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Assessment of an outsourced agricultural extension service in the Mutasa district, Manicaland province, Zimbabwe

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Munyaradzi Machila

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Zimbabwe has a pluralistic agricultural extension system. In addition to the public extension service, donors contract private service providers to deliver extension services in specific project areas. This study assesses the impact of outsourced extension services on rural households in the Mutasa district of Zimbabwe's Manicaland province, and examines the financial cost and benefits of this service. The extension service was delivered by a local agribusiness firm and funded by USAID. The study analyses survey data gathered from 94 client and 90 non-client rural households in June 2014. Propensity score matching was used to identify a subset of comparable clients and non-clients. Descriptive statistics were compared across these groups, and the impact of the extension service on each of several outcome variables was estimated using two-stage least squares regression with instrumental variables to account for selection bias. The results show that the outsourced extension service contributed significantly to household crop income, net crop income and expenditure on farm inputs and services. In addition, clients perceived a range of socio-economic benefits such as better diets and health, improved product quality and job creation. An analysis of the financial cost and benefit of the extension service in the study area suggests an annual net incremental benefit of US$11,587, representing a 30% return on the investment made by the donor to finance the service. This estimate excludes the socio-economic benefits attributed to the extension service.

Keywords: Smallholder extension service, impact assessment, net incremental benefit, treatment model, selection bias, instrumental variables, propensity score matching

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Glossary of Acronyms

2SLS	Two Stage Least Squares
AGRITEX	Agricultural Technical Extension
AKIS	Agricultural Knowledge and Innovation Systems
CBA	Cost, Benefit Analysis
CONNEX	Conservation and Extension
DEVAG	Department of Agriculture
EC	European Commission
FAO	Food and Agricultural Organisation
FAVCO	Fruit and Vegetable Company
HIV/AIDS	Human Immune Virus/ Acquired Immune-Deficiency Syndrome
IFPRI	International Food and Policy Research Institute
MOU	Memorandum of Understanding
NAADS	National Agricultural Advisory Development Services
NGO	Non-Government Organisation
OLS	Ordinary Least Squares
PRP	Protracted Relief Programme
PSM	Propensity Score Matching
PSU	Primary Sampling Units
SNV	Stichting Nederlandse Vrijwilligers
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
SSU	Secondary Sampling Units
US$	United States Dollars
USAID	United States Agency for International Development
VIF	Variance Inflation Factors
ZimAIED	Zimbabwe Agricultural Incomes and Employment Development

Chapter 1

Introduction

This research assesses outsourced agricultural extension services in the Mutasa district of Manicaland province in Zimbabwe. The Introduction contextualises the study, explains why the study is important and then outlines its objectives. The chapter concludes with a description of the structure of the thesis.

1.1 Background to the study

Agricultural extension services typically include capacity development through training, strengthening innovation processes, building linkages between farmers and other agencies, and helping to strengthen farmers' bargaining position through appropriate institutional and organisational development (Sulaiman & Hall, 2002). There is a strong demand for these generic extension services In Zimbabwe where the vast majority (70%) of farmers are small semi-commercial producers (Moyo, 2011). Extension services that provide specialised information may be privately or publicly funded (Birkhaeuser, Evenson & Feder, 1991). In Zimbabwe, the specialised and complex information required by a minority of large scale commercial farmers is sourced from private agribusiness companies and consultants (Hanyani-Mlambo, 2002).

Traditionally, the public component of Zimbabwe's extension system has been delivered by AGRITEX, the Department of Agricultural, Technical and Extension Services. Figure 1.1 illustrates the impersonal delivery approach used by AGRITEX Officers. AGRITEX is the largest public rural intervention agency in Zimbabwe with representatives at the national, provincial, district and village levels (IFPRI, n.d.). Sharp reductions in tax revenue that followed the introduction of Zimbabwe's controversial 'fast track' land reform programme in 2000 reduced the AGRITEX budget (Government of Zimbabwe & FAO, 2011). In addition, donor funding that co-financed AGRITEX was withdrawn in response to the government's land reform initiative. This rendered the public extension service ineffective (Gwaradzimba, 2011) and encouraged donors to experiment with outsourcing. In essence, donors are

funding extension services provided by NGOs and agribusiness firms (Anseeuw, Kapuya & Saruchera, 2012) - a move embraced by many governments in Southern Africa to divest themselves of the full burden of financing and providing extension (Kidd, Lamers, Ficarelli & Hoffman, 2000).

Figure 1.1 Delivery of public extension (From Kiboko, n.d.).

This study examines an outsourced agricultural extension service delivered as a component of the Zimbabwe Agricultural Income and Employment Development (ZimAIED) project funded by USAID. The study area was confined to the Mutasa district of Zimbabwe's Manicaland province where outsourced extension services are well established and where a private service provider is still actively recruiting new farmer clients. The ZimAIED project is managed by Fintrac, a private US based company. Fintrac contracts several NGOs and agribusiness companies to deliver extension services to different parts of its ZimAIED target area. The extension service in the study area is delivered by Favco, a local fruit and vegetable processing private company. The managers of both Fintrac and Favco requested that the names of their organisation be disclosed in publications emanating from this research.

1.2 Rationale for the study

The study estimates the impact of Favco's extension service on small farmers in the Mutasa district and assesses the financial cost and benefit of this service in the study area. These issues are important as agriculture is the only source of income and employment for most of Zimbabwe's poor rural households (FAO, 2003) and there is very little information about the impact, costs or benefits of outsourced extension services in Southern Africa (Heemskerk, Nederlof & Wennick, 2008).

Information and advisory services compete for scarce public and donor financial resources that might be more profitably spent addressing other problems that constrain small farmers, such as poor rural infrastructure (Scoones et al., 2010) and inadequate investment in producer marketing organisations. For instance, Scoones et al. (2010) estimated that it would cost $US100.86 million to rehabilitate the country's cattle farming infrastructure while the provision of publically funded extension services accounts for some US$40 million every year (Ministry of Finance, 2011). Approximately 80% of this expenditure is attributed to salaries.

Although there has been some research on the value of extension services perceived by small farmers in Zimbabwe (Foti, Nyakudya, Moyo, Chikuvire & Mlambo, 2007; Owens, Hoddinott & Kinsey, 2003), there have been no previous attempts to assess the impacts or value added by outsourced extension services in Zimbabwe. The findings from this study are also likely to be useful to neighbouring countries like Mozambique and Malawi where outsourcing is expanding rapidly, and other sub-Saharan African (SSA) countries that are experimenting with pluralistic extension systems (IFPRI, n.d.).

1.3 Research objectives and questions

The objectives of this study are twofold:

1 To assess the impact of Favco's extension service on household income, liquidity and expenditure, and on perceived changes in diet, health, child education, savings and other non-financial outcomes.

2 To estimate the financial cost and benefit of Favco's extension service in the Mutasa district of Zimbabwe's Manicaland province.

The research questions corresponding to each of these objectives are:

1 What are the impacts of Favco's extension service on household income, liquidity and expenditure, and on perceived changes in diet, health, child education, savings and other non-financial outcomes?

2 What is the incremental net financial benefit of the outsourced extension service delivered by Favco in the study area during the 2013/14 cropping season?

The study employs a rigorous sampling design to gather information from rural households and Favco clients. Propensity score matching (Khandker et al., 2010, pp. 53-68) is applied to identify non-clients and clients with similar attributes. The resultant 'control' and 'treatment' groups are compared to identify differences in farm earnings and other outcomes of outsourced extension services. The impact of 'treatment' on key financial outcomes is then estimated using two-stage least squares regression with instrumental variables to account for selection bias (Khandker et al., 2010, pp. 88-90). Descriptive statistics are computed to estimate the incidence of several non-financial benefits perceived by clients.

Cost-benefit analysis (CBA) is used to estimate the financial viability of Favco's extension service in the study area following a 'with and without' project approach (Akroyd, 2003:114-126, 212-215). The CBA compares the net incremental benefit attributed to the extension service with the cost to the sponsor of contracting Favco to deliver the services. This financial CBA is conservative as it assumes that the marginal benefits of servicing existing clients are trivial compared to the benefits gained when 'new' farmers make use of Favco's

services. However, account is taken of the local multiplier effect generated by an increase in the farm earnings of new clients.

1.4 Structure of the thesis

The next chapter reviews the relevant literature on the changing role of governments in delivering extension, and also describes the outsourcing method currently applied in Zimbabwe. Chapter 3 contains a description of the sampling design and research methods employed to answer the research questions. Chapter 4 describes the study area, the survey instrument and field methods used to collect data. This chapter also presents descriptive statistics computed for the household sample. Chapter 5 assesses the impact of the outsourced extension service on rural households in the study area and examines the financial cost and benefit of these services. Chapter 6 summarises the main empirical findings and offers conclusions and recommendations based on these findings. It also highlights limitations of the study and proposes areas for future research.

Chapter 2

Literature review

This chapter contains the relevant literature on the changing role of governments in delivering extension, and describes the outsourcing method currently applied in Zimbabwe. It concludes with literature relating to the cost and benefits of outsourced extension services.

2.1 Changing role of government in the delivery of agricultural extension services

Extension services play an important role in supporting agriculture as an engine of pro-poor growth and enabling small farmers to meet new challenges such as accessing export markets, adopting environmentally sustainable production techniques, and coping with HIV/AIDS and other health challenges that affect agriculture (Birner et al., 2006). The 'public-good' element of agricultural extension services has encouraged many governments to take exclusive responsibility for their delivery (Umali-Deininger, 1997).

While studies reported by Birkhaeuser et al. (1991), Anderson and Feder (2004), and Heemskerk et al. (2008) have demonstrated the positive impacts of good quality agricultural extension, public-sector extension has been fraught with failures. These failures include a lack of relevant information, particularly market information (Feder, Birner & Anderson, 2011; Rivera & Qamar, 2003), and weak outreach. Bembridge (1987) reported that extension in Southern Africa had considerable deficiencies in the quality of the staff, technical support, communication methods, administration and management at all levels. Persistent deficiencies prompted experimentation with alternative methods of delivering publicly-funded extension services, especially in developing countries (Heemskerk et al., 2008).

Umali-Deininger (1997) contends that three other drivers have contributed to this experimentation. First, fiscal crises and budget cutbacks, often associated with structural adjustment programmes, forced governments to reduce spending on public extension

programmes. Financial sustainability and cost effectiveness have become priority concerns. Second, the slow adoption of extension messages spurred the search for more effective methods of delivering information. Third, demand for more specialised information has changed the economic character of extension services. The growing commercialisation of agriculture and increased competition in domestic and international markets has encouraged farmers and other rural entrepreneurs to treat specialised information like any other purchased input used in agricultural production and marketing activities.

The most dramatic change in publically-funded extension services has been the inclusion of non-government stakeholders to address the information needs of farmers (Saravanan, 2010). Many agricultural programmes, especially in sub-Saharan African (SSA) countries, have adopted the agricultural knowledge and information systems (AKIS) perspective. This includes a pluralistic approach to agricultural research and advisory services (Farrington, 1994, Feder, Willet, & Zijp, 1999, Carney, 1998, Alex, Zijp & Byerlee, 2002, Chapman & Tripp, 2003, Chema, Gilbert & Roseboom, 2003, Qamar, 2005, World Bank, 2006). This suggests growing acceptance that non-government stakeholders have a role to play in delivering public extension services. An increasingly popular way of achieving this pluralistic approach is through outsourcing (Heemskerk et al., 2008).

2.2 Outsourced extension services

Outsourcing is a business process term that refers to the contracting of tasks and services that are either not (or no longer) considered to be the core business of a particular enterprise, or that can be achieved more efficiently, or more cheaply, by contracting specialised agencies (Heemskerk et al., 2008). In the case of agricultural extension, outsourcing is a way of contracting private service providers (including private sector firms, NGOs and farmers' organisations) to deliver information and services characterised largely as public goods (Heemskerk et al., 2008). These service providers are often paid from both public and donor funds.

When publically financed extension services are contracted out, the role of the government changes from that of the implementing agency to that of quality assurer responsible for

monitoring and evaluation (Heemskerk et al., 2008) and the provision of training and technical information to service providers (Rivera & Alex 2002). Contracting processes should be transparent and competitive, and restricted to quality-certified service providers. Rivera and Alex (2002) also note that contracts agreed with service providers should specify the target area and beneficiaries, well-defined outputs, responsibilities and lines of accountability.

Rivera and Alex (2002) contend that outsourcing is a useful strategy for public sector extension systems. Potential benefits of outsourcing highlighted by Griffith and Figgis (1997) include cost savings; increased accountability of service providers through contract specifications and performance measurement; better work and management practices; wider access to skills, knowledge and technology; more efficient use of capital and equipment; better service quality; greater flexibility in services; and local industry development. However, the same authors point out that outsourcing government services can also present challenges. These may include reduced accountability of government for the quality and quantity of contracted services, and collusive tendering or other tendering problems.

In sub-Saharan Africa (SSA), Uganda was the first country to experiment with outsourcing through the National Agricultural Advisory and Development Services (NAADS) outsourcing programme (Benin et al., 2007). From 1990 onwards, other pilot projects were initiated in Mozambique, Tanzania and Mali (Swanson & Rajalahti, 2010). These pilots were co-financed by both donors and national governments, but were delivered by private sector firms and NGOs. National governments in these countries are up-scaling their outsourced extension operations (Swanson & Rajalahti, 2010). For example, in Mozambique, NGOs and private companies were delivering extension services in all of the country's 127 rural districts (Alage & Nhancale, 2010). Heemskerk et al. (2008) contend that outsourcing is becoming a way of life in SSA. In Latin America, outsourcing has been practiced in Chile and Costa Rica for more than a decade (Swanson & Rajalahti, 2010).

2.3 Outsourced extension services in Zimbabwe

Outsourcing agricultural extension services is a relatively new concept in Zimbabwe. Following the 2008 food price crisis, donors such as the US Agency for International Development (USAID), European Commission (EC), United Nations Food and Agricultural Organisation (FAO) and Stichting Nederlandse Vrijwilligers (SNV) started experimenting with outsourcing projects. NGOs (both local and international) and private companies were contracted to deliver agricultural extension services in specific parts of Zimbabwe. These services included training in improved livestock and crop farming methods, the introduction of new technologies, and efforts to link small farmers to both input and output markets (Anseeuw et al., 2012). For example, the Protracted Relief Programme (PRP) was launched in 2004 with the purpose of delivering aid to rural communities. From 2008 until 2013 when the project ended, the focus of the PRP switched to agricultural extension services and the provision of food relief to targeted rural areas. The programme was funded by a consortium of eight donors that contracted 32 NGOs (of the 70 operating in Zimbabwe's agricultural sector at that time) to deliver extension services in 54 rural districts and eight urban centres (Anseeuw et al., 2012).

Outsourced extension services are donor-driven in Zimbabwe because donors stopped channelling funds through the Treasury in 2002 following a series of government-orchestrated land acquisitions (Anseeuw et al., 2012). Donors contract private service providers and monitor their performance (Anseeuw et al., 2012). This differs from the approach adopted in Mozambique (where private service providers are contracted by the government) but does not imply a lack of collaboration with, or accountability to, the Zimbabwean Government. Outsourced extension services are offered only in areas where the donors have a memorandum of understanding (MOU) with district and provincial government administrations. These memoranda typically require service providers to submit regular progress reports to government agencies. Outsourced extension services supplement the public extension service delivered by AGRITEX. The public extension service is generally considered to be ineffective owing to a shortage of vehicles and qualified staff (Hanyani-Mlambo, 2002; Saravanan, 2008). Complementarity between the public and donor-funded extension services is unlikely except in the sense that AGRITEX staff may improve their skills by taking advantage of training sessions hosted by private service

providers. Impacts attributed to the provision of outsourced extension services are therefore unlikely to have their origins in the public extension service.

2.4 Public extension services in Zimbabwe

Agricultural extension services were first introduced to Zimbabwe (formerly Southern Rhodesia) in 1927 by Emory Alvord, who started with nine agricultural demonstration workers (Hanyani-Mlambo, 2002). In the late 1920's, the Department of Conservation and Extension (Connex) was enacted to deliver advisory services to white commercial farmers while the Department of Agricultural Development (Devag) (established in 1969) was responsible for providing extension to native smallholders (Hanyani-Mlambo, 2002; Saravanan, 2008). In 1980, following Zimbabwe's democratisation, Connex and Devag were merged to form AGRITEX. Restructuring, transformation and policy changes resulted in an outflow of experienced extension personnel from AGRITEX in the early stages (1981-1985) of its operation (Hanyani-Mlambo, 2002). AGRITEX lost credibility with white commercial farmers and focussed its attention on smallholders (Anseeuw et al., 2012). Once highly regarded (Gwaradzimba, 2011), Zimbabwe's public extension service deteriorated in the face of on-going budgetary cuts (Saravanan, 2008). Donor funding used to co-finance AGRITEX was withdrawn in 2002 in response to the government's 'fast track' land reform initiative. This rendered the public extension service ineffective (Gwaradzimba, 2011) and encouraged donors to experiment with outsourcing, using NGO's to play the role of government as quality assurer (Heemskerk et al., 2008).

2.5 Costs and benefits of outsourced extension services

The costs of a development intervention are usually easier to identify and measure than are its benefits (Gittinger, 1984). With regard to outsourced agricultural extension services, the economic costs are largely reflected in the financial cost of the contract. These financial costs relate to salaries, transport and accommodation costs, and the private service provider's fees for managing the operation and bearing risk. The economic benefits, however, generally, exceed the added farm income as higher levels of agricultural output

and income may well result in better diets, improved health and education, and more employment. Adoption of improved farming practices by smallholders may also have positive environmental effects. Such externalities are difficult and costly to measure. For this reason, this study focused on (a) the financial cost and benefit of an outsourced extension service in a defined study area, and (b) an impact assessment of the extension service on household income, liquidity and expenditure, and on perceived changes in diet, health, child education, savings and other non-financial outcomes. In estimating the financial benefit of the outsourced extension service, consideration was given to the multiplier effect which resulted from increased expenditure on non-tradables produced by rural households (Delgado, Hazell, Hopkins & Kelly, 1994). Hendriks and Lyne (2003) estimated local expenditure multipliers ranging from 1.28 to 1.98 in the communal areas of South Africa. Delgado, Hopkins and Kelly (1998) estimated a local expenditure multiplier of 1.82 in Zambia.

Information on the costs and benefits of outsourced extension is scarce, particularly in sub-Saharan Africa (SSA) where most outsourcing experiments have yet to mature (Heemskerk et al., 2008). The annual financial cost of outsourcing was estimated at US$400 per household in Nicaragua (Rivera & Alex, 2002) and US$425 in Chile (Bebbington & Sotomayor, 1998). Neither of these studies attempted to measure benefits. A case study in Mozambique on outsourced cashew nut extension estimated an annual cost of US$29 per household (including pesticide spraying) but, likewise, did not measure benefits (Heemskerk et al., 2008). Also in Mozambique, the cost of outsourced extension services in the districts of Murrupula and Nicoadala were estimated at US$60 per household in 2006 (Heemskerk et al., 2008). Again, no effort was made to measure benefits. Heemskerk et al. (2008) predict that the cost of outsourced extension will exceed the cost of services delivered by government extension officers (who earn less than their counterparts in the private sector) but highlight a finding from Uganda where farm households serviced by the NAADS programme earned 41% more than comparable households outside the programme. They reported that the NAADS programme generated incremental income of US$10 million per year over the first three years of its operation, but did not explain how the benefits were quantified. The Global Forum for Rural Advisory Services (2012) claims that annual returns of 40-60% are the norm for investments in agricultural extension. However, the studies

supporting this claim do not relate specifically to outsourced extension services or to Southern Africa.

No previous studies have examined either the costs or benefits of outsourced extension services in Zimbabwe. The results generated by this study may be of use to government and non-government rural development agencies in Zimbabwe and also to those in other SSA countries (like Mozambique) that are experimenting with, or contemplating, outsourcing. Moreover, the findings of this study are expected to be useful to donors seeking to improve the welfare of rural households in developing countries.

2.6 Chapter summary

This chapter introduced the concept of outsourcing and how it is used in agricultural extension. It contains a description of the transformation of agricultural extension services in Zimbabwe and presented literature on the cost and benefits of outsourced extension services.

Chapter 3

Research methods and design

This chapter describes and rationalises the methods used to collect and analyse data for the study. The choice of methods was informed by the research questions posed in Chapter 1. The chapter concludes with a section on ethical issues.

3.1 Sample design

3.1.1 Cost and benefit analysis of the outsourced extension service provided by Favco

Two different sample surveys were required to estimate the financial cost and benefit of Favco's extension service in the study area. The first requirement is a representative sample of all households in the study area (a household sample). A two-stage cluster sampling method was proposed to select these households. At the first stage, a sample of villages (primary stage units or PSUs) is drawn from the study area with probability proportionate to an estimate of their size. These estimates are based on a physical count of households (secondary stage units or SSUs) in each village. Households in each of the selected villages are then listed and a simple random sample is drawn from each list using a constant sampling fraction. This approach produces a self-weighting sample that can be analysed as if it were a simple random sample.

The second requirement is a representative sample of all 'new' clients serviced by Favco (a client sample). New clients were defined as those smallholders who, with Favco's assistance, planted tissue culture banana seedlings in 2012/13 to harvest an improved banana crop between January and June 2014. Figure 3.1 outlines the generic sampling design within the target study site.

The household sample provides an estimate of the fraction of new private partner clients (α) in the study area. The treatment group comprises of all new clients, including those identified in the household sample. Households in the treatment group can be matched to

non-clients in the household sample with similar observable characteristics using propensity score matching. This subset of the non-client households constitutes the control group.

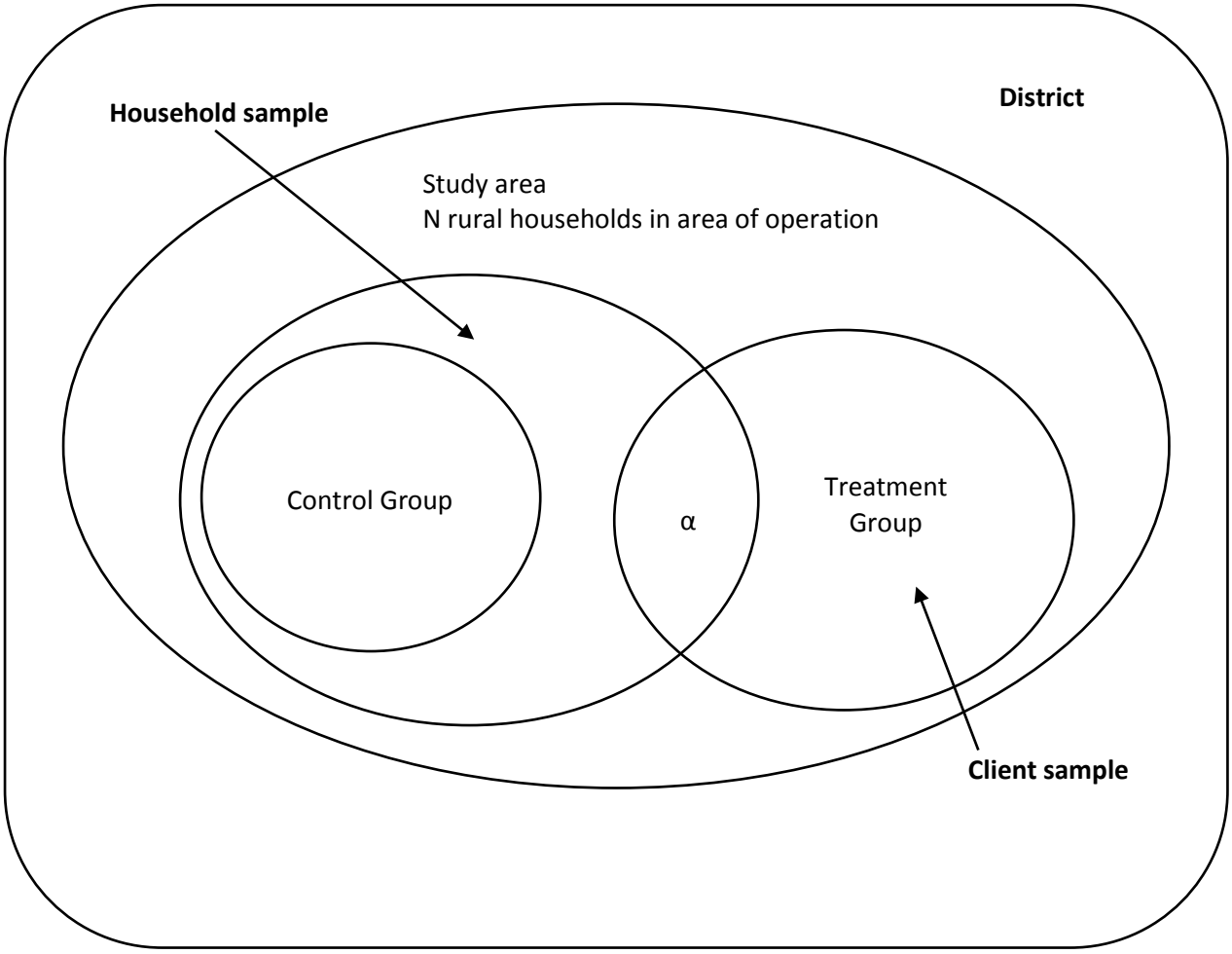

Figure 3.1 Sampling design in the study area

An estimate of the 'without project' net cash farm income can be computed for the study area as $\hat{Y}_0=N(\ddot{y}_c)$, where N is the total number of households counted in the study area and y is the mean net cash income computed for households in the control group. The 'with project' net cash farm income can then be estimated as;

$$\hat{Y}_1= N\,\alpha\,(\ddot{y}_T.M) + N\,(1-\alpha)\,\ddot{y}_c \quad \text{.... (1)}$$

where $\ddot{y}_T$ is the mean net cash farm income computed for client households in the treatment group, M is an estimate of the local economy multiplier, and α represents the estimated fraction of new Favco clients in the study area.

If no new clients are identified in the household sample (i.e. $\alpha = 0$) then $\hat{Y}_1 = \hat{Y}_0$ and there is no estimated incremental benefit from Favco's extension service. Clearly, the true value of Y_1 would exceed $\hat{Y}_1$ if 'old' clients experienced gains as a result of new information and support provided by Favco in the current season (2013/14). $\hat{Y}_1$ is therefore a conservative estimate of financial gains as it discounts the benefits of new information gained by the existing clients. It also ignores the dynamic nature of the adoption process (Rogers, 1976) as 'new' clients may not apply all of the advice given by Favco in their first year of participation. It follows that $\hat{Y}_1$-$\hat{Y}_0$ gives a conservative estimate of the incremental financial (i.e. private) benefit of the outsourced extension service in the study area, and that $\Delta_{PB} = (\hat{Y}_1 - \hat{Y}_0) - C$, where C is the cost to the donor of the support that Favco provided in the study between September 2013 and August 2014, gives a conservative estimate of the net incremental financial benefit of this service. While the effects of exogenous factors are largely accounted for by making a 'with versus without project' comparison, it is possible that significant events, like extreme drought during the cropping season under investigation could remove benefits that would have been observed in an 'average' year. Secondary data (Stack, 2004) did not suggest anything unusual about agronomic or market conditions in the study site during the 2013/14 cropping season. Nevertheless, the survey elicited information about farmers' perceptions of unusual events.

3.1.2 Farm household impacts

Since this part of the study is not concerned with the annual flow of costs and benefits, the treatment group is extended to include all of Favco's clients identified in the sample survey. The impact of Favco's extension service can be measured econometrically using the general treatment model (Khandker et al., 2010, p. 25),

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 X_i + \varepsilon_i \quad \text{.... (2)}$$

where Y_i is an outcome observed for the ith household, T is a variable measuring the level of treatment, X is a vector of observed household and farm characteristics affecting the observed outcome, and ε captures random error and unobserved characteristics influencing the outcome. Heterogeneous programme impacts can be captured by varying the intercept (β_0) and slope parameter (β_1). For example, the sample could be divided into wealth groups, and the model estimated with intercept and interaction terms for each wealth group (Khandker et al., 2010, pp. 116-117).

Estimating the model by ordinary least squares (OLS) poses a problem because households are not randomly selected for treatment. ZimAIED project areas were selected for physical and climatic conditions that favour agriculture. Within these target areas, uptake of Favco's extension service was voluntary but limited to farming households. Client selection was therefore biased by both observed and unobserved attributes resulting in endogeneity of the treatment variable. This problem can be addressed by using two-stage least squares (2SLS) and appropriate instrumental variables (Khandker et al., 2010, pp. 88-90). In the first stage, the treatment dummy is regressed on the instruments (Z) and other independent variables (X) affecting treatment (T).

$$T_i=\lambda_0+\lambda_1 Z_i+\lambda_2 X_i+\mu_i \quad \text{.... (3)}$$

In this study, equation 3 is estimated as a logit model as T is recorded as a binary variable scoring 1 for clients in the treatment group and 0 for non-clients in the control group. Ideally, the instruments are chosen such that Z is correlated with T but uncorrelated with factors affecting Y.

In the second stage, Y is regressed on $\check{T}$, the predicted value of T in equation 3, and other variables (X) thought to affect project outcomes. $\check{T}$ excludes the effect of unobserved variables that may influence both participation and outcomes, and thus embodies only exogenous variation in T. The impact of treatment on households is measured by β_1, the regression coefficient estimated for $\check{T}$. In this instance, a positive and statistically significant coefficient indicates that the outsourced extension service had a positive impact on the outcome.

3.2 Ethical issues

No application was made for human ethics clearance because the questions posed to respondents were of a professional and not a personal nature as provided for in article 6.2.3, sub-article 2 of Lincoln University's Human Ethics Policies and Procedures. In addition, the researcher and enumerators came from the study area and were aware of what respondents would have perceived as sensitive information. In the interests of best practice, respondents were informed that participation was voluntary, confidential and anonymous, that they were not required to answer all questions, and could withdraw their information at any time. The interviews were not recorded.

Chapter 4

The study area, data collection and descriptive statistics

4.1 The study area

Primary data used in this analysis were gathered from May to July 2014 in the Honde Valley (Figure 4.2), an area of 500km^{2}located in the Mutasa district (Figure 4.1) approximately 100km north-east of Mutare, the fourth largest city in Zimbabwe (Mushunje, 2005).The Valley is home to an estimated 1177 households located in five villages.

Agriculture is the main economic activity in this eastern region. Annual rainfall averages 850-1000mm, but is restricted largely to the summer months from October to April. Honde Valley is hot and humid with summer temperatures reaching 30 degrees centigrade. The topography ranges from steep to gently undulating slopes and most farmers irrigate crops using gravity irrigation (Development Technology Unit, 1991).Crops grown include maize, bananas, coffee, tea, tubers and legumes (Mtisi, 2003; Mushunje, 2005).

Approximately 600 of the smallholders farming in the study area used the agricultural extension service provided by Favco under contract to Fintrac (Fintrac, 2014). The service includes training and advice on farming practices, especially bananas and subsistence food crops (Figure 4.3), loans for seasonal farm inputs, help accessing markets (Figure 4.6), and the introduction of new technologies such as use of tissue cultured banana seedlings (Figure 4.4).

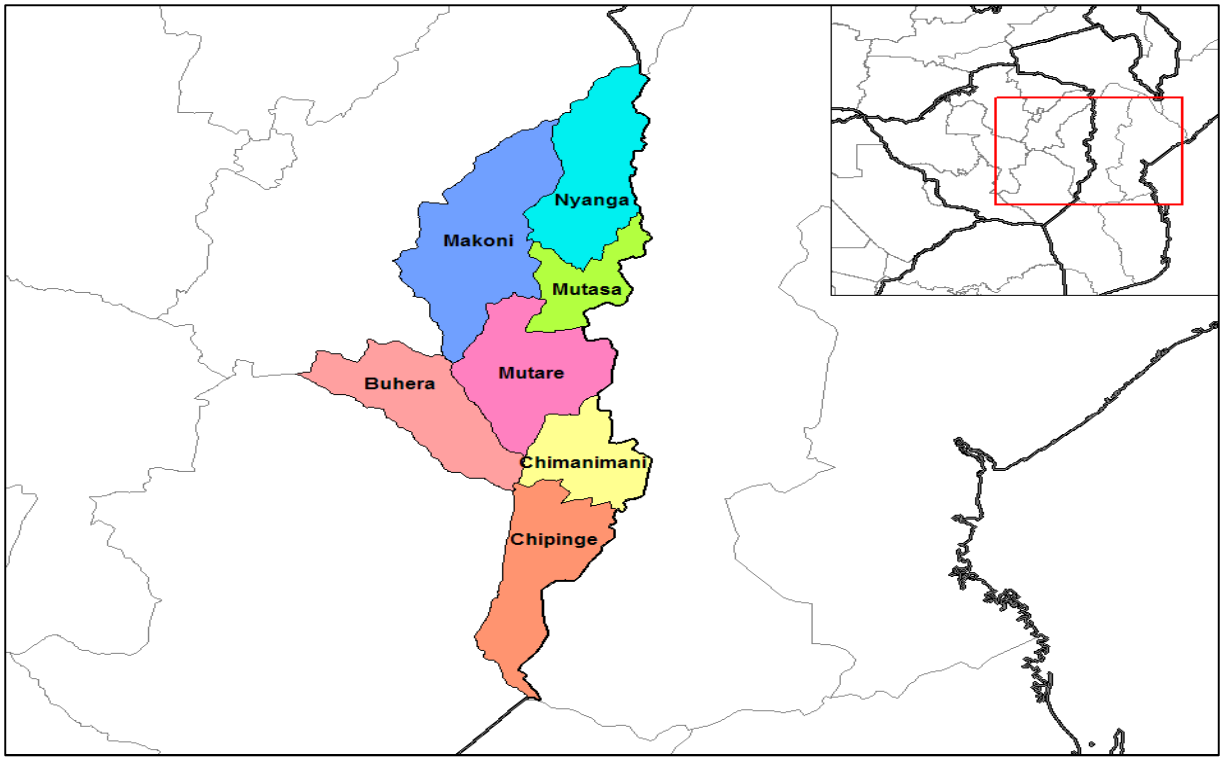

Figure 4.1 Map of districts (Mutasa in green colour) of Manicaland province in Zimbabwe (From Rarelibra, 2006).

Figure 4.2 Image showing part of the study area in Honde Valley

Figure 4.3 Favco extension officer giving advice to clients

Figure 4.4Tissue-cultured seedlings introduced by Favco (From Ariston Holdings Limited, n.d.).

4.2 Data collection

Two sample surveys were conducted between April and June 2014. The first was a representative sample of all households in the study area. A two-stage cluster sampling method was used to select these households (Appendix C). At the first stage of sampling, two of the five villages (primary stage units or PSUs) in the study area were selected with probability proportionate to an estimate of their size. These estimates were based on a physical count of households (secondary stage units or SSUs) in each village. Households in each of the selected villages were then listed and a simple random sample drawn from each list using a constant sampling fraction (20%). This approach produces a self-weighting sample that can be analysed as if it were a simple random sample. A total of 152 households were surveyed, representing almost 13% of the estimated 1177 households in the study area.

The second survey was a census survey of all new clients serviced by Favco in the study site. New clients were defined as those smallholders who, with the firm's assistance, planted tissue culture banana seedlings in 2012/13 to harvest an improved banana crop between January and June 2014. A total of 32 new clients were surveyed (N_{wc}=32). The samples together yielded 184 respondents. Of these, 94 were households that had been serviced by Favco (including the 32 'new' clients) and 90 were non-clients, i.e. n_c=94 and n_{nc}=90.

4.3 Questionnaire and data capture

A uniform and structured questionnaire (Appendix A) was administered in personal interviews with the *de facto* head of each sample household and with all new clients. The questionnaire gathered information on, *inter alia*: household characteristics and farm characteristics; farm enterprises, seasonal input purchases, and income from products sold in the 2013/14 season; use of advisory, market and other services provided by Favco and the season in which each of these services were first used by the household. It was intended to solicit information from clients on their willingness to pay for Favco's extension service but this question was removed in case it discouraged farmers from participating in the

survey. Data recorded in the questionnaires were captured in spreadsheet format and analysed using the Statistical Package for Social Sciences (SPSS 22, 2014). Descriptive statistics were computed for the household sample and these are presented in the following section.

4.4 Descriptive statistics for the household sample

The descriptive statistics presented in the following sections were computed from data gathered in the household sample survey (n_h=152) and therefore describe an average household in the study area.

4.4.1 Household demographics

Table 4.1 presents the mean value of variables measuring household demographics. Very few adults work off-farm. This reflects the relative importance of farming as a livelihood. The virtual absence of off-farm wage employment is also evident in the high proportion of male-headed households (86%). This contrasts with results from other studies of smallholders in parts of Southern Africa where men become migrant workers in towns and cities (Fenwick & Lyne, 1999; Kassie, Erenstein, Mwangi, La Rovere, Setimela, & Langyintuo, 2012). Although household heads are relatively young (46.6 years) and reasonably well educated (7.5 years of schooling), they have acquired substantial experience as farmers (13 years). Household composition is similar to that reported in other studies of Zimbabwean smallholders (Mushunje, 2005; ZimVac, 2013).

Table 4.1 Household demographics in the study area, 2014 (n_h = 152)

Variables	Mean	Standard error
Size of the household (persons)	5.3	0.24
Number of females	2.9	0.15
Number of males	2.5	0.14
Number of children (≤15 years)	2.3	0.15
Number of adults (16-65 years)	2.8	0.14
Number of pensioners (>65 years)	0.3	0.04
Number of school children	1.6	0.10
Number of adults working on-farm	2.6	0.15
Number of adults working off-farm	0.4	0.08
Age of the *de facto* head of the household (years)	46.6	1.22
Formal schooling completed by the *de facto* head of household (years)	7.5	0.25
Farming experience acquired by the *de facto* head of household (years)	13.0	1.03
Households with a male head (%)	86.0	3.00
Households with a male head responsible for farm management (%)	69.0	4.00

Source: Household survey, 2014

4.4.2 Farming operations

Table 4.2 summarises information about household farming operations including annual cash revenue from crop, fruit and livestock sales. These estimates are based largely on recall although many respondents were able to produce receipts and invoices to support their estimates of sales and expenditure. Bananas are by far the most important cash crop, accounting for 75% of farm cash earnings(Figure 4.5). Many authors view a shift from subsistence staples to high value cash crops (such as bananas) as essential for the improvement of rural livelihoods (Jayne, Yamano, Nyoro & Awuor, 2001; Davis, 2006; Fan, Brzeska, Keyser & Halsema, 2013). The small farmers in the study area have minimal revenue from livestock. Maize accounts for more land than any other crop but is grown largely for subsistence purposes (Kassie et al., 2012) and generates only 5% of farm cash earnings. The intensive nature of farming in the study area is reflected in low cattle numbers. Livestock do not make a significant contribution to farm earnings.

Figure 4.5Banana plantations in the study area (Honde Valley) (From FAO, 2014)

Figure 4.6 Favco helping clients to market their bananas

Table 4.2 Household farming enterprises in the study area, 2013/14 (n_h = 152)

Variables	Mean	Standard Error
Revenue from maize, legumes, tubers, vegetables and coffee (US$)	169.17	19.38
Revenue from maize (US$)	38.77	6.00
Revenue from bananas (US$)	645.10	99.34
Revenue from avocados (US$)	34.92	4.49
Revenue from livestock (cattle, goats, chickens & pigs) (US$)	22.95	6.20
Revenue from cattle (US$)	3.95	2.93
Revenue from goats (US$)	6.78	2.02
Total revenue from farming operations (US$)	864.66	100.16
Expenditure on farming inputs, labour and contractor services (US$)	286.41	35.17
Total area cultivated (hectares)	1.13	0.16
Area planted to maize (hectares)	0.48	0.03
Area planted to bananas (hectares)	0.45	0.04
Number of fruit trees	13.48	0.98
Number of cattle	0.78	0.20
Number of goats	2.86	0.23

Source: Household survey, 2014

4.4.3 Asset and wealth ownership

Table 4.3 presents the mean value of important household assets. Although livestock do not produce significant income, they account for the largest share of the estimated market value of these assets. In Southern Africa, smallholders keep cattle largely as a store of wealth (Doran et al., 1979; Bote, Mago, & Hofisi, 2014). Usually, farmers sell small livestock (goats and chickens)rather than cattle to meet their petty financial needs. Irrigation equipment also accounts for a large share of total asset value. The vast majority of households in the representative sample operated their own gravitational irrigation systems.

Table 4.3 Household asset and wealth ownership in the study area, 2014 (n_h = 152)

Variables	Mean	Standard Error
Value of livestock (cattle, goats, pigs and chickens) (US$)	421.76	70.49
Value of cattle (US$)	253.32	67.91
Value of goats (US$)	96.95	8.37
Value of farm improvements (e.g. fencing & irrigation) (US$)	253.94	35.36
Value of irrigation equipment (US$)	181.36	27.19
Value of farm moveable assets (e.g. ox plough and hoes) (US$)	75.27	7.00
Value of household moveable assets (e.g. TV & generator) (US$)	28.40	5.70
Total value of household and farm assets (US$)	779.37	95.39

Source: Household survey, 2014

It is interesting to note that farmers are increasingly owning television sets and generators despite the relatively low value in these assets (Table 4.3). This highlights the growing importance of entertainment, access to information and lighting to small farmers in the study area.

4.5 Chapter summary

This chapter provided an overview of the study area, data collection and the survey instrument. It also presented descriptive statistics computed for an average household in the study area. These statistics provide insight to household demographics, farming operations, and asset and wealth ownership. Banana production accounts for the largest contribution (75%) of total farm income. The *de facto* head of the household is relatively young and well-educated but nevertheless poor.

Chapter 5

Assessment of the outsourced extension service

5.1 Estimation of treatment effects

To assess the impact of a project in the absence of randomisation, it is important to compare similar households within the client (treatment) and non-client (control) groups (Rosenbaum & Rubin, 1983; Mendola, 2007; Khandker et al., 2010). In this study, propensity score matching (PSM) was used to identify a subset of client and non-client households similar in respect of observed family and farm characteristics that were unlikely to vary in the short-term. These variables included the age and gender of the household head; land and labour endowments per adult equivalent[1]; dependants per adult equivalent; per adult equivalent value of farm implements and tools owned before project intervention; and village location. A logit model was estimated to predict the probability (*P*i) that the ith household would use the extension service. Clients were then paired with non-clients that had similar *P*i using the PSM procedure available in SPSS version 22 (Field, 2009). The logistic regression model was statistically significant at the 1% level of probability with a Nagelkerke R^2 of 0.25. Land, labour and dependants were statistically significant and positive determinants of participation. Age was a statistically significant but negative determinant of participation. Village location was not an important determinant of participation. The PSM matched 76 pairs of clients and non-clients. Unmatched cases were excluded from the treatment and control groups

Univariate t-tests for the equality of means across these comparable groups of clients and non-clients revealed marked differences in variables measuring project outcomes. Table 5.1 presents estimates of farm cash income and costs per household and per household adult equivalent. The t-statistics, which test for differences in per adult equivalent group means (to control for differences in household size and composition), highlight large and statistically significant differences in crop revenue, crop net revenue, banana revenue,

[1] Adult equivalent = (no. of Adults + 0.5* no. of Children) $^{0.9}$. The power term 0.9 is included to capture size economies (Low, 1986)

expenditure on farming inputs and services, and levels of liquidity between client and comparable non-client households.

Table 5.1 Comparison of mean outcomes (n=152)

Outcome variables	Treatment (client) group (n=76)		Control (non-client) group (n=76)		t-statistic[1]
	Per adult equivalent	Per household	Per adult equivalent	Per household	
Revenue from all crops (US$)	351.31	1154.95	143.74	503.52	3.26 ***
Net revenue all crops (US$)	226.74	762.63	87.62	326.12	3.46 ***
Revenue from bananas (US$)	315.08	1031.61	84.93	323.24	3.64 ***
Cost of inputs & services (US$)	121.90	383.25	56.41	178.66	1.98 **
Revenue from livestock (US$)	6.81	25.92	9.50	19.54	0.40
Liquidity[2] (US$)	494.16	1572.44	251.73	841.87	2.90 ***

1 Tests for differences in per adult equivalent means.
2 Liquidity = revenue from farming operations plus the market value of cattle and goats.
***, **, * significant at 1%, 5% and 10% levels of probability respectively.

The results presented in Table 5.1 are encouraging but could be misleading as univariate tests do not account for observed and unobserved variables that affect outcomes but which are not related to the project. While the PSM accounted for observed characteristics that are unlikely to vary in the short-term, it excluded variables like prior investment in fencing and irrigation that could also influence participation. This study made use of the 'general treatment model' to control for the effects of these variables. Following Khandker et al. (2010, p.25), the impact of extension services on household outcomes can be measured by estimating the model:

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 X_i + \varepsilon i \quad \ldots\ldots\ldots\ldots (1)$$

where Y_i is an outcome observed for the ith household, T is a variable measuring the level of treatment, X is a vector of observed household and farm characteristics affecting the observed outcome, and ε captures random error and unobserved characteristics influencing the outcome.

Estimating the model by ordinary least squares (OLS) poses a problem because households are not randomly selected for treatment. The project area was selected for physical and climatic conditions that favour agriculture. Within the targeted areas, uptake of project services is voluntary but limited to farming households. Client selection was therefore biased by both observed and unobserved attributes resulting in endogeneity of the treatment variable. This problem can be addressed using two-stage least squares (2SLS) and appropriate instrumental variables (Khandker et al., 2010, pp. 88-90).

In the first stage, the treatment variable (T) is regressed on variables (X) and instruments (Z) that influence participation.

$$T_i=\lambda_0+\lambda_1 Z_i+\lambda_2 X_i+\mu_i \quad \text{..... (2)}$$

Ideally, instruments should be correlated with T but not with factors affecting Y. In this case, equation 2 was estimated as a logit model as T was recorded as a binary variable scoring 1 for (n=76) clients in the treatment group and 0 for (n=76) non-clients in the control group. Household and farm characteristics included in the PSM were omitted from the estimation of equation 2, and T was regressed on prior ownership of irrigation equipment, fencing and possession of a mobile phone (Appendix J). Fencing was viewed as an instrumental variable. Households that had fenced their cropland were considered more likely to participate in the project but fencing was not expected to influence outcomes of the outsourced extension service. The estimated logit model was statistically significant at the 1% level of probability, returned a Nagelkerke R^2 of 0.40 and correctly classified 78% of the 152 matched households into their known treatment and control groups. All of the explanatory variables, including the instrument, were statistically significant and positive determinants of treatment.

In the second stage, Y is regressed on $\check{T}$, the predicted value of T in equation 2, and other variables (X) thought to affect project outcomes. $\check{T}$ excludes the effects of unobserved variables that may influence both participation and outcomes, and thus embodies only exogenous variation in T. Table 5.2 lists the explanatory variables used to estimate the treatment model for each of the five significant outcome variables, and presents their

estimated regression coefficients (full results are presented in Appendices D to H).The treatment model was not estimated for livestock revenue as this outcome did not differ significantly between the treatment and control groups.

Table 5.2 Impact of the outsourced extension service on household outcomes (n = 152)

	Outcomes (US$/adult equivalent)				
Explanatory variables	**Net revenue from all crops**	**Revenue from all crops**	**Revenue from bananas**	**Inputs & services purchased**	**Liquidity**
Extension service (Ť)	209.60 ***	281.66 ***	320.84 ***	75.16 +	293.21 **
Age of farmer	-2.55	-2.95	-2.82	-0.29	-0.36
Gender (1=male)	-31.67	-73.84	-57.59	-35.86	28.41
Education (years)	-2.43	-3.31	-6.51	-0.45	11.64
Experience (years)	6.41 ***	8.15 ***	6.62 **	2.04	17.12 ***
Land/adult equiv. (Ha)	297.98 ***	726.42 ***	683.54 ***	433.59 ***	975.74 ***
Labour/adult equiv. (#)	-27.25	26.18	37.84	48.91	-169.69
Constant	55.63	-52.96	-91.29	-122.63	-241.58
F-statistic	5.01 ***	7.80 ***	6.89 ***	7.92 ***	10.20 ***
Adjusted R^2	0.16	0.24	0.22	0.24	0.30

***, **, *, + significant at 1%, 5%, 10% and 15% levels of probability respectively.

All of the regression models were statistically significant at the 1% level of probability. There was no evidence of severe multicollinearity as most of the explanatory variables, including exposure to the extension service (Ť), had Variance Inflation Factors (VIFs) close to unity. Age and farming experience exhibited modest collinearity with VIFs of 1.5 and 1.8 respectively (Gujarati, 2004, p. 362). The impact of the outsourced extension service at household level is measured by B_1, the regression coefficient estimated for Ť. A positive and statistically significant coefficient indicates that the extension service had a positive impact on the outcome. The standard errors of these coefficients were corrected for the two-stage process using the method described by Gujarati (2004, p. 791).

The results presented in Table 5.2 indicate that the outsourced extension service had a positive impact on household crop income, adding per adult equivalent amounts of US$210 to net crop revenue, US$282 to crop revenue and US$293 to household liquidity.

Expenditure on crop inputs and services increased by US$75 (t-value=1.45) per adult equivalent. This bodes well for local economic growth as the local growth multiplier associated with increased agricultural earnings is expected to be in the order of 1.8 (Hendriks & Lyne, 2003).The cash gains generated by the extension services investigated in this study were driven largely by commercial production of bananas.

Only two of the household and farm characteristics that influenced participation (namely, the farmer's experience and the household's land endowment) also influenced the outcomes presented in Table 5.2. Access to land and the efficiency of the land rental market are clearly important issues in promoting farm incomes and local economic growth. Empirical evidence from southern Africa shows a strong positive relationship between productive use of farmland, the efficiency of the land rental market and measures of land tenure security (Lyne, 2009).

5.2 Additional benefits perceived by clients

Other benefits perceived by client household (n_C=94) were also considered. Table 5.3 presents the incidence of clients that attributed improvements in socio-economic indicators to the outsourced extension service. Clearly, the vast majority of clients perceived improvements in household food security, quality of diet, health, access to support networks, ability to cope with social setbacks, savings and child education. In addition, more than 95% of clients perceived improvements in the quality of their produce (appearance, size and storability) and farm inputs, and in yields achieved for their main cash crops.

On a Likert-type scale of 1 (poor) to 5 (highly satisfactory), these clients rated their overall satisfaction with Favco's agricultural extension service as 4.4. Almost 60% of the clients claimed that they had spent more on labour since becoming clients, and the mean number of permanent jobs created per client was 2.5.

Table 5.3 Additional benefits perceived by clients (n_c=94)

Outcomes	Percentage of clients that perceived: a reduction	no change	an increase
Household food security	0	5.0	95.0
Quality of family's diet	0	5.0	95.0
Family health	0	6.0	94.0
Access to support networks	0	6.0	94.0
Ability to cope with social setbacks like ill-health and death	1	10.0	89.0
Household savings	0	14.0	86.0
Child education	1	16.0	83.0

Source: Household survey, 2014

Improvements in food security and quality of diet were scored the highest by the clients. This is not surprising as the project raised the production of both food and cash crops. Increased incomes also means improved access to healthy diets. It is encouraging that the clients reported improvement in household savings. This is contrary to most purely subsistence rural households in developing nations (FAO, 2003) that have nothing to keep as savings. The project did well to improve child education in the study area. Some respondents admitted that they failed to send their children to school before the project intervention. This is consistent with most rural areas of Zimbabwe where most of the poor farmers fail to pay for their children to go to school (Schuetze, 2014).

5.3 Financial cost and benefit analysis of Favco's extension service

An estimate of the 'without project' net cash farm income can be computed for the study area as $\hat{Y}_0=N(\ddot{y}_C)$, where N is the total number of households counted in the study area and $\ddot{y}_C$ is the mean net cash income computed for households in the control group. Given a total population of N=1177 (Section 4.2) for households in the study area, and net crop (including bananas) revenue of US$326.12 per household in the control group (Table 5.1), the 'without project' net cash farm income for the study area is estimated as:

$\hat{Y}_0 = N(\ddot{y}_C) = 1{,}177(US\$326.12) = US\$383{,}843$

Cash earned from livestock was excluded from this estimate as livestock revenue was not impacted by Favco's extension service (Section 5.1). The 'with project' net cash farm income can be estimated as:

$$\hat{Y}_1 = N\alpha(\ddot{y}_T.M) + N(1-\alpha)\ddot{y}c \quad \ldots\ldots\ldots\ldots (3)$$

where $\ddot{y}_T$ is the mean net cash farm income computed for client households in the treatment group, M is an estimate of the local economy multiplier, and α represents the fraction of new Favco clients in the study area. From Table 5.1, the mean net crop revenue for client households is $\ddot{y}_T$ = US$762.63. The multiplier was taken as M = 1.8, which is consistent with local growth multipliers reported by Hendriks and Lyne (2003) for neighbouring Zambia (1.82). The fraction of new Favco clients identified in the household sample was α = 0.099 (fifteen of the clients identified in the representative sample of 152 households were new clients). From equation 3, the 'with project' net cash farm income for the study area is estimated as:

$\hat{Y}_1$ = $N\alpha(\ddot{y}_T.M) + N(1-\alpha)\ddot{y}c$ = [(1,177*0.099*US$762.63*1.8)]+[1,177(1-0.099)*US$326.12]
= US$434,707

From equation 3, if α = 0 (i.e. there are no new clients) then $\hat{Y}_1 = \hat{Y}_0$ and there is no estimated incremental benefit from Favco's extension service. Clearly, the true value of Y_1 would exceed $\hat{Y}_1$ if 'old' clients experienced gains as a result of new information and services provided by Favco in 2013/14. $\hat{Y}_1$ is therefore a conservative estimate of financial benefits generated by the project as it understates true Y_1 in the presence of such dynamic productivity gains. It follows that $\hat{Y}_1$-$\hat{Y}_0$ (=US$50,863) provides a conservative estimate of the incremental financial (i.e. private) benefit of Favco's extension service in the study area for the 2013/14 season. Consequently, the net incremental financial benefit of these services can be conservatively estimated as $\Delta_{PB} = (\hat{Y}_1-\hat{Y}_0)-C$, where C is the cost to the donor of the support that Favco provided in the study area from September 2013 to August 2014. Fintrac estimated this cost as US$39,276 in 2013/2014 (M. Chirima, personal communication,

December 09, 2014)[2]. The net incremental financial benefit of Favco's extension service in the study area is therefore conservatively estimated as approximately US$11,587 (=US$50,863–US$39,276), a return of 30% on investment for the 2013/14 crop year.

Considering that Favco had serviced only 40% of households in the study area, with just one quarter of these clients added during the 2014/14 season, it is conceivable that this financial benefit could be reaped for several years to come as the services are extended to more households. Moreover, Section 5.2 suggests a host of additional benefits that should be taken into account, such as improvements in food quality, better diets and family health, and pro-poor employment creation.

[2]Field Manager, Fintrac Inc.

Chapter 6

Conclusions and recommendations

This chapter provides a brief summary of the study (Section 6.1), its conclusions and recommendations (Section 6.2). The final section (6.3) outlines limitations of the research and proposes potential areas for future research.

6.1 Summary

The agricultural extension system in Zimbabwe is pluralistic. Zimbabwe is one of several countries in sub-Saharan Africa experimenting with outsourcing models in which donors and/or governments are funding the delivery of extension services by private service providers (for example NGOs, private firms, and farmer organisations) in order to improve cost efficiency and effectiveness.

There is a strong demand for extension services in Zimbabwe where the vast majority (70%) of farmers are small semi-commercial producers. The extension system in Zimbabwe is largely funded by the treasury but significant supplementary funding from donors for specific agricultural programmes occurs. Donors contract private service providers to deliver a range of extension services in specific project areas. However, little is known about the impact or value-added by outsourced small farmer extension services. The study assessed the impact of an outsourced extension service on rural households in the Mutasa district of Zimbabwe's Manicaland province, and examined the financial cost and benefit of this service.

The outsourced extension service was delivered by a local agribusiness firm (Favco) and funded by USAID. Some of the key extension services delivered by Favco included training and advice on farming practices (especially bananas and subsistence crops); provision of loans for seasonal farm inputs; help accessing markets; and the introduction of 'new technologies' such as the use of tissue culture seedlings.

The study analysed survey data for the 2013/14 season collected in June 2014 from 94 client and 90 non-client rural households representative of rural households in parts of the Mutasa district where the firm is very active. A uniform structured questionnaire was administered in personal interviews and provided information on, *inter alia*: household characteristics and farm characteristics; farm enterprises, seasonal input purchases, and income from products sold in the 2013/14 season; use of advisory, market and other services provided by Favco; and the season in which each of these services were first used by the household.

Descriptive information provided a wealth of information about the demographics, farming operations and asset ownership of a representative household in the study area. The majority of the households were male-headed, and the household head was relatively young and well educated but nevertheless poor. The households earned the bulk of their total farm earnings from bananas, and maize (a staple crop) accounted for the majority of the total farming area. Households kept cattle largely as a store of wealth. The vast majority of the households in the study area have their own gravitational irrigation systems.

Propensity score matching was used to identify an appropriate control group within the group of non-clients. Descriptive statistics were compared across the control and client groups, and showed significant differences in mean outcomes. The contribution of the extension service to these differences in household outcomes was identified using a general treatment model estimated with 2SLS and instrumental variables to control for selection bias. The results showed that the outsourced extension service contributed significantly to household crop income, net crop income and expenditure on farm inputs and services. In addition, the vast majority of clients perceived a range of socio-economic benefits such as better diets and health, improved product quality and job creation. Analysis of the financial cost and benefit of the extension service in the study area suggested a 30% return on the investment made by the donor to finance this service.

6.2 Conclusions and recommendations

Participation in Favco's extension service was positively influenced by the household's land and labour endowment, investment in irrigation and fencing, and possession of a mobile telephone. It was estimated that the extension service added per adult equivalent amounts of US$282 and US$75 to crop revenue and expenditure on crop inputs and services respectively. The data also suggest that the outsourced extension service produced other socio-economic benefits like improved food quality and food security. However, there was no evidence of increased livestock revenue.

While these findings support the view that agricultural extension services play an important role in raising farm incomes and creating employment opportunities in poor rural areas, they also highlight the need for an efficient land rental market to alleviate farm size constraints, for rural health services to alleviate labour constraints, for telecommunication services, and for smallholder access to capital to finance improvements like irrigation and fencing. In turn, secure land tenure is required for an efficient land rental market and to strengthen incentives for investment in improvements. In the absence of these fundamentals, even well-resourced extension services will be less effective and less pro-poor than they should be.

An analysis of the financial cost and benefit of the outsourced extension service in the study area suggests an annual net incremental benefit of US$11,587, representing a 30% return on the investment made by a donor to finance the service - even when the socio-economic benefits are disregarded. These results suggest that there is good reason for donors to continue funding effective extension services to small farmers in areas of high agricultural potential such as the Mutasa district.

6.3 Limitations and future research

The findings of this research are based on data collected from one district. Since outsourced extension services are widespread throughout the country, the study should be replicated in other districts of Zimbabwe.

Future studies could also attempt to assess the separate impact of each component of the services delivered to households, particularly those components relating specifically to new technology (e.g. the tissue-cultured seedlings in this study) and improved access to markets using a 'willingness to pay' approach.

This research is built on data observed in a single year (October 2013 to September 2014). Panel data recorded over time would allow for more accurate estimation of both household impact and financial returns to outsourced extension services.

References

Akroyd, H. D. (2003*). Agriculture and Rural Development Planning*. Aldershot, England: Ashgate Publishing.

Alage, A. and Nhancale, I. (2010). An overview of public extension services in Mozambique. In W.H. Kimaro, L. Mukandiwa and E.Z.J. Mario (Eds.), Towards improving agricultural extension service delivery in the SADC Region: Proceedings of the Workshop on Information Sharing among Extension Players in the SADC Region, 26–28 July 2010. Dar es Salaam, Tanzania. Retrieved from http://www.sadc.int/fanr/agricresearch/icart/inforesour

Alex, G., Zijp, W. and Byerlee, D. (2002). Rural extension and advisory services: New directions. Rural development strategy background paper No 9. Washington: World Bank.

Anderson, J. R. and Feder, G. (2004). Agricultural extension: Good intentions and hard realities. *The World Bank Research Observer*, *19*(1), 41-60. Washington: World Bank.

Anseeuw, W., Kapuya, T. and Saruchera, D. (2012). Zimbabwe's agricultural reconstruction: Present state, ongoing projects and prospects for reinvestments. Development Bank of Southern Africa, Halfway House.

Ariston Holdings Limited. (n.d.). *Social responsibility*. (Photograph) Retrieved December, 2014, from http://www.ariston.co.zw/social-responsibility.html

Bebbington, A. and Sotomayor, O. (1998). Case study: Agricultural extension in Chile. In J. Beynon, S. Akroyd, A. Duncan and S. Jones (Eds.), *Financing the Future: Options for Agricultural Research and Extension in Sub-Saharan Africa*. Oxford. Oxford Policy Management.

Bembridge, T. (1987). Agricultural extension in the less developed areas of Southern Africa. *Agricultural Administration and Extension, 27*(4), 245-265.

Benin, S., Nkonya, E., Okecho, G., Pender, J., Nahdy, S., Mugarura, S., …Kayobyo, G. (2007). Assessing the impact of the national agricultural advisory services in the Uganda rural livelihoods. IFPRI Discussion Paper 724. Washington, DC: International Food Policy Research Institute.

Birkhaeuser, D., Evenson, R.E. and Feder, G. (1991). The economic impact of agricultural extension: *Economic Development and Cultural Change,39*(3), 607-650.

Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J., ...Kisamba-Mugerwa, W. (2006). From 'best practice' to 'best fit': A framework for designing and analysing pluralistic agricultural advisory services. Research Brief 4. Washington, D.C.: International Food Policy Research Institute. Retrieved from www.ifpri.org/sites/default/file.

Bote, D., Mago, S., and Hofisi, C. (2014). Innovative rural financing in Zimbabwe: A case of cattle banking. *International Business & Economics Research Journal (IBER)*, *13*(4), 815-822.

Carney, D. (1998). Changing public and private roles in agricultural service provision. Working Paper. London: Overseas Development Institute, Natural Resources Group.

Chapman, R. and Tripp, R. (2003). Changing incentives for agricultural extension. A review of privatised extension in practice. AgREN network paper 132. London. Oversees Development Institute, Agricultural Research and Extension Network. Retrieved from http:// www.odi.org.uk/agren/papers/agrenpaper.

Chema, S., Gilbert, E. and Roseboom, J. (2003). A review of key issues and recent experiences in reforming agricultural research in Africa. Research Report No. 24. The Hague. ISNAR. Retrieved from www.isnar.cgiar.org/publications/pdf/rr-24.pdf.

Davis, J. (2006). How can the poor benefit from the growing markets for high value agricultural products? Retrieved fromhttp://www.fao.org/docs/eims/upload/210971/global_issues_paper.pdf.

Delgado, C., Hazell, P., Hopkins, J. and Kelly, V. (1994). Promoting intersectoral growth linkages in rural Africa through agricultural technology and policy reform. *American Journal of Agricultural Economics*, *76*, 1166-1177.

Delgado, C.L, Hopkins, J. and Kelly, V.A. (1998). *Agricultural Growth Linkages in sub-Saharan Africa*. Washington: International Food and Policy Research Institute.

Development Technology Unit (1991). Assessment of the potential for non-motorised irrigation of small farms from streams in Manicaland, Zimbabwe (Working paper number 32). Coventry: Warwick University.

Doran, M. H., Low, A. R. C., and Kemp, R. L. (1979). Cattle as a store of wealth in Swaziland: Implications for livestock development and overgrazing in Eastern and Southern Africa. *American Journal of Agricultural Economics*, *61*(1), 41-47.

Fan, S., Brzeska, J., Keyzer, M., and Halsema, A. (2013). From subsistence to profit: Transforming smallholder farms (Vol. 26). Retrieved from www.ifpri.org/sites/default/files/publications/pr26.pdf.

FAO (2003). WTO agreement on agriculture: The implementation experience-Developing country case studies. Retrieved from http://www.fao.org/docrep/005/y4632e/y4632e0y.htm#bm34

FAO (2014). *Banana boom improves food, nutrition and income security for small farmers in Zimbabwe*. (Photograph) Retrieved from http://www.fao.org/in-action/banana-boom-improves-food-nutrition-and-income-security-for-smallholder-farmers-in-zimbabwe/en/

Farrington, J. (1994). Public sector agricultural extension: Is there life after structural adjustments. London: Oversees Development Institute, Natural Resources Perspectives. Retrieved from http://www.odi.org.uk/resources/docs/2987.pdf.

Feder, G., Birner, R. and Anderson, J.R. (2011). The private sector's role in agricultural extension systems: Potential and limitations. *Journal of Agribusiness in Developing and Emerging Economies, 1*(1), 31-54.

Feder, G., Willet, A. and Zijp, W. (1999). *Agricultural Extension: Generic Challenges and Some Ingredients for Solutions*. Rome: World Bank.

Fenwick, L. J., and Lyne, M.C. (1999). The relative importance of liquidity and other constraints inhibiting the growth of small-scale farming in KwaZulu-Natal. *Development Southern Africa, 15*(3):141–55.

Field, A. (2009). *Discovering Statistics Using SPSS*. Sage publications.

Foti, R., Nyakudya, I., Moyo, M., Chikuvire, J. and Mlambo, N. (2007). Determinants of farmer demand for 'fee-for-service' extension in Zimbabwe: The case of Mashonaland Central province. *Journal of International Agricultural and Extension Education, 14*(1), 95-104.

Gittinger, J.P. (1984). *Economic Analysis of Agricultural Projects*. Economic Development Institute. Washington: World Bank.

Global Forum for Rural Advisory Services. (2012). Fact sheet on extension services (Position Paper: June 2012). Lindau, Switzerland: GFRAS. Retrieved from http://www.farmingfirst.org/wordpress/wp-content/uploads/2012/06/Global-Forum-for-Rural-Advisory-Services_Fact-Sheet-on-Extension-Services.pdf.

Government of Zimbabwe (GoZ) and FAO (2011). Country programme framework 2012-2015. Retrieved from ftp://ftp.fao.org/TC/CPF/Countries/Zimbabwe/CPF_ZIM_2012-2015.pdf.

Griffith, G. and Figgis, H. (1997). Outsourcing and the public sector. Briefing Paper 22/97. Sydney, Parliament of New South Wales.

Gujarati, D. N. (2004). *Basic Econometrics*. New York: McGraw-Hill.

Gwaradzimba, V. (2011, November 21). Strategies for resuscitating Zimbabwe's agriculture. Retrieved from http://www.entrepreneurshipafrica.com/business-resources/experts/strategies-for

Hanyani-Mlambo, B.T. (2002). Strengthening the pluralistic agricultural extension system: Zimbabwean case study. Rome: FAO. Retrieved from http://www.fao.org /fileadmin/temp.

Heemskerk, W., Nederlof, S. and Wennick, B. (2008). Outsourcing agricultural advisory services. Enhancing rural innovation in sub-Saharan Africa. Bulletin 380. KIT Publishers: Amsterdam. Retrieved from http://www.kit.nl/net/KITPublicitiesoutput/ShowFile2.aspx?e.

Hendriks, S. L., and Lyne, M. C. (2003). Expenditure patterns and elasticities of rural households sampled in two communal areas of KwaZulu-Natal. *Development Southern Africa, 20(1)*, 105-127.

IFPRI (n.d.). Agricultural extension and advisory services worldwide: Eastern Africa. Sub-regional advisory systems and services. Retrieved from http://www.worldwide-extension/.

Jayne, T. S., Yamano, T., Nyoro, J., and Awuor, T. (2001). Do farmers really benefit from high food prices? Balancing Rural Interests in Kenya's Maize Pricing and Marketing Policy. Tegemeo Agricultural Monitoring and Policy Analysis Project Draft (Working paper number 2B). Nairobi: Egerton University.

Kassie, G. T., Erenstein, O., Mwangi, W., La Rovere, R., Setimela, P., and Langyintuo, A. (2012). Characterization of Maize Production in Southern Africa: Synthesis of CIMMYT/ DTMA Household Level Farming System Surveys in Angola, Malawi, Mozambique, Zambia and Zimbabwe (Socio-Economics Program Working Paper 4). Mexico, D.F.: CIMMYT.

Khandker, S.R., Koolwal, G.B. and Samad, H.A. (2010). *Handbook on Impact Evaluation: Quantitative Methods and Practices*. Washington: World Bank.

Kiboko (n.d.) Farmers field day at a fertiliser demonstration in Dareda Tanzania. (Photograph) Retrieved from http://www.kiboko.nl/index.php?option=com_content&task=view&id=34&Itemid=61

Kidd, A. D., Lamers, J. P. A., Ficarelli, P. P., and Hoffmann, V. (2000). Privatising agricultural extension: Caveat emptor. *Journal of Rural Studies*, *16*(1), 95-102.

Low, A. (1986). *Agricultural development in Southern Africa: farm household-economics and the food crisis*. London: James Currey.

Lyne, M.C. (2009) Institutional change to promote a rental market for cropland in the communal areas of KwaZulu-Natal, South Africa. In J.F. Kirsten, A.R. Dorward, C. Poulton and N.Vink,(Eds.), *Institutional Economics Perspectives on African Agricultural Development*. Washington D.C.: IFPRI: 359-373.

Mendola, M. (2007). Agricultural technology adoption and poverty reduction: A propensity-score matching analysis for rural Bangladesh. *Food Policy*, *32*(3), 372-393.

Ministry of Finance. (2011). Zimbabwe budget estimates for the year ending December 31, 2012. Presented by the Minister of Finance on Thursday, 24 November 2011. Harare.

Moyo, S. (2011). Three decades of agrarian reform in Zimbabwe. *The Journal of Peasant Studies*, 38(3) 493-531. doi: 10.1080/03066150.2011.583642.

Mtisi, J., P. (March 2003). Green harvest: The out grower tea leaf collection system in the Honde Valley, Zimbabwe. Retrieved from www.fao.org/uploads/media/Green%20Harvest_%20The%.

Mushunje, A. (2005). Farm effi1010ciency and land reform in Zimbabwe. (Doctoral thesis). Retrieved from http://hdl.handle.net/10353/98.

Oladele, O.I. (2011). Agricultural extension policy: The missing link in innovations in extension and advisory services. Innovations in extension and advisory services, International Conference. Nairobi. Retrieved from http://www.slideshare.net/ctaspace.

Owens, T., Hoddinott, J. and Kinsey, B. (2003). The impact of agricultural extension on farm production in resettlement areas of Zimbabwe. *Economic Development and Cultural Change, 51*(2), 337-357.

Qamar, M.K. (2005). Modernizing national agricultural extension systems: A practical guide for policy makers of developing countries. Research, Extension and Training Division. Sustainable Economic Development. Rome. FAO. Retrieved from www.fao.org /fileadmin/templates/tc/tce/pdf/zimbabwe_planofaction 2010.

Rarelibra (2006). Map of the districts of Manicaland province of Zimbabwe. Retrieved from http://commons.wikimedia.org/wiki/File:Manicaland_districts.png

Rivera, W. M., and Qamar, M. K. (2003). *Agricultural Extension, Rural Development and the Food Security Challenge*. Rome: Food and Agriculture Organization of the United Nations.

Rivera, W.M. and Alex. G. (2002). Contracting for agricultural extension: Review and analysis of diverse public/private contracting arrangements worldwide. 22 Annual conference proceedings. Clearwater beach Florida. AIAEE. Retrieved from http://www.aiaee.org/proceedings/101-2006-clearwater-beach-florida.

Rogers, E. M. (1976). New product adoption and diffusion. *Journal of Consumer Research*, 290-301.

Rosenbaum, P. R., and Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika*, *70*(1), 41-55.

Saravanan, R. (Ed.). (2008). *Agricultural Extension: Worldwide Innovations*. New Delhi: New India Publishing Agency. Retrieved from http://www.saravananraj.net/index. php?option.

Saravanan, R. (Ed.). (2010). *ICTs for Agricultural Extension: Global Experiments, Innovations and Experiences*. New Delhi: New India Publishing Agency.

Schuetze, S.F. (2014, November 23). *Bringing Education to African Girls*. New York Times. Retrieved from http://www.nytimes.com/2014/11/24/world/africa/bringing-education-to-african-girls.html?_r=1

Schwartz, L. A. (1994). The role of the private sector in agricultural extension: Economic analysis and case studies. Network Paper 48. London: Overseas Development Institute.

Scoones, I., Marongwe, N., Mavedzenge, B., Mahenehene, J., Murimbarimba, F. and Sukume, C. (2010). *Zimbabwe's Land Reform: Myths and Realities*. Oxford: James Currey Press.

SPSS (2014). *Statistical Package for Social Sciences. SPSS 22.0 Student Version (SPSS 22, 2014). IBM Company Headquarters, Chicago, Illinois: SPSS Inc.*

Stack, J. (2004). Using secondary data. In K. Muir-Leresche, R. Coeand A. Ekwamu (Eds.), Graduate environmental and agricultural research: A guide to effectiveness and relevant graduate research in Africa. Kampala, Uganda: RUFORUM. Retrieved from http://www.ruforum.org/sites/default/files/GEAR/chapters/GEAR_3.3.pdf.

Sulaiman, V.R. and Hall, A.J. (2002). Beyond technology dissemination: Reinventing agricultural extension. *Outlook on Agriculture*, 31(4), 225-233.

Swanson, B.E. and Rajalahti, R. (2010). Strengthening agricultural extension and advisory systems: Procedures for assessing, transforming and evaluating extension systems. Washington. World Bank.

Umali-Deininger, D. (1997). Public and private agricultural extension: Partners or rivals. Washington. *World Bank Research Observer, 12*(2), 203-224.

World Bank. (2006). Enhancing agricultural innovation: How to go beyond the strengthening of research systems. Washington: World Bank, Agricultural and Rural Development Department.

Zimbabwe Vulnerability Assessment (ZimVac). (2013). Rural livelihoods assessment. Retrieved from http://reliefweb.int/132FD1C8-2C8C-4811-AFE7-DD963A62C46C/FinalDownlo.

Appendices

Appendix A: Household questionnaire used for Honde Valley (Mutasa district) respondents

LINCOLN UNIVERSITY (CANTERBURY – NEW ZEALAND)
FACULTY OF COMMERCE (INTERNATIONAL RURAL DEVELOPMENT)

FAVCO RURAL IMPACT ASSESSMENT HOUSEHOLD SURVEY

INFORMED CONSENT AND DECLARATION

This survey is part of a research project titled "The financial costs and benefits of outsourced agricultural extension services in Zimbabwe and their policy implications. A research student **Mr Munyaradzi Machila**(Munyaradzi.Machila@lincolnuni.ac.nz) is conducting the work under the supervision of Associate Professor **Michael Lyne** (Michael.Lyne@lincoln.ac.nz) and Dr **Peter Nuthall** (Peter.Nuthall@lincoln.ac.nz) (both from Lincoln University, Faculty of Commerce). The purpose of the research is to evaluate extension services contracted to a private service provider (Favco) in order to inform the policy debate about outsourcing. Potential benefits of extension services may improve over the longer term as a result of this study. Participation in this survey is voluntary, and the respondent is free to withdraw at any time. Individual responses will be treated confidentially. In this regard, the identity of the interviewee or his/her household will be coded during the analyses to preserve anonymity. The survey interview is expected to take about 80 minutes.

The results of the research will be published without references to the name of the respondents or the organisations they work for. These organisations will be named in an unpublished thesis and will be available on-line if it meets the requirements of a Masters Degree at Lincoln University. Copyright to the thesis resides with the researcher.

Should you have any question regarding the nature of the survey please contact the Supervisor or Researcher at the addresses listed above or call the Researcher at +263773772372.

Please express your full consent to participate in this survey by writing your name and signing below.

I…… (Full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project. I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Signature:.....Date:.....

SURVEY QUALITY CONTROL

District: Mutasa Ward.....	Respondent is the Head of household (**Y** or **N**): ……if no, what position do the respondent have in the household ……	Duration of interview…….hrs ……minutes

Is the respondent a client of Favco (Y or N)?
.....

Enumerator's Name:.....Signature:.....Date:.....

A. HOUSEHOLD CHARACTERISTICS

A1. Size of household (family or relatives who sleep here every day or at least on the weekends)

Total	Male	Female	≤ 15 years	16 – 65years	≥ 66years	Attend school	Working on farm	Working off-farm	Studying off-farm

A2. Information on the household head and of the person responsible for farming activities in the household

	Age	Gender	Years of formal schooling	Years of farming experience
Household head				
Farmer*				

* Person responsible for farm management if <u>not</u> the household head.

A3. Are you a member of a farmer group association or cooperative? (Y or N).....

3.1 If yes, name of the farmer group/organisation(s)?.....

3.2 What is the main activity of the farmer group/organisation?

Organisation 1……..

Organisation 2……..

3.3 Do you or any member of this household play a leadership role in these groups/ organisation(s)? **(Y or N)**……if yes what leadership role do they have……..

B. FARM ENTERPRISE(S)

B.1 Crops produced and revenue generated in the **2013/14** season (October 2013 – end of July 2014)

Crops grown (excluding fruit trees)	Planted **Y** or **N**	Main reason for planting (a)	Approximate area planted (Specify unit e.g. 1/10 ha)	Total revenue from sales (US dollars)	Sold to (b)
Maize					
Bananas					
Field (kidney) beans					
African/Bambara groundnut					
Tea					
Coffee					
Sweet potatoes					
Magogoya/Madhumbe					
Green vegetables					
Totals (for office use)					

(a) 1 = only for household consumption, 2 = mainly for household consumption, 3 = equally for household consumption and cash income, 4 = mainly for cash income, 5 = only for cash income.

(b) 1 = neighbours, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside marketing 4 = village markets 5 = Favco, 6= other produce buyers (formal companies), 7=City market

B.2 **Inputs used** for crops produced in the **2013/14** season (October 2013 – end of July 2014)

Input	Used **Y** or **N**	Total cost US$
Purchased fertilizer		
Purchased manure		
Purchased chemicals for crops		
Purchased maize seed		
Purchased banana seedlings		
Purchased bean seed		
Other purchased inputs:		
Hired labour		
Hired tractor and equipment		
Hired draught oxen for ploughing		
Hired transport for inputs		
Hired transport to product market		
Other hiring costs:		

B.3 Fruits produced in the **2013/14** season (October 2013 – end of July 2014)

Fruits produced	Planted **Y** or **N**	Main reason for planting (a)	Number of fruit trees	Total revenue from sales (US$)	Sold to (b)
Mangoes					
Avocados					
Apricots					
Guava					
Lemons					
Oranges					
Totals (for office use)					

(a) 1 = only for household consumption, 2 = mainly for household consumption, 3 = equally for household consumption and cash income, 4 = mainly for cash income, 5 = only for cash income.

(b) 1 = neighbours, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside marketing 4 = village markets 5 = Favco, 6= other produce buyers (formal companies), 7= City market

B.4 Livestock

Livestock and livestock products	Cattle	Goats	Pigs	Chickens	sheep	Other (specify)
Number currently owned by all household members						
Approximate value of livestock (US$)						
Total income from animal sales during past year (US$)						
Total income from product sales *e.g.* eggs, manure, milk, etc. in the past year (US$)						

B.5 Fixed improvements

Improvement	Present (**Y** or **N**)	Estimate of market value (US$)	For Favco clients only
			Acquired ***before*** or ***after*** Favco
Irrigation			
Fencing for crops			
Crop storage silo			
Water tanks			
Chicken house			
Other (specify)			

B.6 Farm Assets

Asset	Do you own it? (**Y** or **N**)	Estimate of market value (US$)	For Favco clients only
			Acquired ***before*** or ***after*** Favco
Tractor			
Harrow			
Trailer			
Ox-plough			
Knapsack sprayer			
Wheelbarrow			
Shovel			
Hoes			
Others (specify)			

B.7 Household Moveable Assets

Household Asset	Do you own it? (**Y** or **N**)	Estimate of market value (US$)	For Favco clients only
			Acquired ***before*** or ***after*** Favco
Vehicle			
Fridge/Freezer			
Television			
Generator			
Radio			
Cell phone			
Solar charging system			

B.8

(a) Were the prices of your commercial crops higher or lower as compared to the previous seasons?

Very Low	Low	No change	High	Much higher

(b) Were the yields of your main commercial crops higher or lower compared to previous seasons?

Very Low	Low	No change	High	Much higher

C. EXTENSION SERVICES

C.1a What extension services have you (person responsible for farm management) used or benefited from since 2011

Service	**Govt.**	**Favco**			**Other (Specify)**
		2011/12	**2012/13**	**2013/14**	
Advice or training about crop or livestock production? (**Y** or **N**)					
Advice or training on irrigation and equipment maintenance (Y or N)					
Training on business development services (Farming as a business)? (Y or N)					
Help to access inputs like seed, fertiliser and chemicals? (**Y** or **N)**					
Help to sell farm products? (**Y** or **N**)					
Help to access loans or credit from Microfinance Institutions, Banks or Lenders for inputs procurement or on-farm investments? (**Y** or **N**)					

C.1b How many times in the 2013/2014 season did you receive advice/training by Favco?* .....

*0 = Never, 1 = once in a year, 2 = once in six months, 3 = once in a month, 4 = more than once a month.

C.2 Did you ever attempt to produce a crop for commercial purposes without the help of extension services? (**Y** or **N**) .....

C.3 If you have <u>not</u> used or benefitted from Favco's extension services:

(a) Have you ever heard of Favco? (**Y** or **N**)
.....

(b) Have you ever heard of Favco's agricultural extension programme "ZimAIED"? (**Y** or **N**) .....

(c) If yes, have you ever considered using Favco's services? (**Y** or **N**) .....

(d) If yes, are there reasons why you still have not used Favco's services?

(i).....

(ii).....

(iii).....

D. FAVCO CLIENTS

WHEN DID YOU BECOME A CLIENT OF FAVCO? MONTH …….. YEAR ……

D.1 In your opinion: (tick the appropriate response)

	Less than normal	Nothing extra		A little more (<20%)	A lot more (>20%)
How much less or extra income did you earn this last season (2013/14) as a result of Favco's services?					
How much less or more did you spend on labour as a result of Favco's services?					
How much less or more did you spend on other inputs as a result of Favco's services?					

D.2 Did Favco help you to embark on new commercial enterprises? (**Y** or **N**) If yes,

What were these new enterprises?	Has these new enterprises been successful? (**Y** or **N**)

D.3 Overall, how satisfied are you with Favco's agricultural extension services?*.....

*1 = not at all, 2 = slightly, 3 = somewhat, 4 = mostly, 5 = completely

D.4 In your opinion, which of Favco's training or support services did you find most important/ beneficial to you?

(a)……..

(b)……..

D.5 Based on information services provided by Favco, what is the likelihood that you would recommend Favco extension services to your family and friends or other farmers?.....

1 = not likely, 2 = likely, 3 = neutral, 4 = more likely, 5 = very likely

D.6 Who did you sell your products to *before* joining the Favco project?*.....

*1 = community, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside marketing, 4 = village market, 5 = Produce buyers (registered companies), 6= City market

D.7 Since joining Favco have you created more job opportunities for people to work on your farm (**Y** or **N**)……..

If yes, how many more people work on your farm at the busiest time?.....

D.8 In your view, has the availability of the information and inputs changed since you became a Favco client?

	Change in availability since becoming a Favco client?*
Availability of information on:	
Crop production practices	
Livestock production practises	
Markets and prices for crops	
Markets and prices for livestock	
Physical availability of agricultural production inputs:	
Seeds/planting material	
Livestock breeds	
Fertilisers	
Pesticides and herbicides	
Farm machinery and services	

*1 = reduced a lot, 2 = reduced a little, 3 = no change, 4 = improved a little, 5 = improved a lot

D.9 In your own view, has the quality of your main commercial crop changed since becoming a Favco client?

	How has it changed since becoming Favco client?*
Taste	
Appearance	
Size	
Storability	

*1 = reduced a lot, 2 = reduced a little, 3 = no change, 4 = improved a little, 5 = improved a lot

D.10 In your own view, has the production of your main commercial crop change since becoming a Favco client?

	Change in production attributes since becoming a Favco client*
Yields	
Quality of inputs	
Time taken to grow and sell	
Availability of credit to buy farm inputs	
Access to input and product markets	

*1 = reduced a lot, 2 = reduced a little, 3 = no change, 4 = improved a little, 5 = improved a lot

D.11 What impact has Favco's extension service had on:

	Level of impact*
Your family's food security?	
The quality of your family's diet?	
Your family's health?	
Your family's access to support networks?	
Your family's ability to cope with social issues such as illness, death, unemployment etc.?	
Your children's education?	
Your family savings?	
Your housing quality?	

*1 = Reduced, 2 = No effect, 3 = Improved

Appendix B: Variable definitions for the Honde Valley household survey

Variable	Definition
Case	Case number
Hhldhd	Dummy variable scoring 1 if the respondent is the head of the household, and 0 otherwise
Survey	Dummy variable scoring 1 if the respondent belongs to the household survey and 0 rest
Chhldsur	Dummy variable scoring 1 if the respondent is a client in the household survey and 0 rest
Project	Dummy variable scoring 1 if the respondent is a project client, and 0 otherwise
Village	Catchment areas (in the study site) serviced by the project are coded as: 0 = Mukupe, and 1 = Muparutsa
Total	Number of people in the household
Males	Number of males in the household
Females	Number of females in the household
Age 1	Number of people in the household with ages less or equal to 15 years
Age 2	Number of people in the household with ages between 16-65 years
Age 3	Number of people in the household with ages greater or equal to 65 years
Pupils	Number of children in the household attending school
Wof	Number of people in the household working on-farm
Woff	Number of people in the household working off-farm
Studyn	Number of people in the household studying off-farm
Mgt	Dummy variable scoring 1 if the head of the household is responsible for farm management, and 0 otherwise
Mage	Age of person responsible for farm management
Mgender	Dummy variable scoring 1 if the gender of the person responsible for farm management is a male, and 0 if female
Medu	Years of formal schooling of the person responsible for farm management
Mexp	Years of farming experience of the person responsible for farm management

Fgmship	Dummy variable scoring 1 if the household is a member of a group, and 0 otherwise
Fgname	Farmer locations[3] are coded as: 1 = Murara, 2 = Dambanda, 3 = Buwu, and 4 = Gwinyai
Fgactvt	Farmer group main activities are coded as: 1 = Banana production and marketing, 2 = Coffee production and marketing, and 3 = Cassava production and poultry
Lship	Dummy variable scoring 1 if a household member has a leadership role in a farmer group, and 0 otherwise
Lshprole	Main leadership roles are coded as: 1 = Head of the farmer group, 2 = Secretary, 3 = Treasurer, 4 = Quality control and auditing, 5 = Lead farmer, and 6 = Committee member
Maize	Dummy variable scoring 1 if the household planted maize, and 0 otherwise
Reasonmz	Reasons for planting maize are coded as: 1 = only for household consumption, 2 = mainly for household consumption, 3 = equally for household consumption and cash income, 4 = mainly for cash income, and 5 = only for cash income
Hamz	Approximate hectares (Ha) of land planted to maize
Salesmz	Total revenue from sales (US$) of maize
Marketmz	Primary market the household sold maize to is coded as: 1 = neighbours, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside market, 4 = village market, 5 = private service provider, 6 = other buyers (formal companies), and 7 = city market
Banana	Dummy variable scoring 1 if the household planted bananas, and 0 otherwise
Reasonbn	Reasons for planting bananas are coded the same way as reasonmz
Habn	Approximate hectares (Ha) of land planted to bananas
Salesbn	Total revenue from sales (US$) of bananas
Marktpbn	Primary market[4] the household sold bananas to is coded the same way as marketmz
Marktsbn	Secondary market[5] the household sold bananas to is coded the same way as marketmz
Beans	Dummy variable scoring 1 if the household planted beans, and 0 otherwise

[3] Farmer group names derived from the villages they live in.

[4] Some households reported that they use more than one marketing channel to sell their bananas. Their largest channel is the primary market. This only applies to bananas, all other crops use at most one channel.

[5] It is the second marketing channel that households use to sell their bananas.

Reasonbe	Reasons for planting beans are coded the same way as reasonmz
Habe	Approximate hectares (Ha) of land planted to beans
Salesbe	Total revenue from sales (US$) of beans
Marketbe	Primary market the household sold beans to is coded the same way as marketmz
Coffee	Dummy variable scoring 1 if the household planted coffee, and 0 otherwise
Reasoncf	Reasons for planting coffee are coded the same way as reasonmz
Hacf	Approximate hectares (Ha) of land planted to coffee
Salescf	Total revenue from sales (US$) of coffee
Marketcf	Primary market the household sold coffee to is coded the same way as marketmz
Spotato	Dummy variable scoring 1 if the household planted sweet potato, and 0 otherwise
Reasonsp	Reasons for planting sweet potato are coded the same way as reasonmz
Hasp	Approximate hectares (Ha) of land planted to sweet potato
Salessp	Total revenue from sales (US$) of sweet potato
Marketsp	Primary market the household sold sweet potatoes to is coded the same way as marketmz
Magogoya otherwise	Dummy variable scoring 1 if the household planted magogoya, and 0
Reasonmg	Reasons for planting magogoya are coded the same way as reasonmz
Hamg	Approximate hectares (Ha) of land planted to magogoya
Salesmg	Total revenue from sales (US$) of magogoya
Marketmg	Primary market the household sold magogoya to is coded the same way as marketmz
Gvegtab	Dummy variable scoring 1 if the household planted green vegetables, and 0 otherwise
Reasonvg	Reasons for planting green vegetables are coded the same way as reasonmz
Havg	Approximate hectares (Ha) of land planted to green vegetables
Salesvg	Total revenue from sales (US$) of green vegetables
Marketvg	Primary market the household sold green vegetables to is coded the same way as marketmz

Cropha	Total hectares (Ha) of land planted to crops
Cropsales	Total revenue from sales (US$) of crops
Fert	Dummy variable scoring 1 if the household purchased fertiliser, and 0 otherwise
Fertcost	Cost (US$) of purchased fertiliser
Manu	Dummy variable scoring 1 if the household purchased manure, and 0 otherwise
Manucost	Cost (US$) of purchased manure
Chem	Dummy variable scoring 1 if the household purchased chemicals, and 0 otherwise
Chemcost	Cost (US$) of purchased chemicals
Mzsd	Dummy variable scoring 1 if the household purchased maize seed, and 0 otherwise
Mzsdcost	Cost (US$) of purchased maize seed
Basdlng	Dummy variable scoring 1 if the household purchased banana seedlings, and 0 otherwise
Bacost	Cost (US$) of purchased banana seedlings
Besd	Dummy variable scoring 1 if the household purchased bean seeds, and 0 otherwise
Besdcost	Cost (US$) of purchased bean seeds
Hlbr	Dummy variable scoring 1 if the household used hired labour, and 0 otherwise
Hlbrcost	Cost (US$) of hired labour
Plou	Dummy variable scoring 1 if the household hired ploughing services, and 0 otherwise
Ploucost	Cost (US$) of hired ploughing services
Tinp	Dummy variable scoring 1 if the household hired transport to deliver inputs, and 0 otherwise
Tinpcost	Cost (US$) of hired transport to deliver inputs
Tmkt	Dummy variable scoring 1 if the household hired transport to market products, and 0 otherwise
Tmktcost	Cost (US$) of hired transport to market products
Cinpcost	Total cost (US$) of inputs and hired services

Mango	Dummy variable scoring 1 if the household planted mangoes, and 0 otherwise
Rsnmango	Reasons for planting mangoes are coded as: 1 = only for household consumption, 2 = mainly for household consumption, 3 = equally for household consumption and cash income, 4 = mainly for cash income, and 5 = only for cash income
Mangotr	Number of mango trees
Salmango	Total revenue from sales (US$) of mangoes
Mktmango	Primary market household sold mangoes to is coded as: 1 = neighbours, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside market, 4 = village market, 5 = private service provider, 6 = other buyers (formal companies), and 7 = city market
Avo	Dummy variable scoring 1 if the household planted avocados, and 0 otherwise
Rsnavo	Reasons for planting avocados are coded the same way as rsnmango
Avotr	Number of avocado trees
Salavo	Total revenue from sales (US$) of avocados
Mktavo	Primary market the household sold avocados to is coded the same way as mktmango
Lem	Dummy variable scoring 1 if the household planted lemon, and 0 otherwise
Rsnlem	Reasons for planting lemons are coded the same way as rsnmango
Lemtr	Number of lemon trees
Sallem	Total revenue from sales (US$) of lemons
Mktlem	Primary market the household sold lemons to is coded the same way as mktmango
Ora	Dummy variable scoring 1 if the household planted oranges, and 0 otherwise
Rsnora	Reasons for planting oranges are coded the same way as rsnmango
Oratr	Number of orange trees
Salora	Total revenue from sales (US$) of oranges
Mktora	Primary market the household sold oranges to is coded the same way as mktmango
Fruitr	Total number of fruit trees planted by the household
Fruitsal	Total revenue from sales (US$) of fruits

NCat	Number of cattle owned by the household
Ngoat	Number of goats owned by the household
Npigs	Number of pigs owned by the household
Nchicks	Number of chickens owned by the household
Vcat	Approximate value (US$) of cattle owned by the household
Vgoat	Approximate value (US$) of goats owned by the household
Vpigs	Approximate value (US$) of pigs owned by the household
Vchicks	Approximate value (US$) of chickens owned by the household
Salcat	Total revenue from sales (US$) of cattle
Salgoat	Total revenue from sales (US$) of goats
Salpig	Total revenue from sales (US$) of pigs
Salchick	Total revenue from sales (US$) of chickens
Prodcat	Total income (US$) from cattle products
Prodgoat	Total income (US$) from goat products
Prodpig	Total income (US$) from pig products
Prodchick	Total income (US$) from chicken products
Lstoksal	Total revenue from sales (US$) of livestock and products
Irr	Dummy variable scoring 1 if the household has irrigation, and 0 otherwise
Mvirr	Estimate of the market value (US$) of the irrigation equipment
Irrpro	Dummy variable scoring 1 if the household acquired the irrigation after the project, and 0 if before
Fen	Dummy variable scoring 1 if the household has fencing for crops, and 0 otherwise
Mvfen	Estimate of the market value (US$) of the fencing
Fenpro	Dummy variable scoring 1 if the household acquired the fencing for crops after the project, and 0 if before
Silo	Dummy variable scoring 1 if the household has a crop storage silo, and 0 otherwise
Mvsilo	Estimate of the market value (US$) of the crop storage silo
Siloproj	Dummy variable scoring 1 if the household acquired the crop storage silo after the project, and 0 if before

Wtnk	Dummy variable scoring 1 if the household has a water tank, and 0 otherwise
Mvwtnk	Estimate of the market value (US$) of the water tank
Wtnkproj	Dummy variable scoring 1 if the household acquired the water tank after the project, and 0 if before
Chchs	Dummy variable scoring 1 if the household has a chicken house, and 0 otherwise
Mvchchs	Estimate of the market value (US$) of the chicken house
Chchspro	Dummy variable scoring 1 if the household acquired the chicken house after the project, and 0 if before
Gpen	Dummy variable scoring 1 if the household has a goat pen, and 0 otherwise
Mvgpen	Estimate of the market value (US$) of the goat pen
Gpenproj	Dummy variable scoring 1 if the household acquired the goat pen after the project, and 0 if before
Psty	Dummy variable scoring 1 if the household has a pig sty, and 0 otherwise
Mvpsty	Estimate of the market value (US$) of the pig sty
Pstyproj	Dummy variable scoring 1 if the household acquired the pig sty after the project, and 0 if before
Cpen	Dummy variable scoring 1 if the household has a cattle pen, and 0 otherwise
Mvcpen	Estimate of the market value (US$) of the cattle pen
Cpenproj	Dummy variable scoring 1 if the household acquired the cattle pen after the project, and 0 if before
Mvfimp	Total estimate of the market value (US$) of the fixed improvements
Mvfipro	Total estimate of the market value (US$) of the fixed improvements after the project
Oxplo	Dummy variable scoring 1 if the household has an ox-plough, and 0 otherwise
Mvoxplo	Estimate of the market value (US$) of the ox-plough
Oxplopro	Dummy variable scoring 1 if the household acquired the ox-plough after the project, and 0 if before
Kspr	Dummy variable scoring 1 if the household has a knapsack sprayer, and 0 otherwise
Mvkspr	Estimate of the market value (US$) of the knapsack sprayer
Ksprproj	Dummy variable scoring 1 if the household acquired the knapsack sprayer after the project, and 0 if before

Wbar	Dummy variable scoring 1 if the household has a wheelbarrow, and 0 otherwise
Mvwbar	Estimate of the market value (US$) of the wheelbarrow
Wbarproj	Dummy variable scoring 1 if the household acquired the wheelbarrow after the project, and 0 if before
Shov	Dummy variable scoring 1 if the household has a shovel, and 0 otherwise
Mvshov	Estimate of the market value (US$) of the shovel
Shovproj	Dummy variable scoring 1 if the household acquired the shovel after the project, and 0 if before
Hoe	Dummy variable scoring 1 if the household has hoes, and 0 otherwise
Mvhoe	Estimate of the market value (US$) of the hoes
Hoeproj	Dummy variable scoring 1 if the household acquired the hoes after the project, and 0 if before
Slash	Dummy variable scoring 1 if the household has slashers, and 0 otherwise
Mvslash	Estimate of the market value (US$) of the slashers
Slashpro	Dummy variable scoring 1 if the household acquired the slashers after the project, and 0 if before
Sickl	Dummy variable scoring 1 if the household has sickles, and 0 otherwise
Mvsickl	Estimate of the market value (US$) of the sickles
Sicklpro	Dummy variable scoring 1 if the household acquired the sickles after the project, and 0 if before
Mvfmaset	Total estimate of the market value (US$) of farm moveable assets
Mvfmapro	Total estimate of the market value (US$) of farm moveable assets acquired after the project
Tv otherwise	Dummy variable scoring 1 if the household has a television set, and 0
Mvtv	Estimate of the market value (US$) of the television set
Tvproj	Dummy variable scoring 1 if the household acquired the television set after the project, and 0 if before
Gen	Dummy variable scoring 1 if the household has a generator, and 0 otherwise
Mvgen	Estimate of the market value (US$) of the generator
Genproj	Dummy variable scoring 1 if the household acquired the generator after the project, and 0 if before

Rad[6]	Dummy variable scoring 1 if the household has a radio, and 0 otherwise
Radproj	Dummy variable scoring 1 if the household acquired the radio after the project, and 0 if before
Cphon	Dummy variable scoring 1 if the household has a cell phone, and 0 otherwise
Cphonpro	Dummy variable scoring 1 if the household acquired the cell phone after the project, and 0 if before
Solas	Dummy variable scoring 1 if the household has a solar charging system, and 0 otherwise
Solaspro	Dummy variable scoring 1 if the household acquired the solar charging system after the project, and 0 if before
Mvhmaset	Total estimate of the market value (US$) household moveable assets
Mvhmapro	Total estimate of the market value (US$) of the household moveable assets acquired after the project
Cppssn	Prices of commercial crops compared to the previous seasons ranked as: 1 = very low, 2 = low, 3 = no change, 4 = high, and 5 = much higher
Cypssn	Yields of commercial crops compared to previous seasons are coded the same way as Cppssn
Clpgvpro	Organisations that delivered extension advice on crop or livestock production to households are coded as: 1 = government, 2 = the private service provider, 3 = both government and private service provider, and 4 = neither government nor the private service provider
Clpproj	The seasons during which the household benefited from extension advice or training about crop or livestock production are coded as: 1 = 2012/2013, 2 = 2013/2014, and 3 = both 2012/13 and 2013/14
Irrgvpro	Organisations that delivered extension advice on irrigation and equipment maintenance to households are coded the same way as Clpgvpro
Irrproj	The seasons during which the household benefited from extension advice or training about irrigation and equipment maintenance are coded the same way as Clpproj
Bdsgvpro	Organisations that delivered extension advice on business development services to households are coded the same way as Clpgvpro

[6] Rad, cphon and solas (radio, cell phone and solar system respectively) do not have estimated market value because their value is 'negligible', depreciates quickly and cannot be liquidated easily as compared to other household moveable assets on the lists.

Bdsproj	The seasons during which the household benefited from extension advice or training on business development services from the project are coded the same way as Clpproj
Inpgvpro	Organisations that delivered extension advice on accessing inputs (seed, fertiliser and chemicals) to households are coded the same way as for Clpgvpro
Inpproj	The seasons during which the household benefited from extension advice or training on accessing inputs (seed, fertiliser and chemicals) from the project are coded the same way as Clpproj
Sfpgvpro	Organisations that delivered extension advice on selling farm products are coded the same way as Clpgvpro
Sfpproj	The seasons during which the household benefited from extension advice or training on selling farm products are coded the same way as Clpproj
Longvpro	Organisations that delivered extension advice on accessing loans or credit from various institutions (for input procurement and farm investments) to households are coded the same way as Clpgvpro
Lonproj	The seasons during which the household benefited from extension advice or training on accessing loans or credit from various institutions (for input procurement and farm investments) from the project is coded the same as Clpproj
Extympro	Number of times the household received advice or training from the project in 2013/14 season
Apdnoext	Dummy variable scoring 1 if the household attempted to produce a crop for commercial purposes without the help of extension services, and 0 otherwise
Hproj	Dummy variable scoring 1 if the household was aware of the project's extension services, and 0 otherwise
Hprojnam	Dummy variable scoring 1 if the household was aware of the project's name, and 0 otherwise
Conproj	Dummy variable scoring 1 if the household had considered but not used the project's extension services, and 0 otherwise
Rsnno	Dummy variable scoring 1 if the household considered using the project's services but they had no reason for not using them, and 0 otherwise
Rsnageth	Dummy variable scoring 1 if the household considered using the project's services but mentioned old age and health challenges as reasons they had not used them, and 0 otherwise

Rsnfina	Dummy variable scoring 1 if the household considered using the project's services but mentioned lack of financial resources to source inputs and inability to repay loans as reasons they had not used them, and 0 otherwise
Rsnirr	Dummy variable scoring 1 if the household considered using the project's services but mentioned insufficient or no irrigation to meet crop water requirements as reasons they had not used them, and 0 otherwise
Rsnprlbr	Dummy variable scoring 1 if the household considered using the project's services but mentioned insufficient produce and labour to meet quantity and quality requirements of the private service provider as reasons they had not used them, and 0 otherwise
Projmon	Month the household became a project client, January = 1, …, December = 12
Projyear	Year household became a project client
Projinco	Income earned by the household as a consequence of project activities in 2013/14 season is ranked as: 1 = less than normal, 2 = nothing extra, 3 = a little more (<20%), and 4 = a lot more (>20%)
Projlab	Expenditure on labour by the household as a consequence of project activities is ranked the same way as Projinco
Proinp	Expenditure on other inputs by the household as a consequence of project activities is ranked the same way as Projinco
Newent	Dummy variable scoring 1 if the household embarked on a new commercial enterprises with the help of the project, and 0 otherwise
Vegtab	Dummy variable scoring 1 if the household embarked on vegetable production with the help of the project, and 0 otherwise
Vegsucc	Dummy variable scoring 1 if the household succeeded in vegetable production enterprise, and 0 otherwise
Poultry	Dummy variable scoring 1 if the household embarked on poultry production with the help of the project, and 0 otherwise
Pousucc	Dummy variable scoring 1 if the household succeeded in poultry production enterprise, and 0 otherwise
Fbe	Dummy variable scoring 1 if the household embarked on field bean production with the help of the project, and 0 otherwise
Fbesucc	Dummy variable scoring 1 if the household succeeded in field bean production enterprise, and 0 otherwise
Hortprod	Dummy variable scoring 1 if the household embarked on horticultural production, and 0 otherwise

Hortsucc	Dummy variable scoring 1 if the household succeeded in horticultural production enterprise, and 0 otherwise
Satispro	Overall satisfaction with the project's agricultural extension services is ranked as: 1 = not at all, 2 = slightly, 3 = somewhat, 4 = mostly, and 5 = completely
Banprod	Dummy variable scoring 1 if the household viewed commercial banana production as the most important training delivered by the project, and 0 otherwise
Banmark	Dummy variable scoring 1 if the household viewed access to a market for bananas as the most important support service benefited from the project, and 0 otherwise
Busdev	Dummy variable scoring 1 if the household viewed business development as the most important training delivered by support benefited from the project, and 0 otherwise
Recoproj	Likelihood that the household would recommend the project's extension services to family or friends is ranked as: 1 = not likely, 2 = likely, 3 = neutral, 4 = more likely, and 5 = very likely
Pmarkbf	The primary market that the household used to sell its products to before joining the project is coded as: 1 = neighbours, 2 = hawkers who call & collect their products (Makoronyera), 3 = roadside market, 4 = village market, 5 = other buyers (formal companies), and 6 = city market
Smarkbf	The secondary market that the household used to sell its products to before joining the project is coded the same way as Pmarkbf
Mchanbf	Maximum number of market channels the household used to sell their products to before joining the project
Createjb	Dummy variable scoring 1 if the household created on-farm job opportunities since joining the project, and 0 otherwise
Wbstim	Number of people paid to work on the farm at the busiest time
Ainfcpp	Availability of information on crop production practices since becoming a project client is ranked as: 1 = reduced a lot, 2 = reduced a little, 3 = no change, 4 = improved a little, and 5 = improved a lot
Ainflpp	Availability of information on livestock production practices since becoming a project client is ranked the same way as Ainfcpp
Ainfmpcr	Availability of information on markets and prices for crops since becoming a project client is ranked the same way as Ainfcpp
Ainfmpls	Availability of information on markets and prices for livestock since becoming a project client is ranked the same way as Ainfcpp

Ainfsdpm	Availability of information on seeds/planting material since becoming a project client is ranked the same way as Ainfcpp
Ainflsbd	Availability of information on livestock breeds since becoming a project client is ranked the same way as Ainfcpp
Ainfert	Availability of information on fertilisers since becoming a project client is ranked the same way as Ainfcpp
Ainfphcd	Availability of information on pesticides and herbicides since becoming a project client is ranked the same way as Ainfcpp
Ainfms	Availability of information on farm machinery and services since becoming a project client is ranked the same way as Ainfcpp
Qtaste	Change in taste of the main commercial crops since becoming a project client is ranked as: 1 = reduced a lot, 2 = reduced a little, 3 = no change, 4 = improved a little, and 5 = improved a lot
Qappear	Change in appearance of the main commercial crops since becoming a project client is ranked the same way as Qtaste
Qsize	Change in size of the main commercial crops since becoming a project client is ranked the same way as Qtaste
Qstore	Change in storability of the main commercial crops since becoming a project client is ranked the same way as Qtaste
Cyield	Change in yields of the main commercial crops since becoming a project client is ranked the same way as Qtaste
Clnputs	Change in quality of inputs purchased to produce the main commercial crops since becoming a project client is ranked the same way as Qtaste
Ccycle	Change in time taken to grow and sell the main commercial crops since becoming a project client is ranked the same way as Qtaste
Cinpcred	Change in availability of credit to buy farm inputs since becoming a project client is ranked the same way as Qtaste
Cinprodm	Change in accessibility to input and product markets for the main commercial crops since becoming a project client is ranked the same way as Qtaste
Impfood	Project's extension impact on household food security is ranked as: 1 = reduced, 2 = no effect, and 3 = improved
Impdiet	Project's extension impact on household quality of diet is ranked the same way as Impfood
Imphth	Project's extension impact on household health is ranked the same way as Impfood

Impsnwrk	Project's extension impact on household access to support networks is ranked the same way as Impfood
Impcopsi	Project's extension impact on household ability to cope with social issues such as illness, death, unemployment etc. is ranked the same way as Impfood
Impedu	Project's extension impact on household children's education is ranked the same way as Impfood
Impsav	Project's extension impact on household savings is ranked the same way as Impfood
Imphsq	Project's extension impact on household housing quality is ranked the same way as Impfood
Minus one (-1)	Codes for a missing value due to missing or inadequately supplied information during interviews
Blank cell	Codes for inapplicable information

Appendix C: Sampling design

Village	Estimated number of households	Range	Random numbers	Selected villages	Selection probability percentage	Actual head count	Size of the household sample (second stage sampling fraction=1/5)
1	196	1-196			0.17	196	
2	160	197-357			0.14	161	
3	80	358-438			0.07	81	
4	302	439-741	450	*	0.26	303	62
5	435	742-1177	861	*	0.37	436	88

Appendix D: Regression analysis estimating treatment effect on net revenue from all crops (n=152)

Explanatory variables	Coefficients				Collinearity statistics
	B		Std. Error	Beta	VIF
Constant	55.63		145.96		
Extension service	209.60	***	68.32	0.23	1.03
Age of farmer	-2.55		1.80	-1.44	1.81
Gender (1=male)	-31.67		44.21	-0.06	1.07
Education (years)	-2.43		7.06	-0.03	1.30
Experience (years)	6.41	***	2.10	0.28	1.50
Land/adult equiv. (Ha)	297.98	***	85.67	0.27	1.04
Labour/adult equiv. (#)	-27.25		90.53	-0.02	1.08
F-statistic	**5.01**	***			
Adjusted R^2	**0.16**				

***, **, * significant at 1%, 5%, and 10% levels of probability respectively.

Appendix E: Regression analysis estimating treatment effect on revenue from all crops (n=152)

Explanatory variables	Coefficients				Collinearity statistics
	B		Std. Error	Beta	VIF
Constant	-52.96		218.72		
Extension service	281.66	***	102.54	0.20	1.03
Age of farmer	-2.95		2.71	-0.11	1.84
Gender (1=male)	-73.84		66.28	0.08	1.07
Education (years)	-3.31		10.59	-0.03	1.30
Experience (years)	8.15	***	3.05	0.24	1.54
Land/adult equiv. (Ha)	726.42	***	128.35	0.41	1.04
Labour/adult equiv. (#)	26.18		135.95	0.01	1.08
F-statistic	**7.80**	***			
Adjusted R^2	**0.24**				

***, **, *significant at 1%, 5%, and 10% levels of probability respectively.

Appendix F: Regression analysis estimating treatment effect on revenue from bananas (n=152)

Explanatory variables	Coefficients				Collinearity Statistics
	B		Std. Error	Beta	VIF
Constant	-91.29		222.42		
Extension service	320.84	***	104.28	0.23	1.03
Age of farmer	-2.82		2.76	-0.10	1.84
Gender (1=male)	-57.59		67.40	-0.06	1.07
Education (years)	-6.51		10.77	-0.05	1.30
Experience (years)	6.62	**	3.10	0.19	1.54
Land/adult equiv. (Ha)	683.54	***	130.52	0.40	1.04
Labour/adult equiv. (#)	37.84		138.25	0.02	1.08
F-statistic	**6.89**	***			
Adjusted R^2	**0.22**				

***, **, *significant at 1%, 5%, and 10% levels of probability respectively.

Appendix G: Regression analysis estimating treatment effect on inputs and services hired (n=152)

Explanatory variables	Coefficients				Collinearity Statistics
	B		Std. Error	Beta	VIF
Constant	-122.63		111.54		
Extension service	75.16	+	51.88	0.10	1.03
Age of farmer	-.29		1.37	-0.02	1.79
Gender (1=male)	-35.86		33.47	-0.08	1.07
Education (years)	-.45		5.39	-0.01	1.30
Experience (years)	2.04		1.58	0.11	1.48
Land/adult equiv. (Ha)	433.59	***	65.38	0.48	1.04
Labour/adult equiv. (#)	48.91		68.73	0.05	1.08
F-statistic	**7.92**	***			
Adjusted R^2	**0.24**				

***, **, *, + significant at 1%, 5%, 10% and 15% levels of probability respectively.

AppendixH: Regression analysis estimating treatment effect on liquidity (n=152)

Explanatory variable	Coefficients	Collinearity

	B		Std. Error	Beta	Statistics VIF
Constant	-241.58		276.36		
Extension service	293.21	**	128.55	0.16	1.03
Age of farmer	-0.36		3.40	-0.01	1.79
Gender (1=male)	28.41		82.93	0.02	1.07
Education (years)	11.64		13.35	0.07	1.30
Experience (years)	17.12	***	3.91	0.36	1.48
Land/adult equiv. (Ha)	975.74	***	162.00	0.42	1.04
Labour/adult equiv. (#)	-169.69		170.31	-0.07	1.08
F-statistic	**10.20**	***			
Adjusted R^2	**0.30**				

***, **, * significant at 1%, 5%, and 10% levels of probability respectively.

Appendix J: Data used to estimate the general treatment model

Case	Hdhld	Survey	Chhldsur	Project	Village	Total	Age 1	Age 2	Age3	*Adult Equivalent*
1	1	1	1	1	1	9	2	6	1	6.50
2	1	1	1	1	1	10	4	6	0	6.50
3	1	1	0	1	1	4	2	0	2	2.69
4	1	1	1	1	1	11	7	4	0	6.13
5	1	1	1	1	1	8	4	4	0	5.02
6	0	1	1	1	1	6	4	2	0	3.48
7	1	1	0	1	1	6	3	2	1	3.87
8	0	1	0	1	1	4	1	3	0	3.09
9	1	1	1	1	1	10	4	6	0	6.50
10	0	1	0	1	0	2	0	1	1	1.87
11	0	1	0	1	1	9	3	6	0	6.13
12	1	1	0	1	1	5	3	2	0	3.09
13	0	1	1	1	1	5	3	2	0	3.09
14	1	1	0	1	0	2	1	1	0	1.44
15	1	1	0	1	0	2	0	2	0	1.87
16	1	1	0	1	1	11	7	4	0	6.13
17	0	1	0	1	0	3	1	2	0	2.28
18	1	1	0	1	0	5	4	1	0	2.69
19	1	1	0	1	0	4	1	2	1	3.09
20	1	1	0	1	0	5	3	2	0	3.09
21	1	1	0	1	1	4	2	2	0	2.69
22	1	1	0	1	1	5	3	2	0	3.09
23	1	1	1	1	1	8	4	4	0	5.02
24	1	1	1	1	1	6	3	2	1	3.87
25	1	1	0	1	0	13	7	6	0	7.58
26	1	1	0	1	0	12	7	5	0	6.86
27	0	1	0	1	0	13	5	8	0	8.3
28	1	1	1	1	1	14	5	8	1	9.01
29	1	1	0	1	0	4	2	2	0	2.69
30	1	1	0	1	0	4	2	2	0	2.69
31	1	1	0	1	0	3	0	3	0	2.69
32	1	1	1	1	1	6	3	3	0	3.87
33	1	1	0	1	1	6	2	4	0	4.26
34	1	1	1	1	1	5	4	1	0	2.69
35	1	1	0	1	0	5	4	1	0	2.69
36	1	1	0	1	0	4	2	2	0	2.69
37	1	1	0	1	0	9	3	6	0	6.13
38	1	1	0	1	0	7	5	2	0	3.87
39	1	1	0	1	0	5	1	4	0	3.87
40	1	1	0	1	0	6	5	1	0	3.09
41	1	1	0	1	0	6	4	2	0	3.48

Case	Hdhld	Survey	Chhldsur	Project	Village	Total	Age 1	Age 2	Age3	*Adult Equivalent*
42	1	1	0	1	0	2	0	2	0	1.87
43	0	1	0	1	1	6	2	4	0	4.26
44	0	1	0	1	1	9	3	5	1	6.13
45	1	1	1	1	1	3	1	2	0	2.28
46	1	1	0	1	1	4	2	2	0	2.69
47	1	1	0	1	1	16	9	7	0	9.01
48	0	1	0	1	1	5	2	3	0	3.48
49	1	1	0	1	1	6	2	4	0	4.26
50	1	1	0	1	1	4	2	2	0	2.69
51	0	1	0	1	1	6	2	4	0	4.26
52	0	1	0	1	1	4	2	2	0	2.69
53	1	1	0	1	1	4	2	2	0	2.69
54	1	1	0	1	1	3	0	1	2	2.69
55	1	1	0	1	0	6	3	3	0	3.87
56	1	1	0	1	0	5	3	2	0	3.09
57	1	1	0	1	1	5	3	2	0	3.09
58	1	1	0	1	1	5	1	4	0	3.87
59	1	1	0	1	1	6	2	4	0	4.26
60	1	1	1	1	1	4	2	2	0	2.69
61	0	1	0	1	1	2	0	2	0	1.87
62	1	1	1	1	1	11	4	5	2	7.22
95	1	1	0	0	1	3	2	1	0	1.87
96	0	1	0	0	0	2	0	2	0	1.87
97	1	1	0	0	0	7	4	3	0	4.26
98	1	1	0	0	0	2	0	2	0	1.87
99	1	1	0	0	0	4	2	2	0	2.69
100	1	1	0	0	1	4	2	2	0	2.69
101	1	1	0	0	0	4	2	2	0	2.69
102	1	1	0	0	1	4	1	3	0	3.09
103	1	1	0	0	0	4	1	3	0	3.09
104	1	1	0	0	0	3	1	2	0	2.28
105	1	1	0	0	1	3	1	2	0	2.28
106	1	1	0	0	0	5	3	2	0	3.09
107	1	1	0	0	1	5	4	1	0	2.69
108	1	1	0	0	0	1	0	1	0	1.00
109	1	1	0	0	0	4	1	2	1	3.09
110	1	1	0	0	1	4	1	3	0	3.09
111	0	1	0	0	0	5	2	2	1	3.48
112	1	1	0	0	0	4	2	2	0	2.69
113	0	1	0	0	1	2	0	1	1	1.87
114	1	1	0	0	1	5	2	3	0	3.48
115	1	1	0	0	0	5	2	1	2	3.48

Case	Hdhld	Survey	Chhldsur	Project	Village	Total	Age 1	Age 2	Age3	*Adult Equivalent*
116	0	1	0	0	0	2	0	2	0	1.87
117	1	1	0	0	0	20	13	7	0	10.41
118	1	1	0	0	1	2	1	0	1	1.44
119	1	1	0	0	0	4	2	1	1	2.69
120	1	1	0	0	1	5	3	2	0	3.09
121	1	1	0	0	0	4	2	2	0	2.69
122	1	1	0	0	1	7	1	6	0	5.39
123	1	1	0	0	0	5	3	2	0	3.09
124	1	1	0	0	1	4	2	2	0	2.69
125	1	1	0	0	0	1	0	0	1	1.00
126	1	1	0	0	1	5	0	4	1	4.26
127	1	1	0	0	0	5	3	2	0	3.09
128	1	1	0	0	1	4	2	2	0	2.69
129	1	1	0	0	0	5	1	4	0	3.87
130	0	1	0	0	0	4	2	2	0	2.69
131	1	1	0	0	1	9	5	4	0	5.39
132	1	1	0	0	0	5	1	3	1	3.87
133	1	1	0	0	1	3	0	2	1	2.69
134	1	1	0	0	0	4	1	3	0	3.09
135	1	1	0	0	1	5	2	3	0	3.48
136	1	1	0	0	1	4	2	2	0	2.69
137	1	1	0	0	1	5	2	3	0	3.48
138	0	1	0	0	0	5	2	2	1	3.48
139	1	1	0	0	1	5	2	3	0	3.48
140	1	1	0	0	1	4	2	2	0	2.69
141	0	1	0	0	1	5	2	3	0	3.48
142	1	1	0	0	1	3	1	2	0	2.28
143	1	1	0	0	1	6	1	5	0	4.64
144	1	1	0	0	1	4	0	3	1	3.48
145	1	1	0	0	0	5	3	2	0	3.09
146	1	1	0	0	1	7	3	4	0	4.64
147	1	1	0	0	0	3	0	3	0	2.69
148	1	1	0	0	1	6	4	2	0	3.48
149	1	1	0	0	1	2	1	0	1	1.44
150	1	1	0	0	1	6	3	3	0	3.87
151	0	1	0	0	1	6	2	4	0	4.26
152	1	1	0	0	1	6	3	3	0	3.87
153	1	1	0	0	0	6	2	3	1	4.26
154	0	1	0	0	1	4	2	2	0	2.69
155	1	1	0	0	0	5	2	3	0	3.48
156	1	1	0	0	1	2	1	1	0	1.44
157	1	1	0	0	1	5	1	4	0	3.87

Case	Hdhld	Survey	Chhldsur	Project	Village	Total	Age 1	Age 2	Age3	*Adult Equivalent*
158	1	1	0	0	0	8	3	5	0	5.39
159	1	1	0	0	1	4	0	4	0	3.48
160	1	1	0	0	1	1	0	1	0	1.00
161	1	1	0	0	1	12	2	10	0	8.65
162	1	1	0	0	1	2	1	0	1	1.44
163	1	1	0	0	0	2	0	1	1	1.87
164	1	1	0	0	1	5	2	3	0	3.48
165	1	1	0	0	0	6	1	3	2	4.64
166	1	1	0	0	1	11	4	5	2	7.22
167	1	1	0	0	0	4	2	2	0	2.69
168	1	1	0	0	1	12	5	7	0	7.58
169	1	1	0	0	0	3	1	2	0	2.28
170	1	1	0	0	1	4	0	4	0	3.48
171	0	1	0	0	0	9	5	4	0	5.39
172	1	1	0	0	1	4	2	2	0	2.69
173	1	1	0	0	1	6	4	2	0	3.48
174	1	1	0	0	0	2	1	1	0	1.44
175	1	1	0	0	1	4	2	2	0	2.69
176	1	1	0	0	1	6	4	2	0	3.48
177	1	1	0	0	0	5	3	2	0	3.09
178	0	1	0	0	1	5	2	2	1	3.48
179	1	1	0	0	1	5	3	2	0	3.09
180	1	1	0	0	1	4	2	2	0	2.69
181	0	1	0	0	0	4	1	3	0	3.09
182	0	1	0	0	0	5	3	2	0	3.09
183	0	1	0	0	1	5	1	3	1	3.87
184	1	1	0	0	1	2	0	0	2	1.87

Case	Project	Cropha	*Land/adult equiv.(Ha)*	Crop sales	*Inputs & services purchased*	*Revenue from all crops*	*Net revenue from all crops*	*Revenue from bananas*	*Revenue From fruits*
1	1	2.12	*0.33*	850	*560*	*131*	*45*	*62*	*6*
2	1	2.35	*0.36*	425	*389*	*65*	*6*	*38*	*0*
3	1	0.62	*0.23*	1000	*401*	*372*	*223*	*372*	*0*
4	1	1.81	*0.30*	200	*201*	*33*	*0*	*16*	*0*
5	1	0.69	*0.14*	40	*109*	*8*	*-14*	*0*	*0*
6	1	1.30	*0.37*	320	*101*	*92*	*63*	*86*	*0*
7	1	2.00	*0.52*	1837	*-1*	*474*	*-1*	*436*	*-1*
8	1	1.62	*0.52*	1425	*541*	*461*	*286*	*259*	*16*
9	1	1.00	*0.15*	400	*267*	*62*	*20*	*0*	*0*
10	1	1.53	*0.82*	2400	*469*	*1286*	*1035*	*1286*	*0*
11	1	1.28	*0.21*	890	*377*	*145*	*84*	*114*	*15*
12	1	0.92	*0.30*	645	*255*	*209*	*126*	*194*	*6*
13	1	0.61	*0.20*	2800	*382*	*907*	*783*	*907*	*0*
14	1	0.72	*0.50*	650	*337*	*451*	*217*	*417*	*35*
15	1	1.14	*0.61*	645	*142*	*346*	*270*	*268*	*0*
16	1	4.00	*0.65*	1900	*1076*	*310*	*134*	*277*	*36*
17	1	1.02	*0.45*	1010	*245*	*443*	*335*	*263*	*15*
18	1	1.50	*0.56*	1370	*241*	*510*	*420*	*484*	*0*
19	1	0.00	*0.00*	400	*190*	*130*	*68*	*130*	*6*
20	1	1.30	*0.42*	2450	*519*	*793*	*625*	*712*	*26*
21	1	1.20	*0.45*	845	*390*	*314*	*169*	*112*	*11*
22	1	0.62	*0.20*	542	*117*	*176*	*138*	*130*	*5*
23	1	1.46	*0.29*	497	*224*	*99*	*54*	*60*	*0*
24	1	1.30	*0.34*	-1	*460*	*-1*	*-1*	*-1*	*13*
25	1	1.22	*0.16*	6200	*1939*	*817*	*562*	*817*	*5*
26	1	1.35	*0.20*	4000	*983*	*583*	*440*	*583*	*3*
27	1	2.60	*0.31*	2354	*689*	*284*	*201*	*193*	*6*
28	1	3.66	*0.41*	580	*499*	*64*	*9*	*64*	*0*
29	1	0.80	*0.30*	630	*361*	*234*	*100*	*205*	*7*
30	1	1.02	*0.38*	180	*129*	*67*	*19*	*22*	*22*
31	1	0.95	*0.35*	1315	*409*	*489*	*337*	*484*	*0*
32	1	1.18	*0.30*	40	*156*	*10*	*-30*	*10*	*10*
33	1	1.41	*0.33*	540	*205*	*127*	*79*	*68*	*0*
34	1	1.38	*0.51*	270	*342*	*100*	*-27*	*45*	*0*
35	1	1.35	*0.50*	895	*310*	*333*	*218*	*298*	*22*
36	1	0.23	*0.09*	3070	*312*	*1142*	*1026*	*1116*	*0*
37	1	0.73	*0.12*	-1	*327*	*-1*	*-1*	*-1*	*0*
38	1	1.05	*0.27*	415	*248*	*107*	*43*	*103*	*7*
39	1	1.40	*0.36*	400	*155*	*103*	*63*	*103*	*6*
40	1	0.23	*0.07*	2415	*783*	*782*	*529*	*745*	*0*
41	1	1.31	*0.38*	544	*50*	*156*	*142*	*144*	*0*
42	1	2.60	*1.39*	7320	*4598*	*3923*	*1459*	*3923*	*27*
43	1	1.30	*0.31*	1050	*250*	*247*	*188*	*117*	*9*

Case	Project	Cropha	*Land/adult equiv.(Ha)*	Crop sales	*Inputs & services purchased*	*Revenue from all crops*	*Net revenue from all crops*	*Revenue from bananas*	*Revenue from fruits*
44	1	1.49	*0.24*	990	*249*	*161*	*121*	*130*	*7*
45	1	1.68	*0.74*	2670	*344*	*1170*	*1020*	*1096*	*0*
46	1	1.16	*0.43*	1110	*280*	*413*	*309*	*298*	*33*
47	1	3.00	*0.33*	3000	*641*	*333*	*262*	*333*	*0*
48	1	1.42	*0.41*	730	*319*	*210*	*118*	*210*	*9*
49	1	1.08	*0.25*	850	*270*	*200*	*136*	*141*	*21*
50	1	1.49	*0.55*	1220	*336*	*454*	*329*	*335*	*37*
51	1	0.66	*0.16*	618	*291*	*145*	*77*	*141*	*5*
52	1	0.64	*0.24*	350	*201*	*130*	*55*	*112*	*0*
53	1	2.50	*0.93*	1175	*1036*	*437*	*52*	*186*	*0*
54	1	0.80	*0.30*	2950	*346*	*1098*	*969*	*1098*	*10*
55	1	0.90	*0.23*	300	*52*	*77*	*64*	*77*	*13*
56	1	1.54	*0.50*	300	*273*	*97*	*9*	*32*	*16*
57	1	1.41	*0.46*	1870	*725*	*606*	*371*	*541*	*6*
58	1	0.81	*0.21*	1350	*700*	*349*	*168*	*310*	*26*
59	1	3.30	*0.78*	1210	*474*	*284*	*173*	*258*	*117*
60	1	1.35	*0.50*	805	*220*	*299*	*218*	*234*	*0*
61	1	1.28	*0.69*	460	*211*	*247*	*133*	*161*	*0*
62	1	1.85	*0.26*	230	*278*	*32*	*-7*	*28*	*0*
63	1	0.63	*0.20*	1000	*328*	*324*	*218*	*324*	*0*
64	1	0.56	*0.30*	800	*80*	*429*	*386*	*322*	*0*
65	1	0.48	*0.16*	60	*46*	*19*	*5*	*19*	*0*
66	1	0.71	*0.49*	165	*210*	*115*	*-31*	*35*	*21*
67	1	0.71	*0.18*	530	*192*	*137*	*87*	*77*	*16*
68	1	1.27	*0.47*	400	*269*	*149*	*49*	*149*	*11*
69	1	1.06	*0.39*	370	*230*	*138*	*52*	*126*	*0*
70	1	0.70	*0.23*	410	*207*	*133*	*66*	*65*	*32*
71	1	0.88	*0.23*	900	*169*	*232*	*189*	*232*	*0*
72	1	1.03	*0.33*	700	*149*	*227*	*178*	*227*	*0*
73	1	1.42	*0.33*	2230	*439*	*524*	*421*	*470*	*0*
74	1	0.25	*0.11*	330	*11*	*145*	*140*	*145*	*0*
75	1	2.53	*0.24*	910	*124*	*87*	*76*	*87*	*0*
76	1	1.53	*0.44*	750	*262*	*215*	*140*	*215*	*0*
77	1	1.58	*0.32*	950	*112*	*189*	*167*	*179*	*0*
78	1	1.88	*0.29*	2850	*861*	*439*	*306*	*385*	*15*
79	1	1.32	*0.43*	700	*111*	*227*	*191*	*227*	*0*
80	1	1.53	*0.28*	800	*143*	*148*	*122*	*148*	*0*
81	1	1.61	*0.35*	900	*193*	*194*	*152*	*194*	*0*
82	1	0.78	*0.20*	192	*43*	*50*	*38*	*39*	*0*
83	1	1.08	*0.58*	400	*133*	*214*	*143*	*214*	*0*
84	1	1.56	*0.45*	1000	*194*	*287*	*231*	*287*	*0*
85	1	1.53	*0.40*	800	*193*	*207*	*157*	*207*	*0*
86	1	1.05	*0.15*	700	*204*	*102*	*72*	*102*	*0*

Case	Project	Cropha	*Land/adult equiv.(Ha)*	Crop sales	*Inputs & services purchased*	*Revenue from all crops*	*Net revenue from all crops*	*Revenue from bananas*	*Revenue from fruits*
87	1	2.65	*0.76*	1530	*406*	*439*	*323*	*287*	*0*
88	1	1.32	*0.26*	651	*492*	*130*	*32*	*69*	***0***
89	1	2.26	*0.39*	636	*195*	*110*	*77*	*104*	*0*
90	1	3.15	*0.32*	760	*309*	*78*	*46*	*51*	*7*
91	1	1.13	*0.16*	175	*171*	*26*	*1*	*26*	*0*
92	1	0.90	*0.11*	1200	*342*	*151*	*108*	*151*	*0*
93	1	1.29	*0.28*	300	*139*	*65*	*35*	*65*	*0*
94	1	1.34	*0.35*	110	*314*	*28*	*-53*	*13*	*0*
95	0	0.72	*0.39*	960	*125*	*514*	*447*	*0*	*27*
96	0	0.83	*0.44*	300	*334*	*161*	*-18*	*161*	*38*
97	0	1.25	*0.29*	300	*36*	*70*	*62*	*70*	*0*
98	0	0.60	*0.32*	0	*28*	*0*	*-15*	*0*	*0*
99	0	1.43	*0.53*	80	*76*	*30*	*1*	*30*	*0*
100	0	0.55	*0.21*	250	*123*	*93*	*47*	*30*	*11*
101	0	0.91	*0.34*	320	*188*	*119*	*49*	*112*	*19*
102	0	0.86	*0.28*	540	*126*	*175*	*134*	*32*	*19*
103	0	0.70	*0.23*	450	*56*	*146*	*128*	*146*	*0*
104	0	0.65	*0.28*	50	*58*	*22*	*-4*	*22*	*0*
105	0	0.45	*0.20*	140	*108*	*61*	*14*	*0*	*0*
106	0	1.30	*0.42*	200	*68*	*65*	*43*	*65*	*13*
107	0	0.90	*0.34*	1030	*186*	*383*	*314*	*0*	*38*
108	0	1.10	*1.10*	250	*113*	*250*	*137*	*160*	*40*
109	0	1.05	*0.34*	1080	*248*	*350*	*269*	*324*	*4*
110	0	0.69	*0.22*	550	*140*	*178*	*133*	*130*	*29*
111	0	0.97	*0.28*	250	*108*	*72*	*41*	*72*	*6*
112	0	0.55	*0.20*	225	*49*	*84*	*65*	*84*	*0*
113	0	0.50	*0.27*	160	*113*	*86*	*25*	*54*	*38*
114	0	0.58	*0.17*	370	*123*	*106*	*71*	*29*	*17*
115	0	1.27	*0.36*	50	*165*	*14*	*-33*	*14*	*23*
116	0	0.52	*0.28*	0	*12*	*0*	*-6*	*0*	*0*
117	0	3.62	*0.35*	7830	*1203*	*752*	*637*	*752*	*8*
118	0	0.43	*0.30*	100	*61*	*69*	*27*	*69*	*42*
119	0	0.21	*0.08*	60	*50*	*22*	*4*	*22*	*26*
120	0	0.60	*0.19*	290	*149*	*94*	*46*	*0*	*32*
121	0	0.80	*0.30*	50	*23*	*19*	*10*	*19*	*0*
122	0	0.82	*0.15*	850	*343*	*158*	*94*	*0*	*0*
123	0	1.54	*0.50*	4140	*290*	*1341*	*1247*	*1295*	*65*
124	0	0.49	*0.18*	160	*109*	*60*	*19*	*0*	*45*
125	0	1.33	*1.33*	2000	*118*	*2000*	*1882*	*2000*	*0*
126	0	0.91	*0.21*	440	*213*	*103*	*53*	*9*	*0*
127	0	1.30	*0.42*	80	*374*	*26*	*-95*	*26*	*29*
128	0	1.10	*0.41*	635	*258*	*236*	*140*	*37*	*52*
129	0	1.02	*0.26*	800	*32*	*207*	*198*	*207*	*0*
130	0	1.66	*0.62*	70	*209*	*26*	*-52*	*26*	*0*

Case	Project	Cropha	*Land/adult equiv.(Ha)*	Crop sales	*Inputs & services purchased*	*Revenue from all crops*	*Net revenue from all crops*	*Revenue from bananas*	*Revenue from fruits*
131	0	0.06	*0.01*	300	*69*	*56*	*43*	*0*	*0*
132	0	0.80	*0.21*	50	*25*	*13*	*6*	*13*	*0*
133	0	0.64	*0.24*	390	*192*	*145*	*74*	*56*	*19*
134	0	0.58	*0.19*	25	*37*	*8*	*-4*	*8*	*0*
135	0	0.49	*0.14*	550	*169*	*158*	*109*	*29*	*34*
136	0	0.57	*0.21*	0	*74*	*0*	*-28*	*0*	*0*
137	0	0.53	*0.15*	280	*120*	*80*	*46*	*17*	*9*
138	0	2.12	*0.61*	275	*161*	*79*	*33*	*72*	*0*
139	0	1.38	*0.40*	254	*324*	*73*	*-20*	*0*	*11*
140	0	1.04	*0.39*	1055	*200*	*393*	*318*	*33*	*19*
141	0	2.26	*0.65*	60	*314*	*17*	*-73*	*0*	*17*
142	0	0.42	*0.19*	190	*118*	*83*	*32*	*44*	*0*
143	0	1.80	*0.39*	200	*299*	*43*	*-21*	*43*	*0*
144	0	1.00	*0.29*	1050	*129*	*302*	*264*	*230*	*29*
145	0	1.12	*0.36*	560	*65*	*181*	*160*	*130*	*0*
146	0	0.87	*0.19*	415	*168*	*89*	*53*	*13*	*19*
147	0	1.40	*0.52*	500	*173*	*186*	*122*	*186*	*0*
148	0	0.92	*0.26*	1110	*650*	*319*	*132*	*86*	*0*
149	0	0.20	*0.14*	250	*137*	*174*	*78*	*174*	*0*
150	0	1.49	*0.38*	662	*578*	*171*	*22*	*52*	*16*
151	0	0.93	*0.22*	620	*353*	*146*	*63*	*47*	*14*
152	0	0.45	*0.11*	370	*131*	*96*	*62*	*26*	*26*
153	0	0.97	*0.23*	370	*116*	*87*	*60*	*47*	*0*
154	0	1.31	*0.49*	8	*119*	*3*	*-41*	*3*	*0*
155	0	0.30	*0.09*	200	*199*	*57*	*0*	*57*	*0*
156	0	1.36	*0.94*	0	*243*	*0*	*-169*	*0*	*42*
157	0	0.51	*0.13*	50	*134*	*13*	*-22*	*13*	*0*
158	0	1.00	*0.19*	820	*206*	*152*	*114*	*117*	*0*
159	0	1.48	*0.43*	255	*122*	*73*	*38*	*57*	*0*
160	0	1.60	*1.60*	600	*263*	*600*	*337*	*500*	*30*
161	0	3.03	*0.35*	222	*244*	*26*	*-3*	*17*	*0*
162	0	0.22	*0.16*	20	*103*	*14*	*-58*	*0*	*42*
163	0	2.10	*1.13*	280	*164*	*150*	*62*	*107*	*9*
164	0	1.33	*0.38*	-1	*273*	*-1*	*-1*	*-1*	*0*
165	0	0.60	*0.13*	20	*47*	*4*	*-6*	*4*	*0*
166	0	0.79	*0.11*	50	*193*	*7*	*-20*	*7*	*3*
167	0	0.42	*0.16*	150	*93*	*56*	*21*	*37*	*18*
168	0	1.33	*0.18*	0	*168*	*0*	*-22*	*0*	*0*
169	0	0.30	*0.13*	0	*105*	*0*	*-46*	*0*	*0*
170	0	1.01	*0.29*	935	*206*	*269*	*209*	*29*	*0*
171	0	0.51	*0.09*	245	*129*	*45*	*22*	*28*	*19*
172	0	0.51	*0.19*	220	*107*	*82*	*42*	*26*	*15*
173	0	1.39	*0.40*	218	*175*	*63*	*12*	*22*	*0*
174	0	1.03	*0.71*	310	*115*	*215*	*135*	*174*	*0*

Case	Project	Cropha	*Land/adult equiv.(Ha)*	Crop sales	*Inputs & services purchased*	*Revenue from all crops*	*Net revenue from all crops*	*Revenue from bananas*	*Revenue from fruits*
175	0	1.28	*0.48*	30	*84*	*11*	*-20*	*0*	*5*
176	0	0.92	*0.27*	860	*126*	*247*	*211*	*172*	*17*
177	0	0.71	*0.23*	165	*59*	*53*	*34*	*32*	*0*
178	0	0.79	*0.23*	0	*128*	*0*	*-37*	*0*	*12*
179	0	0.81	*0.26*	720	*172*	*233*	*177*	*32*	*13*
180	0	0.13	*0.05*	675	*233*	*251*	*164*	*223*	*3*
181	0	0.95	*0.31*	950	*212*	*308*	*239*	*32*	*1*
182	0	0.65	*0.21*	100	*60*	*32*	*13*	*6*	*0*
183	0	0.33	*0.09*	0	*40*	*0*	*-10*	*0*	*0*
184	0	0.23	*0.12*	60	*125*	*32*	*-35*	*32*	*107*

Case	Project	Vcat	Vgoat	Lstoksal	*Revenue from livestock*	*Liquidity*	Irr	Fence	Cphon
1	1	0	35	20	*3*	*145*	1	1	1
2	1	3000	300	150	*23*	*596*	1	1	1
3	1	6650	175	100	*37*	*2948*	1	1	1
4	1	0	240	165	*27*	*99*	1	1	1
5	1	0	320	0	*0*	*72*	0	0	1
6	1	0	50	30	*9*	*115*	1	1	1
7	1	0	103	0	*0*	*-1*	1	0	1
8	1	0	175	0	*0*	*534*	1	1	1
9	1	0	0	0	*0*	*62*	1	0	1
10	1	0	245	0	*0*	*1417*	1	0	1
11	1	0	280	0	*0*	*206*	1	0	1
12	1	0	0	0	*0*	*215*	1	0	1
13	1	0	200	0	*0*	*972*	1	0	1
14	1	0	0	0	*0*	*486*	1	0	1
15	1	0	125	25	*13*	*426*	1	0	1
16	1	0	90	0	*0*	*360*	1	0	1
17	1	0	60	20	*9*	*493*	0	0	1
18	1	0	100	0	*0*	*547*	1	0	1
19	1	0	60	10	*3*	*159*	1	0	1
20	1	0	150	25	*8*	*876*	1	0	1
21	1	0	60	0	*0*	*348*	1	1	1
22	1	0	60	0	*0*	*200*	0	0	1
23	1	0	120	0	*0*	*123*	0	0	1
24	1	1200	0	450	*116*	*521*	1	1	1
25	1	0	60	0	*0*	*830*	1	0	1
26	1	0	120	0	*0*	*603*	1	0	1
27	1	0	300	220	*27*	*352*	1	0	1
28	1	0	0	0	*0*	*64*	1	0	1
29	1	0	0	55	*20*	*262*	1	0	1
30	1	0	315	10	*4*	*210*	0	0	1
31	1	0	30	55	*20*	*521*	1	0	1
32	1	0	0	160	*41*	*62*	1	1	1
33	1	0	0	0	*0*	*127*	1	0	1
34	1	0	0	0	*0*	*100*	1	1	1
35	1	0	60	0	*0*	*378*	1	0	1
36	1	0	0	0	*0*	*1142*	1	0	1
37	1	0	90	0	*0*	*22*	1	0	1
38	1	0	0	35	*9*	*123*	1	0	1
39	1	0	30	90	*23*	*141*	1	0	1
40	1	0	90	30	*10*	*821*	1	0	1
41	1	5	0	0	*0*	*158*	0	0	0
42	1	0	210	0	*0*	*4062*	1	0	1
43	1	0	240	0	*0*	*312*	1	0	1

Case	Project	Vcat	Vgoat	Lstoksal	*Revenue from livestock*	*Liquidity*	Irr	Fence	Cphon
44	1	0	175	*0*	*0*	*197*	1	0	1
45	1	3150	150	*30*	*13*	*2630*	1	0	1
46	1	0	60	*0*	*0*	*469*	1	0	1
47	1	0	0	*0*	*0*	*333*	1	0	1
48	1	0	180	*30*	*9*	*279*	1	0	1
49	1	0	90	*0*	*0*	*242*	1	1	1
50	1	0	120	*0*	*0*	*536*	1	0	1
51	1	0	0	*30*	*7*	*157*	1	0	1
52	1	0	180	*0*	*0*	*197*	1	0	1
53	1	3600	0	*0*	*0*	*1777*	1	1	1
54	1	0	120	*55*	*20*	*1173*	1	0	1
55	1	0	0	*0*	*0*	*90*	1	0	1
56	1	0	90	*0*	*0*	*142*	0	0	1
57	1	0	0	*0*	*0*	*611*	1	0	1
58	1	0	120	*0*	*0*	*406*	1	0	1
59	1	0	0	*0*	*0*	*402*	1	1	1
60	1	2800	120	*0*	*0*	*1386*	1	1	1
61	1	0	0	*0*	*0*	*247*	1	0	1
62	1	1300	60	*0*	*0*	*220*	0	1	1
63	1	0	30	*35*	*11*	*345*	1	1	1
64	1	0	0	*0*	*0*	*429*	1	1	1
65	1	750	90	*300*	*97*	*389*	1	0	1
66	1	1200	90	*0*	*0*	*1031*	0	0	1
67	1	0	360	*0*	*0*	*245*	0	0	1
68	1	0	0	*0*	*0*	*160*	1	1	1
69	1	0	90	*0*	*0*	*171*	1	0	1
70	1	0	280	*0*	*0*	*256*	1	0	1
71	1	0	110	*35*	*9*	*270*	1	0	1
72	1	0	0	*0*	*0*	*227*	1	1	1
73	1	0	140	*0*	*0*	*557*	1	0	1
74	1	0	0	*0*	*0*	*145*	1	0	1
75	1	0	0	*0*	*0*	*87*	1	0	1
76	1	600	55	*300*	*86*	*490*	1	1	1
77	1	0	60	*0*	*0*	*201*	1	1	1
78	1	0	140	*0*	*0*	*476*	1	0	1
79	1	0	0	*0*	*0*	*227*	1	0	1
80	1	0	0	*0*	*0*	*148*	1	1	1
81	1	0	80	*100*	*22*	*233*	1	0	1
82	1	2400	450	*0*	*0*	*786*	0	1	0
83	1	0	0	*0*	*0*	*214*	1	0	1
84	1	0	80	*0*	*0*	*310*	1	0	1
85	1	0	90	*0*	*0*	*230*	1	0	1
86	1	0	145	*65*	*9*	*133*	1	1	1

Case	Project	Vcat	Vgoat	Lstoksal	*Revenue from livestock*	*Liquidity*	Irr	Fence	Cphon
87	1	0	140	*0*	*0*	*480*	1	1	1
88	1	0	0	*0*	*0*	*130*	1	1	1
89	1	0	0	*0*	*0*	*110*	1	1	1
90	1	0	0	*35*	*4*	*89*	0	0	1
91	1	0	0	*0*	*0*	*26*	1	0	1
92	1	0	0	*0*	*0*	*151*	1	1	1
93	1	0	0	*0*	*0*	*65*	1	1	1
94	1	0	100	*60*	*16*	*70*	1	1	1
95	0	0	160	*0*	*0*	*627*	0	0	0
96	0	0	160	*0*	*0*	*284*	0	0	1
97	0	0	0	*0*	*0*	*70*	1	0	1
98	0	0	0	*0*	*0*	*0*	0	0	0
99	0	0	80	*0*	*0*	*60*	1	0	0
100	0	0	280	*0*	*0*	*208*	0	0	1
101	0	0	90	*0*	*0*	*171*	0	0	0
102	0	0	200	*0*	*0*	*259*	0	0	1
103	0	0	0	*0*	*0*	*146*	1	0	1
104	0	0	0	*0*	*0*	*22*	0	0	1
105	0	0	0	*0*	*0*	*61*	0	0	1
106	0	0	0	*0*	*0*	*78*	0	0	1
107	0	0	120	*0*	*0*	*465*	1	0	1
108	0	0	90	*50*	*50*	*430*	0	0	1
109	0	0	30	*0*	*0*	*363*	1	0	0
110	0	0	210	*0*	*0*	*275*	0	0	1
111	0	0	0	*0*	*0*	*78*	1	0	1
112	0	0	0	*0*	*0*	*84*	0	0	1
113	0	0	175	*0*	*0*	*217*	0	0	0
114	0	1200	120	*0*	*0*	*503*	0	0	1
115	0	0	175	*5*	*1*	*89*	0	0	0
116	0	0	0	*0*	*0*	*0*	0	0	0
117	0	0	0	*0*	*0*	*760*	1	0	1
118	0	0	0	*0*	*0*	*111*	0	0	0
119	0	0	0	*0*	*0*	*48*	1	0	0
120	0	0	175	*0*	*0*	*183*	0	0	1
121	0	0	0	*0*	*0*	*19*	0	0	0
122	0	0	0	*0*	*0*	*158*	1	0	1
123	0	0	245	*0*	*0*	*1485*	1	0	1
124	0	0	280	*0*	*0*	*208*	0	0	1
125	0	1200	0	*0*	*0*	*3200*	0	0	1
126	0	3150	240	*30*	*7*	*907*	0	0	1
127	0	0	360	*0*	*0*	*172*	1	0	1
128	0	0	60	*0*	*0*	*311*	0	0	1

Case	Project	Vcat	Vgoat	Lstoksal	*Revenue from livestock*	*Liquidity*	Irr	Fence	Cphon
129	0	0	120	*40*	*10*	*248*	1	0	1
130	0	0	60	*0*	*0*	*48*	1	0	1
131	0	0	0	*0*	*0*	*56*	0	0	1
132	0	0	120	*10*	*3*	*46*	0	0	0
133	0	0	200	*0*	*0*	*238*	0	0	1
134	0	0	60	*0*	*0*	*28*	0	0	1
135	0	0	240	*0*	*0*	*261*	0	0	1
136	0	0	0	*0*	*0*	*0*	0	0	1
137	0	600	280	*0*	*0*	*342*	0	0	1
138	0	0	0	*0*	*0*	*79*	0	0	0
139	0	0	50	*0*	*0*	*99*	1	0	1
140	0	900	80	*0*	*0*	*776*	0	0	1
141	0	0	0	*0*	*0*	*34*	0	1	1
142	0	0	0	*0*	*0*	*83*	0	0	1
143	0	700	110	*30*	*6*	*224*	1	1	0
144	0	0	320	*0*	*0*	*422*	0	0	1
145	0	0	25	*0*	*0*	*189*	1	0	1
146	0	1500	440	*0*	*0*	*527*	0	0	1
147	0	0	210	*120*	*45*	*309*	1	0	1
148	0	0	0	*0*	*0*	*319*	0	0	1
149	0	0	50	*0*	*0*	*208*	0	0	1
150	0	0	140	*0*	*0*	*223*	0	0	0
151	0	0	210	*0*	*0*	*209*	0	1	1
152	0	1500	240	*0*	*0*	*571*	0	0	1
153	0	0	70	*50*	*12*	*115*	0	0	1
154	0	0	0	*0*	*0*	*3*	1	1	1
155	0	0	60	*30*	*9*	*83*	0	0	1
156	0	0	0	*700*	*486*	*528*	0	0	1
157	0	0	40	*30*	*8*	*31*	1	1	0
158	0	0	0	*40*	*7*	*160*	1	0	1
159	0	0	0	*0*	*0*	*73*	0	0	1
160	0	0	60	*0*	*0*	*690*	0	0	0
161	0	500	178	*200*	*23*	*127*	0	1	1
162	0	400	60	*9*	*6*	*381*	0	1	1
163	0	0	120	*150*	*80*	*303*	1	0	1
164	0	1750	60	*0*	*0*	*649*	1	0	1
165	0	0	50	*0*	*0*	*15*	1	0	1
166	0	1300	60	*0*	*0*	*198*	0	1	1
167	0	0	0	*50*	*19*	*93*	1	0	1
168	0	0	0	*0*	*0*	*0*	0	0	1
169	0	0	0	*0*	*0*	*0*	1	0	1
170	0	0	200	*0*	*0*	*326*	1	0	1
171	0	0	0	*0*	*0*	*64*	1	0	1

Case	Project	Vcat	Vgoat	Lstoksal	*Revenue from livestock*	*Liquidity*	Irr	Fence	Cphon
172	0	2100	360	*0*	*0*	*1012*	0	0	1
173	0	0	0	*10*	*3*	*65*	1	0	1
174	0	0	0	*0*	*0*	*215*	0	0	1
175	0	0	0	*0*	*0*	*16*	1	1	0
176	0	0	360	*0*	*0*	*368*	0	0	1
177	0	0	165	*140*	*45*	*152*	1	0	1
178	0	0	0	*0*	*0*	*12*	0	1	1
179	0	0	280	*0*	*0*	*337*	0	0	1
180	0	0	60	*0*	*0*	*276*	1	0	1
181	0	0	140	*0*	*0*	*354*	0	0	1
182	0	0	150	*0*	*0*	*81*	0	0	0
183	0	0	100	*0*	*0*	*26*	0	0	1
184	0	0	0	*0*	*0*	*139*	0	0	1

Note: Italics represent computed variables and their data values. All variables in italics are expressed per adult equivalent.