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Swedish University of Agricultural Sciences

Faculty of Veterinary Medicine and Animal Science
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Socioeconomic impact of infectious animal diseases in smallholder settings in low-income countries

Focussing on African swine fever in Uganda

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Socioeconomic impact of infectious animal diseases in smallholder settings in low-income countries – Focussing on African swine fever in Uganda

Smittsamma djursjukdomars socioekonomiska betydelse i småskalig djurproduktion i låginkomstländer – Med fokus på afrikansk svinpest i Uganda

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SUMMARY

Smallholder farmers in low-income countries face a number of challenges in animal production. Animal husbandry carries great potential in reducing poverty, hunger and gender inequality, but at the same time infectious diseases are prominent threats to farmers' livelihoods and their animals. The objective of this study was to investigate the socioeconomic impact of infectious animal diseases on smallholder farmers in low-income countries, using African swine fever (ASF) in Uganda as an example.

The study was conducted in two parts. The first part of the study was questionnaire-based and performed in Gulu district, northern Uganda. In total, 198 households from all the 12 sub-counties in Gulu district were visited. The second part of the study was conducted using interviews and evaluation of available data, collected from an outbreak of ASF at Adina farm, Lira district, Uganda. To assess the socioeconomic impact in the two different parts, and compare the findings in this study to those of others, a literature review was performed focussing on the social and economic impact on smallholder farmers in low-income countries, and on ASF.

This study concludes that ASF is a major challenge for smallholders and larger farms alike.

SAMMANFATTNING

Småskalig djurproduktion i låginkomstländer möter ständiga utmaningar men innehar också stor potential för att minska fattigdom, svält och ojämställdhet. Infektiösa djursjukdomar hotar djurhållningen och gör att djurproduktionens fulla potential inte kan utnyttjas. Syftet med den här studien var att undersöka den socioekonomiska påverkan av infektiösa djursjukdomar i låginkomstländer med afrikansk svinpest i Uganda som ett exempel.

Studien utfördes som två delstudier. Första delen var en frågeformulärsbaserad hushållsstudie som genomfördes i distriktet Gulu i norra Uganda. Totalt besöktes 198 hushåll från alla delar av distriktet. Den andra delstudien baserades på intervjuer och tillgänglig data från ett utbrott av afrikansk svinpest på en större gård i Lira, Uganda. En litteraturstudie genomfördes för att kunna jämföra den här studiens resultat med andra studier inom ämnet.

Den här studiens slutsats är att afrikansk svinpest utgör en omfattande utmaning för småskaliga såväl som storskaliga djurproducenter i låginkomstländer.

CONTENT

INTRODUCTION

Animal husbandry has great potential in reducing poverty, hunger and gender inequality in rural areas in low-income countries. Smallholder farmers in low-income countries are constantly challenged by animal diseases in their livestock production. This makes it very difficult for the smallholder farmers to access the full potential of their livestock (Perry and Sones, 2007; Ouma *et al*., 2014).

African swine fever (ASF) is a disease with severe socioeconomic consequences, especially for smallholder pig farmers. This is because of its extremely high morbidity and mortality in domestic pigs. ASF is a viral haemorrhagic disease, caused by the African swine fever virus (ASFV), an enveloped DNA virus. When the virus infects domestic pigs and wild boars it causes severe symptoms and typically acute to peracute death. The different species of African wild pigs are non-symptomatic when infected with ASFV. There is a sylvatic cycle between soft ticks and warthogs which contributes to the disease being endemic in many countries in sub-Saharan Africa (Costard *et al*., 2013). The disease can be transmitted from ticks to domestic swine. This in turn, leads to a transmission cycle between domestic pigs. The main mechanism of spread in the domestic cycle is via pig to pig contact.

In Uganda, ASF is endemic and the sylvatic cycle is present (Atuhaire *et al.,* 2013). The domestic pig population is growing and has the potential of improving the livelihood of many Ugandans. ASF is a difficult challenge for the pig farmers, since the disease is highly contagious and has severe consequences.

The general objective of this study was to investigate the socioeconomic impact of animal diseases on smallholder farmers. More specifically it aimed to study the situation of smallholder pig farmers in northern Uganda, where ASF is a constant threat to the pig production. Another aim was to study the impact of an ASF outbreak in a larger pig farm in Lira, northern Uganda. The study, consisting of two parts, was performed as a minor field study (MFS) funded by the Swedish International Development Cooperation Agency (Sida) and the Elsa Paulsson memorial fund. The study was performed in association with a long-term collaborative project on ASF in Uganda. The collaborators are the Swedish University of Agricultural Sciences (SLU), Swedish National Veterinary Institute (SVA), Makerere University, Kampala, and the International Livestock Research Institute (ILRI).

LITERATURE REVIEW

Livestock and poverty

Approximately 70% of the world's poor in rural areas rely on livestock as part of their income (Ashley *et al*., 1999). Livestock is also one of few capital assets of poor households; therefore, they can be very important in times of great need (Webb *et al*., 1992). The main use of livestock in rural areas in low-income countries is as a commodity which can generate cash income to cover expenses such as school fees and medical bills (Bellemare and Barrett, 2006).

Understanding the complex roles of livestock in the livelihood and nutrition of the farmers is needed in order to properly take advantage of the potential of livestock in reducing poverty (Randolph *et al*., 2007). Targeting women to improve livestock husbandry could increase both production and availability of animal products on a community level. This in turn can help in reducing poverty and enhancing economic growth. Involvement of women in the decision-making concerning livestock and the income generated can improve family welfare and reduce both poverty and hunger (Waters-Bayer and Letty, 2010; Ouma *et al*., 2014).

The characteristics of smallholder livestock farmers in sub-Saharan Africa

Smallholder livestock farmers consider animal diseases, lack of feed and high cost of feed to be the most important obstacles in their animal husbandry. The households mainly keep the livestock as an asset and for cash income, making it an important part of their livelihood, even though each household usually only owns a few animals (Kagira *et al., 2010;* Maass *et al*., 2012).

Maass et al. (2012) found in a study in DR Congo that many of the smallholder households kept several types of livestock. Selling of livestock mainly took place when the households were in need of cash, for example to pay school fees. Because of this, the livestock prices were lower around the start of the school year as many farmers sold their livestock at that time. Some farmers reported that swine gave higher and faster returns than goats, which the authors interpret as an incentive to keep swine despite the threat of diseases such as ASF. (Maass *et al*., 2012)

Kagira et al. (2010) found in a study in Kenya that smallholder pig farmers kept their pigs primarily as a source of income rather than for household consumption. The pigs were mainly kept tethered or in a mixed system with tethering and free-range combined. Only two percent were permanently kept confined. Thirty-six percent of the farms provided some type shelter, most with mud floors. (Kagira *et al*., 2010)

The impact of animal diseases on smallholder production in low-income countries

Livestock diseases have widespread effects in low-income countries since livestock often have a variety of both commercial and non-commercial roles (Rich and Perry, 2011). Livestock diseases limit the possible reduction of poverty that livestock could represent for smallholder farmers (Perry and Sones, 2007).

The complexity of the impact of animal diseases, particularly in endemic countries, should be the focus when assessing the losses caused by a disease (Knight-Jones and Rushton, 2013). The timing of outbreaks could affect the level of impact of a particular disease, as it could potentially interfere with critical crop-farming activities. For example, it could coincide with planting or harvesting (Perry *et al*., 2002). Delayed access to cash because of an outbreak may have severe consequences for the individual households (Perry *et al*., 2012).

The wide-spread and ongoing losses due to Foot and Mouth Disease (FMD) in endemic countries hinders the development of the livestock sector (Knight-Jones and Rushton, 2013). Nampanya *et al.* (2013) found that for large ruminant smallholder farmers in Northern Laos, sales of large ruminants contributed up to 25% of the households' total income. They also reported a 16-60% loss of annual income for the households after a FMD outbreak. This confirms that FMD causes substantial losses to the smallholder farmers, although the possible indirect costs could make the losses greater (Nampanya *et al*. 2013). The most visible direct losses due to FMD in Ethiopia were loss of draught power, decreased milk production, and losses due to mortality (Jemberu *et al*. 2014).

The weight loss caused by FMD on smallholder farmers' cattle in Southern Cambodia was 23.8%, ranging from 11.1% to 42.9%. The value of the cattle was estimated to have decreased with between 54% and 92%. Especially, if draught animals contracted the disease, it increased this loss since the farmers needed to hire draught power. (Young *et al*., 2013)

Haemorrhagic septicaemia, a disease on mainly buffalo and cattle caused by specific strains of *Pasteurella multocida,* has been shown to have severe consequences for the affected smallholder households. An example of this, from a study in Cambodia, was that the mean number of cattle decreased from 5.0 to 3.6 after an outbreak of haemorrhagic septicaemia in cattle, another example was that the farmers experienced loss of income from secondary employment. The disease may cause a severe financial shock as well as an increased amount of labour associated with the livestock. This, in turn, has both direct and indirect consequences, such as children missing school and the crop farming being neglected. (Kawasaki *et al*., 2013)

After an outbreak of avian influenza in small-scale production in Indonesia the poultry raising decreased with 30% on average, ranging from 7% to 93%. Some farmers had to change their field of business due to the outbreak; many changed their occupation to non-agricultural. The non-infected farms in the areas with outbreaks recovered faster after the outbreak but were indirectly affected, for example by lower income from sales. The amount of money spent on education decreased in both infected and non-infected farms. Depending on the type of production—broiler or layer farm—the source of losses were different. Both for infected broiler and layer farms, the losses were mainly because of mortality, whereas the non-infected broiler farms experienced losses due to a decreased market price. In layer farms, the losses in non-infected farms were due to decreased egg prices, higher operational costs due to the outbreak, and decreased production because of stress during vaccination. Due to the outbreak,

the rural economy was damaged, and the social capital of the villagers was reduced. Other social relationships and organisations remained relatively unchanged. (Basuno *et al*., 2010)

African swine fever

African swine fever is a viral haemorrhagic swine disease caused by African swine fever virus (ASFV), an enveloped DNA virus and member of the *Asfarviridae* family, genus *Asfivirus*. The disease is considered to be a serious threat to the pig industry because of its up to 100% morbidity, and up to 100% mortality in the acute and peracute form. Transmission occurs via direct or indirect contact with any excretion or secretion. When the virus infects domestic pigs and wild boars it causes severe symptoms and typically acute to per acute death. The different species of African wild pigs are non-symptomatic when infected with ASFV. In the original setting, in absence of domestic pigs, virus transmission occurs via a sylvatic cycle involving soft ticks (*Ornitodoros moubata*) and warthogs (*Phacochoerus africanus*). The disease can be transmitted from ticks to domestic swine. This in turn, leads to a transmission cycle between domestic pigs. The main mechanism of spread in the domestic cycle is via pig to pig contact. (Penrith and Vosloo, 2009; Costard *et al.*, 2013; Penrith *et al.*, 2013)

The disease is endemic in many sub-Saharan countries, including Uganda (Gallardo *et al*., 2011; Atuhaire *et al*., 2013). Spread to the Caucasus and the Russian federation has been a fact for several years (Beltrán-Alcrudo *et al*., 2008; Beltrán-Alcrudo *et al*., 2009). Recently, in 2014, ASF has been introduced in the European Union (EU) and has spread to all the Baltic states and Poland (ProMEDmail, 2014). Since the domestic pig and the wild boar infected with ASFV develop clinical signs similar to those of other haemorrhagic diseases, such as classical swine fever and erysipelas, laboratory confirmation is required to differentiate them (Sánchez-Vizcaíno *et al*., 2012; Costard *et al*., 2013). There is no vaccine against ASF available (Penrith and Vosloo, 2009; OIE, 2010).

Uganda and pig production

The current human population of Uganda is 34.9 million, according to the 2014 census (UBOS, 2014). 24.5% of the people live below the national poverty line, whilst 37.9% live on less than 1.25 USD a day (Worldbank, 2009). Between September 2009 and August 2010, 48% of the Ugandans were deficient in food energy according to the World Food Program's (WFP, 2013) Comprehensive Food Security and Vulnerability Analysis of Uganda (2013). In Northern Uganda 59% of the people were food insecure, meaning that they have limited access to food that meets their dietary needs, which is consistent with rural areas having a higher percentage of food insecurity (WFP, 2013).

In the 2008 national livestock census (UBOS, 2008), Uganda had 3.2 million pigs. Previously, the pig population has shown a ten percent annual increase (Phiri *et al*., 2003). In Uganda smallholders normally keep their pigs in free-range management systems, while during cropping season they keep them tethered to a higher degree. Other smallholder farmers practiced confinement during part of the day, and others had their pigs confined at all times. (Ouma *et al*., 2014)

FIELD STUDIES

The field work for this study was conducted in northern Uganda in October 2014. The main part of the study was performed as a questionnaire-based household study in Gulu district. The second part was interview-based, performed at Adina farm and Adina foundation in Lira.

Objectives

The objectives of this project were:

- To investigate the socioeconomic impact of ASF on smallholder pig farmers
- To study the economic impact and the social consequences of an ASF outbreak on a larger pig farm
- To gain insight in animal husbandry and veterinary practice in a low-income country

Materials and methods

This study was performed September – November 2014 and consisted of two parts. Part one was questionnaire-based and included 198 households in Gulu District, Uganda. Part two was a descriptive case study of an ASF outbreak based on data from an outbreak in a larger pig farm in Lira, Uganda, as well as in-depth interviews with the financial manager. The data collection was made together with Caroline Bössfall, a fellow veterinary student and MFS scholar. The two studies complement each other as Caroline's study focuses on smallholder farmers' attitudes to biosecurity.

Part One – Gulu

Study area

This part of the study took place in Gulu district, northern Uganda, as part of a more long-term collaborative project on ASF between Swedish and Ugandan researchers from Makerere University, Uganda, SVA and SLU. The human population of Gulu district is approximately 444,000, with the main town being Gulu municipality, which is also the most densely populated place in the district (National Population and Housing Census, 2014). In Gulu district more than half of the rural population lives below the national poverty line (WRI, 2005). The insurgency that took place in Gulu from 1986 to 2007 is a probable contributor to the current situation with a high poverty rate. For more than 20 years, the government fought the rebel group Lord's resistance army (LRA), and for more than ten years, a majority of the rural population was relocated to camps. (Branch, 2013)

Study design

This study consisted of questionnaire-based interviews, performed at household level. The questionnaire used was developed in collaboration with ILRI. The questionnaire consisted of 70 questions, mostly closed questions. Some of the questions were statements, where the respondents' level of agreement was given as the answer, while other questions were of multiple-choice type. The focus of the questionnaire was mapping of the households' pig-related activities, economic situation and attitudes towards biosecurity and pig production. The interviews were performed in the local language (Luo) by two staff members from the local district veterinary office (DVO), specially trained in interview techniques and

participatory methods. The interviews were conducted in 30-60 minutes, with a few exceptions. The 198 households included were randomly selected from a sampling frame containing 4,000 pig-keeping households from all 12 rural sub-counties, with the addition of one urban subdivision of Gulu Town. The sampling frame had already been created by using local informants, so called Community Knowledge Workers (CKWs), as part of previous research activities within the long-term project. All villages were visited by CKWs in the included parishes, with the aim of interviewing up to 20 pig-keeping households in each village. The households in the study had already been visited within the earlier mentioned long-term project approximately six months ago. The questionnaire used at the two visits were similar, with some additions made prior to the second visit.
To find the location of each household, a previously established network of local informants (CKWs) was used. The people in the network were also supposed to have mobilised the respondents, so that they were aware of the upcoming visit. The person interviewed was always someone with sufficient knowledge of the household to give reliable answers to the questions, preferably the same person who had been interviewed six months earlier, in most cases the household head. If someone other than the household head had been interviewed and this person was not present at the time of visit, the household head was chosen for the second interview. The pictures show typical settings for the interviews (Figure 1.).

For the complete questionnaire used for Part one, see Appendix one.

Figure 1 a,b. *Typical rural settings for the interviews, in a questionnaire-based study at household level, performed in the Gulu area between September and October 2014. Personal photos, Gulu, Uganda, 2014.*

Data compiling and analysis

The data was recorded on paper-copies of the questionnaire. As soon as possible after each interview, data was entered in the internet-based tool EasyResearch, provided by QuestBack (QuestBack Sweden AB). The data was processed and visualised using descriptive statistics in Microsoft Excel. The parameters to analyse were chosen based on the objectives of the project. RStudio, version 0.98.1062 (RStudio Inc.), was used to conduct the statistical analysis and for assembling tables. The methods used for evaluating the data were correlation tests and chi-square tests through the commands "*cor.test"* and "*chisq.test*". Other commands used were "*table*" and "*subset*" to organise the data in RStudio. The P-values regarded as significant was ≤ 0.05.

Part Two – Adina Farm

Study population

Adina foundation, a Norwegian non-governmental organisation, runs the Lira rehabilitation centre since 2010, with the purpose of improving conditions for children with disabilities in northern Uganda. In 2012, they rehabilitated 94 children at the centre, and this number increases every year. They also run additional projects in the community and offer educational and psychosocial support.

Figure 2 a,b. *Photos included in a case-study of an African swine fever outbreak performed in October 2014. 2a) Adina farm from outside, with the main pig house on the left and outdoor pens on the right. 2b) The interior of one of the stalls in the main pig house. 2a) Photo: Erika Chenais, 2b) Personal Photo*

In connection to Lira rehabilitation centre, the construction of Adina farm was started to create a profit that would support the centre. The aim of the enterprise was to sell both piglets and pork. The building was finished in 2013 and at the start of 2014, the farm had 150 pigs. About one month later they started selling their first animals. The pigs were kept in a purpose-built, fenced compound with 13 pens, see Figure 2a and b, and additional buildings for office, storage and guards. The goal of Adina farm for 2014 was to sell pork from 200 slaughtered pigs. The slaughter took place inside the compound, but the facilities were not intended for

this originally. Due to the possibility of gaining more profit and meat of better quality, the staff were trained in slaughtering by Norwegian butchers.

In March 2014 Adina farm was hit by an outbreak of ASF, which was laboratory confirmed. At the start of the outbreak, the farm had 35 adult pigs and 103 piglets and growers, all of exotic breed. Twenty-four of these were soon ready to be slaughtered and most of the sows and grown boars were supposed to be kept for breeding. This enclosed population of exotic breed pigs was chosen for the study because of this recent outbreak of ASF. The dynamics of the spread of the disease as well as socioeconomic impact could potentially be studied on a herd level.

Study design

The study was carried out as a case study based on retrospective data and complementary in-depth interviews. The data consisted of documentation from Adina foundation concerning the ASF outbreak, and information gathered on three previous visits by representatives from Gulu DVO and SVA/SLU made during the ongoing outbreak. The information available was, however, not complete, as no formal production data registration was done at the farm.
The situation and the social impact was assessed by email correspondence followed by interviews on 21 September and 2 October 2014 with a spokesperson from Adina foundation. Interviews with ILRI representatives, Dr. Michel Dione and Dr. Emily Ouma, who had been involved in investigating the outbreak and possible ways forward were also included in the study.

Data compiling and analysis

All data collected was compiled in Microsoft Word. Calculations were made using Microsoft Excel.

Results

Part one - Gulu

Demographics

The smallholder farmers in Gulu district included in our study had an average of 7.1 household members with the largest household having 21 members. The households had an average of 3.3 children of school age, ranging from 0 to 13. Of the 198 households, 185 had children of school age. At the time of our visit, 79% of the households kept pigs, 50% kept cattle, and 81% kept goats. The primary source of income was crop farming for most of the respondents. Thirty-one percent of the households had off-farm income, the remaining 69% only had income from their farms. The median frequency of meat consumption was once per month, whereas 22% of the households consumed meat less often than monthly.

The households in the study had on average 3.4 pigs, ranging from 0 to 20. Forty-two households did not have pigs, of these, 50% had sold pigs during the past six months. The vast majority of the pigs were of local breed. The pigs were kept in three different housing

systems with the following distribution: free-range 45%, tethered 32%, and confined 23%. Twenty-three percent of the households who currently kept pigs practiced several housing systems. During the past six months 11.5% of the households had expanded their pig enterprise. Most of the households, 81%, had been able to pay all or most of their medical expenses. The past six months, 59 households had had one or more family gatherings planned (e.g. wedding, funeral, baptism). Thirty-one households (53%) had had to postpone one or all of their planned family gatherings due to lack of money.

As seen in table 1, 7.5% of the households had had an outbreak of ASF the past six months, making the estimated annual incidence 15%. Almost seventy percent of the households had sold pigs since the last visit.

Table 1 *Percentage of the households that the statements applied to the past six months, from a questionnaire-based interview study on smallholder pig farmers, conducted on household level. Gulu district, Uganda, October 2014.*

Statement	Number of households	Comments
The household (HH) had sold pigs	136 (69%)	
The household had had pigs that died from ASF	15 (7.5%)	
The HH had to sell assets due to losses in pig enterprise	49 (25%)	
The HH needed financial credit	68 (34%)	81.7% received the credit needed
The household had family gatherings planned	59 (30%)	Family gathering: e.g. funeral, baptism, wedding
The household had a family gathering planned that they were forced to postpone due to lack of money	31 (53%)	Of those that had a family gathering planned
The household had paid all needed school fees	79 (43%)	

Ability to pay school fees

In order to investigate the factors having impact on the ability of the households to pay school fees the households were grouped on whether they had been able to pay all school fees or not. As seen in table 2, there were no significant differences between the groups when tested with chi-square test. Nevertheless, it was possible to see a trend that a larger proportion of the households engaged in pig trading were able to pay all school fees than those that were not engaged in pig trading.

Table 2 *Results from chisquare tests with the groups below and whether the households had been able to pay all needed school fees. From a questionnaire-based household study in Gulu district, Uganda, October 2014.*

Variable	Category	Number of households in the group	Percentage of the group that could pay all school fees	P-value
Pigs that had died	Yes	85	41	0.74
	No	113	44	
Meat consumption	Less than monthly	42	40	0.86
	≥ monthly	149	43	
Off-farm income	Yes	61	39	0.18
	No	136	51	
Engaged in pig trading	Yes	86	51	0.09
	No	112	37	
Expansion in the pig enterprise	Yes	23	40	0.24
	No	175	45	
Had sold pigs	Yes	136	44	0.69
	No	61	40	
Sold assets due to losses in the pig enterprise	Yes	49	40	0.64
	No	141	45	
Had need of financial credit	Yes	68	48	0.41
	No	123	41	

Meat consumption

The households that had had off-farm income (N= 60) ate meat more often than those that did not have off-farm income (N=130) (p-value: 0.0002). See figure 3.

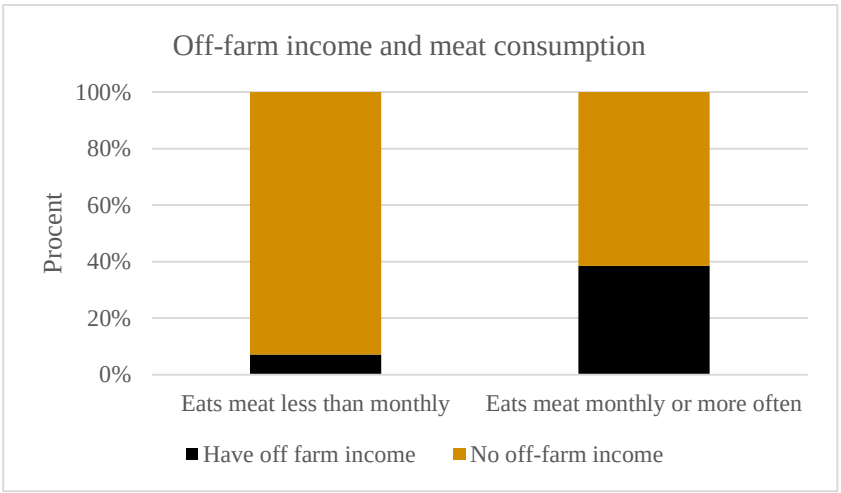

Figure 3 *Off-farm income and frequency of meat consumption from a questionnaire-based interview study on household level, Gulu district, Uganda, October 2014*

A larger percentage of the households that ate meat monthly or more often (N=149) had pigs that had died during the past six months, than those who ate meat less often (N=42), as shown in figure 4. There is a significant difference between the groups (p-value: 0.03). There was no significant difference in meat consumption frequency between the households who stated that they had pigs that had died from ASF and those that did not. If the household was involved in pig trading or not, did not significantly affect the frequency of meat consumption or vice versa.

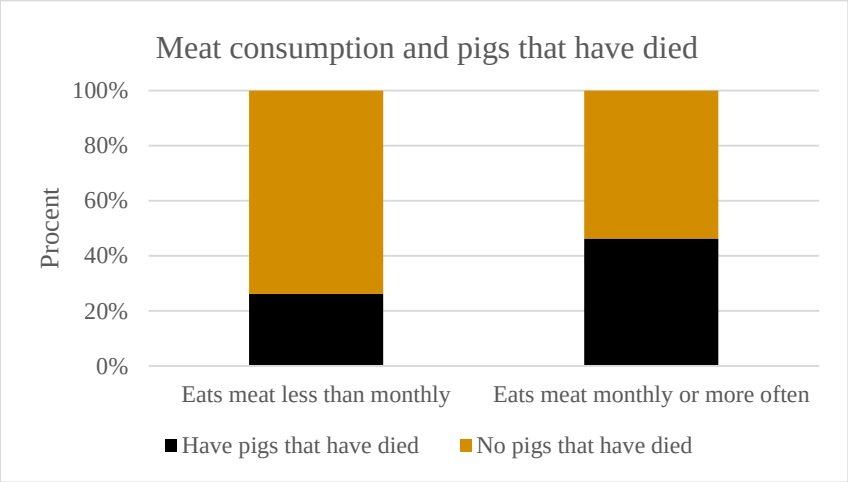

Figure 4. *Percentage of the households with pigs that had died the past six months, grouped depending on frequency of meat consumption. Data from a questionnaire-based interview study on household level, Gulu district, Uganda, October 2014*

The meat consumption frequency was also compared to a number of other questions than those referred to above. The results are shown in table 3.

Table 3 *The households had answered several questions regarding their pig enterprise and economy the past six months. These answers were compared with how often they ate meat (less than monthly or monthly and more often) using chi-square tests. From a questionnaire-based interview study on household level, Gulu district, Uganda, October 2014.*

Variable	Category	Ate meat less than monthly (Number of households)	Ate meat monthly or more often (Number of households)	P-value
Expansion in the pig enterprise	Yes	5	16	1
	No	37	133	1
Had sold pigs	Yes	3	101	0.84
	No	12	47	0.84
Had hired labour in the pig enterprise	Yes	0	4	0.64
	No	42	145	0.64
Family gatherings due to lack of money	Yes	3	28	0.47
	No	4	21	0.47
Had sold assets due to losses in the pig enterprise	Yes	13	36	0.39
	No	26	109	0.39
Need of financial credit	Yes	12	54	0.36
	No	30	89	0.36

Financial factors and attitudes towards pig farming and ASF

A larger percentage of the farmers with off-farm income had needed financial credit the past six months (p-value: 0.06). This is shown in Figure 5. If the household needed financial credit but did not get it, the household was more likely to have had to postpone a family gathering during the past six months (p-value: 0.012).

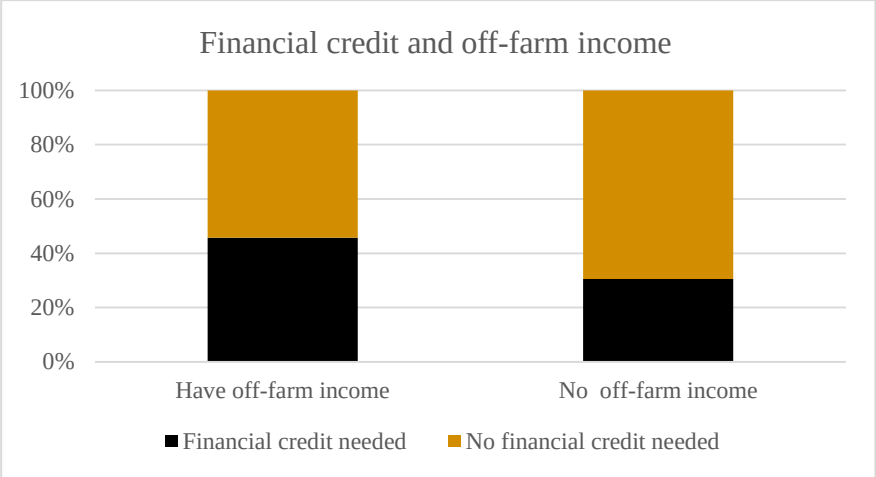

Figure 5. *Need of financial of the households with and without off-farm income. P-value when chisquare test was performed: 0.06. Based on data from a questionnaire based interview study on household level, October 2014, Gulu district, northern Uganda.*

When the households were sorted into groups depending on whether they had off-farm income (N= 61) or not (N=136) and then analysed with a chi-square test, for the following parameters, there was no significant difference between the groups: expansion, pig trading, sold assets, hired labour, family gatherings postponed. This was also the case when looking at whether the households had needed financial credit during the past six months (N= 68) or not (N=123), and the following parameters: postponed family gatherings, sold pigs, dead pigs, outbreak of ASF.

As seen in table 4, close to 60% of the respondents claimed not being able to afford any investment in their pig farming. Despite this, 85% of the households felt more optimistic concerning their pig enterprise. The majority, 126 (64%) of the respondents still had confidence in pig production. The majority, 152 (77%), of the respondents had not experienced an increased level of disputes for most of the time.

Table 4 *Level of agreement with the statements concerning the attitude of smallholder farmers to the prevention of African swine fever and pig farming. From a questionnaire-based interview study on household level. October 2014, Gulu, Uganda.*

Statement	Agree	Neither agree nor disagree	Disagree
ASF cannot be prevented	22 (12%)	40 (20%)	136 (68%)
I could adapt my pig farming in order to have pigs ready at specific times	67 (34%)	37 (19%)	94 (47%)
I can choose where/to whom I sell my pigs	121 (62%)	32 (16.5%)	43 (21.5%)
I cannot afford to invest in my pig farming	116 (58%)	58 (29%)	24 (12%)

Part two – Adina farm

ASF outbreak in March 2014

The outbreak of ASF started on 7 March 2014, with one boar that died after having shown clinical signs of inappetence, high fever (40.8°C), shivering, and ataxia. Two pregnant sows were also affected and both aborted their fetuses on 8 March. One died the same day, and the other died on 9 March. A fourth pig died on 10 March and two growers died on 12 March. A sow that farrowed on 14 March fell ill and was slaughtered on 16 March, together with another sow who also showed symptoms. On 17 March, one pig suddenly died and three other fell ill. These three sickly pigs were slaughtered. Ten piglets were born during the outbreak, on 13 March.

When the farm was visited on 23 March the total number of adult pigs dead from ASF was 15, and 11 adult pigs had been slaughtered due to early signs of disease, from the start of the outbreak. The number of small pigs, including piglets and smaller growers, that had died was 27. On 2 April an additional nine adult pigs had died from ASF and 14 had been slaughtered. The number of small pigs that had died since the last visit was 16. In June 2014 the last pig was slaughtered and the compound was therefore emptied. In total, approx. 95 pigs had died from ASF and the rest had been slaughtered. This gives a cumulative mortality of 69%. In figure 6 a and b, dead and sickly pigs can be seen. The dead pig shows typical discoloration.

Figure 6 a, b. *To the left a pig dead in ASF outside of the main pig building. In the right picture, two pigs in an outdoor pen where one of them could be showing initial clinical signs of ASF. Photo: Erika Chenais.*

Economic impact

The goal for 2014 for Adina farm was to sell 200 grown pigs as pork. This would generate an estimated income of 60 million UGX, by which the farm almost would have reached a break-even. One grown pig of exotic breed sold as pork generates an income of approx. 300,000 UGX. As seen in table 5, the losses and costs associated with the outbreak are substantial.
The value of a good sow is substantially higher. Each of the small pigs has the potential of generating an income of 300,000 UGX.

Table 5. *Some of the economic losses and costs associated with the African swine fever (ASF) outbreak on Adina Farm, Lira. From a retrospective case-study performed in October-November 2014 of an outbreak of ASF on Adina farm, Lira, Uganda.*

1 USD = 2750 UGX (2014-12-11, www.xe.com)

Income loss (UGX)	Costs to restart the farm (UGX)	Income during outbreak (UGX)	Minimum economic impact (UGX)
60 million	7.1 million for restocking 2.3 million for renovating	1.9 million	67.5 million

Social impact

Three people at Adina farm lost their jobs because of the outbreak. One, the foreman, left in April without any prior notice. The other staff were laid off because the farm did not have any activity. These people kept the insurance that they had during their time as employees. The foreman did not give any indication as to why he left, but the situation was probably very painful for him, according to the spokesperson and financial manager at Adina foundation, Lira. No other member of staff at Adina foundation resigned because of the outbreak.

The people involved in the piggery all experienced a feeling of hopelessness. The financial manager felt that he had not done enough to prevent the outbreak. He had even considered quitting his job at Adina foundation; fortunately, he was able to see a way through the problems. Many people were affected by the outbreak. The staff at Adina foundation in Lira, including the rehabilitation centre, were worried that they might lose their jobs because of the economic impact of the outbreak on the foundation.

DISCUSSION

The livestock production in low-income countries has great potential to reduce poverty and increase the livelihood of smallholder farmers (Perry and Sones, 2007). Nevertheless, the challenges are many, and in order to make animal husbandry a sustainable source of income for the rural population, strategies for optimising the production is needed. Enabling farmers to protect their animals from diseases is of crucial importance. Mapping of the specific situation and cultural aspects of the region is a must in order not to implement interventions that have negative effects on the society or the individual (Randolph *et al*., 2007).

The Gulu smallholder situation

Since ASF is endemic in Uganda (Atuhaire *et al*., 2013), the pig keeping households suffer from indirect effects of the disease at all times. In Gulu district, with an estimated incidence based on interviews of 15% per year, ASF definitely is a real threat and a difficult challenge for smallholder pig farmers. The Gulu district smallholder pig farmers, and other actors of the pig value chain in the district, did not have lack of knowledge regarding the pathways of transmission of ASF (Chenais *et al*., 2015). The pig farmers practiced several housing systems, similar to that found in Kenya by Kagira *et al*. (2013). It is likely that the Gulu

farmers shift between housing systems depending on season and the amount of feed available, as other studies in Uganda have shown (Ouma *et al*., 2014). Poverty and lack of feed are probable reasons why there is a discrepancy between knowledge and practice amongst the farmers.

The households in the study struggle with poverty – only 43% had managed to pay all needed school fees and 53% of those with a family gathering planned had to postpone it due to lack of money. Thirty-four percent of the households had had need of financial credit the past six months. Over 80% of the households that needed financial credit got it, which is positive if the interest is reasonable. For the households that did not get the credit they needed, this of course had consequences. For example, we found that a larger percentage of the households that did not get credit had had to postpone a family gathering due to lack of money compared to the households that did not get credit.

A larger percentage of the households with off-farm income had had need of financial credit when compared to the households that with no off-farm income. The reason for this could for example be that those with off-farm income had needed to make investments associated with the off-farm activity or that they had had more expenditures because of the off-farm activity. It could also be that the households with off-farm income knew that they would get the credit and therefore were more likely to apply for credit. A larger percentage of the households that had off-farm income ate meat monthly or more often compared to households that did not have off-farm income. This may suggest that these households had more expensive habits, made possible by their off-farm income.

Amongst the farmers who ate meat at least monthly, a larger percentage had had pigs that had died compared to the farmers who ate meat less often than monthly. The reason for this could be that they had eaten the dead pigs. Normally, smallholder farmers do not keep pigs for household consumption but to generate income or cash needed for their expenditures (Maass *et al*., 2012; Kagira *et al*. 2010). Another possible reason could be that they had brought pork to their farms and that the pigs may have come into contact with blood, bones or pickings from that pork, an evident risk behaviour for spreading diseases to the pigs.

Timing of the outbreaks, as discussed by Perry *et al*. (2002), may explain why not so many school fees were unpaid when looking at households with pigs that had died from ASF – different timing could cause larger impact. This could also be the case when looking at the death of pigs and if all school fees were paid or not. The households answered whether they had had any pig exits and if pigs had died due to a disease. Fifteen households

In this study, when looking at the ability of the households to pay school fees, the choice was made to mainly focus on whether all school fees had been paid or not. The reason for this was that if not all school fees had been paid, at least one child had missed school which in turn may hinder this child in his or her continued education.

Performing an interview-based study is associated with several difficulties, for example the sample size, recall bias, the person holding the interview and the questionnaire design. To

consider practicality as well as to include a large enough number of respondents is important when deciding a sample size. In some aspects of this study it would have been better with a larger sample, since some groups became very small and therefore difficult to analyse. A larger sample would have made the results from the statistical analysis more reliable.

The chi-square test and correlation test, the two statistical methods used in this study, are limited tools since they do not give us any causality. A chi-square test that gives us a significant p-value only indicates that the difference between the distributions within the groups is probably not caused by chance. If more information and, to some extent, causality is to be extracted from the data it would be possible to perform a multivariable regression analysis.

The respondents were asked to remember a number of details of their activities over the past six months. It is likely that not all of the answers were entirely correct due to recall bias. Two different people were involved in holding the interviews. Both the skill and personalities of the interviewers may have influenced the answers. Also their ability and consistency in interpreting the questionnaire may have varied.

An example of the difficulties in communicating the intention of some questions is whether the household was engaged in pig trading or not. The original intention of the question was to single out the households who operated as pig traders on a larger scale. Since 86 out of 198 answered that they were engaged in pig trading we are doubting that all those households really trade with pigs on a larger scale. It is more likely that they have interpreted the question as if the households sells and buys pigs more occasionally. The reason for this could be because of the language or because the interviewers misinterpreted the question. This could have been avoided by giving more thorough instructions to the interviewers.

As mentioned in the results, 15 households had stated that they had had pigs that had died from ASF. This information was gathered by asking about pig exits and asking the households to specify which disease had killed their pigs. It is important to bear in mind that these cases were not laboratory confirmed. However, the knowledge of the disease amongst the farmers is wide-spread (Chenais *et al*., 2015). Therefore, the 7.5% incidence rate can be considered as a likely reflection of the real situation (Karl Ståhl, Personal communication, 2014).

Adina farm

Adina farm was in many aspects a very good example of a setting where pig rearing could have the potential of being a lucrative business, from which many can benefit. Despite having good chances of success, ASF somehow made its way in to the compound, eradicating the herd.

The pig records were incomplete, which makes the reliability of the analysis questionable. For example the calculated cumulative mortality rate, can be considered unsure. Since the cumulative mortality calculated for Adina farm did not include the slaughtered pigs the

number would have been higher. The income and losses stated are more reliable, although the figures stated cannot be said to be exact and the analysis performed can be considered as very basic. Nonetheless, the results show that the economic losses were extremely high.

The interviews made in this study gathered important information about the ripple effects an outbreak could have. In this context the entire Adina foundation was affected as well as the surrounding community. The worry of staff members is likely to have been perceived by the children at the rehabilitation centre. The foreman of the farm decided to leave the security that an employment brings, most likely on account of feeling responsible and experiencing a vast powerlessness.

From the example of Adina farm, we can conclude that ASF is a difficult challenge even for those with more resources and knowledge available. ASF is a substantial threat to the growing pig production in Uganda.

Ways forward for livestock production in smallholder settings in low-income countries

One step forward in preventing animal diseases in smallholder settings is to encourage and educate the farmers in basic biosecurity measures. Vaccination against endemic diseases can also be an important step in ensuring a good animal health status. In the case of ASF no vaccine is available at the time. Perry and Sones (2007) argue that the European attitude of stamping out could affect the incentive to develop a vaccine. However, the European Union (EU) have financed vaccine research since at least 2008 (ASFRISK, 2015). In 2014 ASF had made its way to the EU by way of the wild boars, and has spread to all Baltic states and Poland. Both the wild boars and the domestic swine have been affected in Poland, Latvia and Lithuania (ProMEDmail, 2014). These outbreaks further increase the need for a vaccine (ASFORCE, 2015), and the argument mentioned above can be considered as outdated.

In order for livestock to be a reliable source of income, as well as a path out of poverty and gender inequality, many households need to optimise their production. Involving women in this would be an excellent strategy. Many sell their animals to get access to cash for their expenditures – the animals are used as a savings account. Often many farmers sell their animals at the same time, for example when the school fees are due. The profit would be higher if the animals could be sold when the demand for meat is high. The complex roles of animal husbandry in the rural, low-income country context, are important to bear in mind when conducting research or implementing measures in this kind of setting (Randolph *et al*., 2007; Rich and Perry, 2011; Knight-Jones and Rushton, 2013). The challenges are many; diseases cause losses of animals or decreased production and affording sufficient feeds for the animals can be a problem.

When implementing and developing strategies for optimising the livestock production it is important to consider if the strategies further adds to the women's workload and if the women are involved in controlling both the production and its benefits (Waters-Bayer and Letty, 2010; Ouma *et al*., 2014). Lastly, the demand for meat and animal produce is increasing

throughout the world, making livestock production a possibly potent tool in reducing poverty in Uganda, as well as in other low-income countries.

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APPENDIX 1

1. Questionnaire ID

_____

2. Date of Survey

- 2014-09-17
- 2014-09-18
- 2014-09-19
- 2014-09-20
- 2014-09-21
- 2014-09-22
- 2014-09-23
- 2014-09-24
- 2014-09-25
- 2014-09-26
- 2014-09-27
- 2014-09-28
- 2014-09-29
- 2014-09-30
- 2014-10-01
- 2014-10-02
- 2014-10-03
- 2014-10-04
- 2014-10-05
- 2014-10-06
- 2014-10-07
- 2014-10-08
- 2014-10-09

3. You participated in a previous part of this project by answering many questions about you and your pigs. According to you, how many months has passed since we were here last time?

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8

- 9
- 10
- 11
- 12

4. Enumerator

- Alike Solomon
- Bruce Nokorach

5. Time interview started

_____

6. Time intreview ended

_____

7. Name of the head of the household

_____

8. Respondents name

_____

9. Respondents telephone number

_____

10. Gender of respondent

- Male
- Female

11. Marital status of household head

- Married
- Widow/widower
- Single parent
- Other (specify)

If other, specify:

_____

12. Subcounty

- Awach
- Bardege
- Bobi
- Bungatira
- Koro
- Lakwana
- Lalogi
- Odek
- Ongako
- Paicho
- Palaro
- Patiko
- Unyama

13. Parish

- Acoyo
- Abwoch
- Agonga
- Alokolum
- Angaya
- Atiabar
- Bardege
- Binya
- Forgod
- Gem
- Gweng Diya
- Ibakara
- Idobo
- Kal
- Kal-ali
- Kalumu
- Kanyagoga
- Kasubi
- Labworomor
- Laliya
- Lamola
- Lapinat west
- Laroo
- Lujorogole
- Lukwir

- Mede
- Otino
- Pabwo
- Paduny
- Paidwe
- Pakwelo
- Palenga
- Parwech
- Patuda
- Pawel
- Pugwinyi
- Pukony
- Te-got

14. Village

_____

15. GPS coordinates Latitdues N/S

_____

16. GPS coordinates Longitudes E/W

_____

17. Household details: Did anyone leave or enter the household since last visist?

Compare with list from last visit

- Yes
- No

Specify if entry or exit, if entry provide details in question below, if exit specify whom. Compare to list from last visit.

18. Household details

Gender: 1=Male, 2=Female

Relationship to household head:
1 = Head, 2 = Spouse , 3 = Child, 4 = Sibling, 5 = Parent,
6 = Grandchild, 7 = Other relative, 8 = Non-relative (including employees who live in house), 9 = Other (specify in comments)

Highest education level:
0 = No formal education, 1 = Nursery, 2 = Pre-school age,
3 = Primary education (P1-P4),
4 = Primary education (P5-P7), 5 = Secondary school (S1-S2),
6 = Secondary school (S3-S4),
7 = High school (S5-S6), 8 = Vocational training (specify no of years in comments), 9 = Tertiary training (specify no of years in comments), 10 = University degree (undergraduate)
11 = University degree (postgraduate), 12=Adult literacy, 13=Other (specify in comments)

Primary source of income:
0 = None, 1 = Crop farming, 2 = Pig keeping (incl. sales) , 3 = Cattle keeping, 4 = Poultry/keeping (inc. sales), 5 = Salaried employment, 6 = Self-employed-off farm, 7 = Casual laborer, 8 = Boda boda,
9 = Student/pupil, 10 = Charcoal burning, 11 = Pre-school age,
12 = Other (specify in comments)

	Members of household [*FIRST NAMES]*	**Year of birth**	**Gender**	**Relationship to household head**	**Highest education level attained**	**Primary source of income**
1						
2						
3						
4						

Comments

20. Chidren of school age:

Type of school:
1=Public (UPE/USE) day school, 2=Private day school, 3= Private boarding school, 4= Religious day school,
5= Religious boarding school, 6=Other (specify in comments)

Reason for missed school days:
1=School closed, 2=Child sick, 3=Child needed at home (work, other), 4= Could not pay school fees or material, 5=Other (specify in comments)

	Name	**Type of school**	**Cost per term**	**Number of missed schooldays during last term**	**Reason for missed schooldays**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Comments

22. Does the household have off-farm income?

- Yes
- No

23. Is the household engaged in the following pig related activities

- ☐ Pig trading
- ☐ Processing of pork/pork products (e.g. slaughter)
- ☐ Operating a butchery
- ☐ Operating a pork kiosk
- ☐ Operating a pork joint
- ☐ Other

If other, specify

_____

24. Indicate the type and number of livestock kept/owned currently

Pigs _____
Cattle _____
Sheep _____
Goats _____
Poultry _____
Other _____

25. Indicate the different categories of pigs kept currently:

Breed type: 1=Local, 2=Cross, 3=Exotic
Housing: 1=Confined, 2=Tethered, 3=Free range

	Numbers kept	Breed type	Housing
Breeding boars	_____	_____	_____
Breeding sows	_____	_____	_____
Growers	_____	_____	_____
Piglets	_____	_____	_____

26. Have any pigs left your herd since the last visit?

- ☐ Yes
- ☐ No

27. Pig exits

Breed: 1=Local, 2=Cross, 3=Exotic
How exited: 1=Sold, 2=Sold because sick, 3=Sold because fear of pig disease, 4=Slaughter for sale,
5= Slaughter for household consumption, 6=Slaughter because sick, 7=Stolen, 8=Death, 9=Gift, 10=Other (specify in comments)
In case of death, cause: 1=Disease, 2=Starvation, 3=Poisoned, 4=Injury, 5=Other (specify in comments)

	Breed	**How exited**	**How many pigs exited**	**How many pigs died**	**In case of death; cause**	**If disease; which**
Breeding boars						
Breeding boars						
Breeding boars						
Breeding sows						
Breeding sows						
Breeding sows						
Growers						
Growers						
Growers						
Piglets						
Piglets						
Piglets						

28. Comments

29. Has there been any inflow of pigs through purchases, births or any other form since the last visit?

- Yes
- No

30. Pig entries

Breed: 1=Local, 2=Cross, 3=Exotic
Type of entry: 1=Bought from smallholder farm, 2=Bought from individual trader/broker, 3=Bought from a large scale farm, 4=Loan from project, 5=Gift, 6=Birth/born on farm, 7=Other (specify in comments)
Reason for purchase: 1=Replace old stock, 2=Saving money, 3=Prestige, 4=Expand herd, 5=Other (specify in commetns)
Purchase point: 1=Within village, 2=Neighbouring village, 3=Other (specify in comments)

	Breed	**Type of entry**	**How many pigs**	**Reason for purchase**	**Cost per animal**	**Purchase point**
Breeding boars						
Breeding boars						
Breeding boars						
Breeding sows						
Breeding sows						
Breeding sows						
Growers						
Growers						
Growers						
Piglets						
Piglets						
Piglets						

31. Comments

32. Have you done any expansion in the pig enterprise since last visit?

- ☐ Yes
- ☐ No

33. If yes, specify how:

_____
_____

34. Do you keep records associated with the pig enterprise?

- ☐ Yes
- ☐ No

35. What types of records?

- ☐ Feeds
- ☐ Reproduction and breeding

- Animal inventory (births, deaths, sales)
- Financial (income and expenditure)
- Other

If other, specify

_____

36. Did you sell any pigs since the last visit?

- Yes
- No

37. Indicate the numbers sold from each pig category:

Sales outlet: 1=Farm gate, 2=Village/local market. 3=Slaughterhouse/abbatoir, 4=Butchery, 5=Other (specify in coments)

	How many sold	Weight (live)	Weight (carcass)	Price/head (UGX)	Sales outlet
Breeding boars					
Breeding sows					
Growers					
Piglets					

38. Comments

39. Did you have any other income related to products from your own pigs since the last visit?

- Yes
- No

40. If yes, what was the total income since the last visit?

_____

41. Do you own a breeding boar?
(If no skip to Q 44)

- Yes
- No

42. Do you use it/them for own or communal breeding?

- Own
- Village/communal
- Other

If other, specify:

_____

43. How much do you charge per service (UGX)?

_____

44. What was your total income from the breeding boar since the last visit?

_____

45. Indicate the source of breeding for the sows since the last visit

- Didnt do any breeding
- Own boar
- Other boar

If other, specify:

_____

46. What is the cost per service (UGX or other)?

_____

47. What was your total expenditure for the breeding service since the last visit?

_____

48. Did you have any hired labour engaged in the pig enterprise since the last visit?

- Yes
- No

49. If yes, what was your total expenditure for hired labour engaged in the pig enterprise since the last visit (UGX)?

_____

50. Did your pigs recieve any medical treatments (deworming, antiparasitic, profylaxis, antibiotics, vaccination) since the last visit?

- Yes
- No

51. If yes, what treatment(s)?

_____
_____

52. What was your total expenditure for medical treatments since the last visit (UGX)?

_____

53. Did you have any expenditure for biosecurity equipment (protective clothing, boots, disinfectants etc) since the last visit?

- Yes
- No

54. If yes, what sort of equipment did you buy?

_____
_____

55. What was your total expenditure for bio security equipment since the last visit (UGX)?

_____

56. Did you receive any extension service related to pigs since the last visit?

- Yes
- No

57. What was your total expenditure for extension service related to pigs since the last visit (UGX)?

_____

58. What was your total expenditure on pig feeds since the last visit (UGX)?

_____

59. Since the last visit, did you have to sell any household assets due to losses incured in the pig production?

- ☐ Yes
- ☐ No

60. If yes, Indicate what asset and the price obtained

	Type of asset	Price obtained
Asset	_____	_____
Asset	_____	_____
Asset	_____	_____

61. Since the last visit, how many times a week did your family eat meat (on average)?

_____

62. Have you needed any financial credit since the last visit)?

- ☐ Yes
- ☐ No

63. If yes, did you get the credit?

- ☐ Yes
- ☐ No

64. If no, why was credit not acquired?

- ☐ No collateral
- ☐ Credit terms unfavourable
- ☐ Other

If other, specify:

_____

65. Amount needed, recieved, interest rate and use of credit

Reasons: 1=Family health problems, 2=Animal health problems, 3=Crop failure, 4=Investments, 5=Pay school fees, 6=Wedding, 7=Funeral, 8= Other, specify in comments Use of credit: 1=Feeds, 2=Animal health, 3=Labour, 4=Capital costs, 5=Other (specify in comments)

	Reason for needing credit	Amount needed	Amount received	Interest rate	Use of credit
Credit 1					
Credit 2					
Credit 3					

66. Comments

67. Since the last visit; 67. Since the last visit;

	No, none	Most not	Some yes, some not	Yes, most	Yes, all
Have the family been able to pay all needed school fees?					
Have the family been able to meet all medical expenses that has come up					
Have there been any family gatherings (weddings, funeral, baptisms) etc that had to be changed or postponed due to lack of money?					

Comments

68. Since the last visit;

	No, never	Most of the times not	Sometimes yes, sometimes not	Yes, most of the time	Yes, always
I feel more optimistic about the pig enterprise					
There has been an increase in disputes, disagreements or jealousy among my neighbours					
I have lost confidence in pig production					

Comments

69. How do you agree with the following statements;

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I think it is possible to protect my pigs from getting ASF by improving farm bio security					
Eating pork from pigs that have died from ASF is safe for human health					
If I would get a fair price I would be willing to sell all my heatlhy pigs when an ASF-outbreak were present in the area					
I would like to invest in farm bio security if I recieved advice on what to do					
I would be happy to buy pork products from a slaughterhouse that recieve pigs that have been in contact with pigs dying from ASF					
It is safe to give pigs water that has been used to clean knifes and pangas used for slasughtering and butchering as drinking water					
Buying live pigs is a risk behaviour for contracting ASF					
I dont want to eat or buy pork from pigs that have died from ASF					
I can not afford to invest in my pig farming					
ASF can not be prevented					
I can choose where/to whom I sell my pigs					
Frequent sellling and buying of pigs is neccessary for succesfull pig farming					
Improved farm bio security improves pig health and pig growth					
I could adopt my pig farming in order to have pigs ready for sale at specific times of the year					
Cooking kills the ASF-virus					
It is possible for me to tell visitors such as veterinarians, middle men and extension workers not to enter in the pig house with their own boots					
If pork prices are lower in the neighbouring village due to them having an outbreak of ASF I will buy my pork there					

Comments

_____
_____

70. Comments

_____
_____
_____
_____