallholder pig keepers' livelihood framework to understand the opportunities and challenges to pig production in rural areas. Specifically, the study assessed the livelihoods of smallholder pig farmers in relation to each of the five capitals: human capital, social capital, natural capital, physical capital, and financial capital. District livestock development departments should consider these opportunities and challenges for improving smallholder pig keeping in the district and the country at large. These should include educating pig keepers on improved pig husbandry. For example, it was observed that most of the pig keepers had no records of the activities that they carried out in pig keeping, hence little was known. Records are needed on pig investment: housing, feeding, and treatment.

Livestock extension agents should educate pig keepers to build good pig houses, control pig endo- and ecto-parasites and diseases so that farmers produce healthy pigs that can fetch high prices in the markets. Livestock extension agents should assist smallholder pig keepers to form producer associations so that they can produce quality pigs and counteract the little prices received from the pig traders. The studied district councils should improve rural infrastructure for farmers to access pig inputs and markets. Further, this study found that few respondents had bank accounts and were unable to get loans from the banks. This is a general anomaly in Tanzania as most smallholder farmers cannot produce credible collaterals to get bank loans. It is, therefore necessary for the studied district development officials to liaise with rural financing institutions in the districts so that smallholder farmers can easily access credits and improve their financial capital for increasing pig production for improving their livelihoods holistically.

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## REFERENCES

- Carney D, Drinkwater M, Rusinow T, Neejes K, Wanmali S, Singh N (1999). Approaches compared. London. Retrieved from: <http://www.livelihoods.org/info/docs/lacv3.pdf>.
- Chambers R, Conway GR (1992). Sustainable Rural Livelihoods: Practical concepts for the 21<sup>st</sup> century. IDS Discussion Paper No. 296. IDS, Brighton. P. 29.
- Cheng H, Wang Y, Meng Q, Guo J, Wang Y (2011). Pork production system and its development in mainland China. *Int. J. Fish. Aqua.*, 3(5): 166-174.
- Delgado C L, Rosegrant M, Steinfeld H, Ehui S, Courbois C (1999). Livestock to 2020: The next food revolution. Food, Agriculture and the Environment Discussion Paper No. 28. IFPRI, FAO and ILRI. P. 83.
- FAOSTAT (2012). FAO statistical databases. Retrieved from: <http://faostat3.fao.org/home/index.html>.
- Food and Agriculture Organization (FAO) (2005). Livestock brief. United Republic of Tanzania. Livestock Information Sector Analysis and Policy Branch. AGAL, FAO. Retrieved from: <http://www.faostat.external.fao.org/default.jsp>.
- Food and Agriculture Organization (FAO) (2012). Pig sector in Kenya. FAO Animal Production and Health Livestock Country Reviews. No. 3. FAO, Rome. Retrieved from: <http://www.fao.org/docrep/015/i2566e/i2566e00.pdf>.
- Lemke U, Kaufmann B, Thuy LT, Emrich K, Valle-Zárate A (2006). Evaluation of smallholder pig production systems in North Vietnam: Pig production management and pig performances. *Livestock Sci.*, 105(1): 229-243.
- Mutua FK, Randolph TF, Kitala P, Githigia SM, Willingham AL, Njeruh FM (2007). Palpable lingual cysts: A possible indicator of porcine cysticercosis in Teso District, Western Kenya. *J. Swine Health Prod.*, 15: 206-212.
- Mwalukasa E E, Kaihura F B S, Kahembe E (2000). Socio-economic factors influencing small scale farmers livelihood and agrobiodiversity. Retrieved from: <http://www.unu.edu/env/plec/clusters>.
- Phiri IK, Ngowi H, Afonso SMS, Matenga E, Boa M, Mukaratirwa S, Githigia SM, Saimo MK, Sikasuge CS, Maingi N, Lubega GW, Kassuku A, Michael LM, Siziya S, Krecek RC, Noormahomed E, Vilhena M, Dorny P, Willingham AL (2003). The emergence of *Taenia solium* cysticercosis in Eastern and Southern Africa as a serious agricultural problem and public health risk, *Acta Tropica*, 87: 13–23.
- Riedel S, Schiborra A, Huelsebusch C, Huanming M, Schlecht E (2012). Opportunities and challenges for smallholder pig production systems in a mountainous region of Xishuangbanna, Yunnan Province, China. *Trop. Ann. Health Prod.*, 44: 1971–1980
- United Republic of Tanzania (URT) (2002). Population and Housing Census: Mbeya regional profile, Bureau of Statistics and Planning Commission, Dar es Salaam. Retrieved from: <http://www.odi.org.uk/resources/docs/3341.pdf>.
- United Republic of Tanzania (URT) (2003). The 2002 Population and Housing Census. General report. National Bureau of Statistics. Government Printers, Dar es Salaam, Tanzania. P. 203.
- United Republic of Tanzania (URT) (2012). National Sample Census of Agriculture, Smallholder Agriculture 2007/2008. Volume III: Livestock Sector–National Report. Ministry of Agriculture, Food Security and Cooperatives and Ministry of Livestock Development and Fisheries. National Bureau of Statistics and Planning Commission, Dar es Salaam, p. 187.
- Yamane T (1967). *Statistics: An introductory analysis*. Harper and Row, New York. p. 919.