CHAPTER 10
SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

This chapter presents a summary of the thesis. Relevant conclusions are deduced and the policy implications that emerge from the findings presented in the study are explored.

10.1. Summary of the study

10.1.1 Background

Agriculture is the most important economic activity in Uganda, providing income and employment to over 85 per cent of the Ugandan population, but its productivity has stagnated relative to population growth. Soil fertility decline and the increased incidence and intensity of pests and diseases are among the primary causes of low agricultural productivity in Uganda. Crop management technologies that could mitigate the negative effects of these biotic factors (i.e. pests, diseases and the deterioration of soil fertility) are available but the adoption thereof is lower than expected. A better understanding of the adoption process and constraints to adoption is needed to guide policymakers in designing appropriate policies to stimulate technology adoption.

Understanding the determinants of technology adoption has long preoccupied economists concerned with crop productivity potential in developing economies. Ample empirical work has been done on the determinants of technology adoption but most of the earlier adoption studies were focused on the green revolution technologies. In the post green revolution period, most crop management technologies recommended to small farmers in sub-Saharan African countries have been low external input technologies. The banana management technologies recommended for Ugandan farmers constitute a typical example of such low external input technologies. While these technologies have some advantages and are generally assumed to be affordable by resource-poor farmers, their characteristics may impede their adoption by many farmers. They tend to be location-specific and knowledge-intensive, and to substitute labour for capital. These technological characteristics mean that the factors

that influence their adoption may not necessarily be similar to those that were important in the adoption of the green revolution technologies.

Despite the massive literature on technology adoption, some aspects of technology adoption have been under-researched. In particular, the role of social capital in technology adoption has received less attention in applied economics studies of technology adoption. There is an increasing interest in a paradigm that recognizes social capital as an additional asset in economic development. Among the reasons for this interest is the fact that social capital can facilitate information flow, reduce transaction costs and avoid collective-action dilemmas. This is critical for agricultural development in developing economies where the majority of the farmers have had fewer years of formal education and extension systems are weak. Furthermore, in developing economies transaction costs constitute a major challenge to agricultural development and mechanisms that can reduce these transaction costs will have a significant impact on positive development in these economies.

Although the literature showing that social capital and economic outcomes are related has been increasing, very few applied economics studies have tested the effect of social capital on the adoption of agricultural innovations. Moreover, those studies that have been undertaken to assess the importance of social capital in adoption decision-making processes have focused on information diffusion. The possibility that social capital may also generate resources in the form of cash or labour that could influence technology adoption has not been fully considered in the economic modelling of technology adoption. Furthermore, there is paucity of information on the determinants of social capital among agricultural households.

10.1.2. Purpose of the study

The purpose of this study was to examine the nature of the relationship between social capital and adoption of banana production management technology. The specific objectives of the study were to (a) conceptualise, define and measure social capital; (b) identify the determinants of social capital among agricultural households in Uganda; (c) examine the effect of social capital on banana production management

decisions; and (d) determine other factors that are important in banana production management decisions.

To the researcher's knowledge, this is the first study to develop a model of technology adoption within an agricultural household framework that incorporates social capital and offers two explicit mechanisms through which social capital may be linked to technology adoption. By incorporating two mechanisms in the same analysis, the study was able to provide an insight into the mechanism that is likely to be important in linking social capital to the adoption of banana management practices

The main hypothesis of the study is: that the adoption of banana management practices is likely to be higher in households that (a) participate more in associations and have better access to labour and social insurance; (b) receive zero-interest credit/cash remittances from their social networks; (c) live in areas where association leaders have higher levels of education and livelihood; and (d) live in areas where social interactions are guided by participatory decision-making norms. The study also tested the hypothesis that household consumption and banana production management decisions are separable.

10.1.3. Research methods

Empirical analysis was based on the primary data collected in a survey of 400 banana-producing households in Uganda. These households were selected from the three major banana-producing regions (i.e. the Eastern, Central and south-western) of Uganda, using multi-stage random sampling methods. Survey instruments were designed to elicit detailed information on adoption, social capital and other household and village variables. The method of data collection, a combination of recall and observation, was designed somewhat differently from the conventional approaches in order to minimize the problem of measurement error. Colour photographs were also used to enhance farmers' recognition of the technology or constraint they were being asked about.

A combination of econometric methods was employed to analyse the data. A Probit model was used to estimate the probability of using an improved banana management

practice and of participation in associations. The extent of use of improved banana management practices was estimated using two methods, namely ordinary least squares (OLS) and the Heckman procedure, to account for sample selection in some equations. Intensity of participation in associations was estimated using a Poisson model. A negative binomial model that allows for over-dispersion in the data was employed to identify the determinants of the intensity of participation in private social networks. Each technology and association equation was estimated separately because there were no efficiency gains in estimating a complex simultaneous system when the same explanatory variables were used across equations.

10.2 Major findings of the study

10.2.1 Use of banana management practices

The study found that there was a considerable diffusion of management practices among banana-growing households, but the share of the banana area treated using each practice was low. Considering the overall banana producing areas, less than 30 per cent of the banana areas are treated with soil fertility management practices (i.e. mulching and manure), but this percentage is much lower in high elevation areas. Constraints on access to organic fertilizers, which are more binding for farmers in high elevation areas, who are also comparatively large-scale banana producers, are likely to be an important reason underlying the smaller share of banana area allocated to soil fertility management practices. In high elevation areas, farmers try to compensate for the low use of external organic fertilizers by investing in the recycling of banana residues (through making extensive use of the stumping and splitting/chopping of pseudo-stems and the removal of extra suckers), but the same is not true in the case of farmers in low elevation areas. Neither soil fertility nor sanitation is extensively used in low elevation areas.

10.2.2 Determinants of use of banana management practices

The study results indicate that the choice of and demand for improved banana production management practices (i.e. mulching with crop residues or grass, manure application, de-suckering, post-harvest pseudo-stem management practices and corm

paring) depend on a host of factors. All five groups of factors identified from the theoretical model were statistically significant in either the choice of or demand for improved banana management practices, or both, implying that the model appropriately describes the behaviour of banana producers in Uganda. However, the effects of most of the hypothesized factors were technology-specific, reflecting the heterogeneous nature of the practices and the fact that these factors may act through various mechanisms. This implies that the explanations of the results should be considered separately for the different technologies studied and their contextual settings. The null hypothesis of separable production and consumption decisions, a major analytical feature of the model of the agricultural household, was rejected for most of the practices, supporting the use of the non-separable household model to analyse the production decisions of banana farmers.

For simplicity of presentation, the determinants of banana production management decisions are organized under two themes. First, the results regarding the effect of social capital are discussed. This is followed by a discussion of the other determinants of the use of banana management practices identified from the study.

10.2.2.1 Effect of social capital

The study findings support the hypotheses that the use of banana management practices (a) increases with the number of household memberships in associations and household access to labour and social insurance from social networks; and (b) is higher in areas where association leaders have achieved higher levels of education and livelihood. The study results indicate that these aspects of social capital exert a significant influence on banana management decisions but, like many other variables, the effects were technology-specific.

Different dimensions of association-related social capital (number of memberships, leadership heterogeneity and participatory decision-making norms) are important in banana management decisions but the effects are specific to the particular practice as well as the form of social capital involved. A possible explanation for this is that these dimensions of social capital may work through different mechanisms that may be specific to the form of social capital involved, which influences the use of certain

technologies but not others. Banana management practices also differ a great deal, which adds another source of heterogeneity. The most important conclusion from this finding is that the nature of the relationship between social capital and adoption of agricultural technologies depends upon the properties of the technology and the specific form of social capital used in the analysis.

After controlling for physical and human capital, households that have greater participation in associations are more likely to apply organic mulch on a larger proportion of their banana plantations than those with little or no participation in associations. However, this variable was not significant in the adoption of other practices, which suggests that it may influence mulching through mechanisms other than information diffusion. Mulching has been known in the communities for a relatively long period compared to some of the other practices studied. A possible mechanism through which membership density in associations may increase the extent of mulching is the access to resources, such as farm implements and land for cutting grass or growing annual crops, which could augment the use of mulching. Households that belong to many associations are likely to have access to such resources because, through associations, they learn both to trust other people and also how to approach them. Since manure may require more expensive farm implements such as wheelbarrows, which are owned by few households in rural areas, this kind of externality does not influence the adoption of manure application practices. Other practices are typically implemented using labour, which has been controlled for in the analysis, and a panga, which is owned by almost every household.

The study further indicates that the likelihood and extent of good banana management is higher in communities where associations are under the leadership of individuals having higher levels of education and a higher livelihood status. This aspect of social capital was significant in four out of five of the technologies included in the analysis. This is because individuals with a higher education and livelihood status are likely to be connected to external sources of information and people in powerful positions. When placed at the centre of social interactions in the community, by assuming leadership responsibilities in an association, people of higher social status generate positive externalities in the form of information or other resources (e.g. complementary inputs from external sources) for the adoption of new technologies

because their higher social capital becomes accessible to more people in the community. This is because the majority of community members have attained low levels of education and are poor, implying that they have low social capital endowments of their own. Moreover, individuals with higher education and higher livelihood status are likely to be adopters and because people tend to emulate their leaders, there would be positive externalities for technology adoption. It can, therefore, be concluded that when people with a higher social status participate in guiding collective action within the community, the externalities for technology adoption generated from their participation are likely to be significant.

The effect of participatory decision-making norms on the adoption of banana management practices is ambiguous. Participatory norms of decision-making were positively associated with the use of mulching and manure technologies but negatively associated with use of corm paring. The negative effect in the adoption of corm paring was unexpected. The negative effect may be associated with the belief that when all the roots are removed, the sucker will not germinate. This finding re-enforces the assertion in the literature that social capital is double-edged. It can have positive or negative effects. It can, therefore, be concluded that while social capital facilitates the exchange of information, transformation and action, the information shared can result in either the adoption or non-adoption of the technology, depending on the contextual setting.

The analysis also reveals that labour transfers and social insurance from private social networks positively influence decisions regarding the use and extent of use of manure, a labour-intensive soil fertility management practice. This is evidence that agricultural households also use their social capital to compensate for high transaction costs in the labour and financial markets. However, the magnitude of the coefficients of these bilateral transfers was too small to be considered important. This finding implies that though bilateral transfers may be used to compensate for the high cost of transactions in the market, these do not entirely overcome market constraints when it comes to banana production management decisions. Institutional social networks (i.e. associations) are likely to be more important than private social networks. However, this should not be taken to mean that private social networks are not important in the adoption of agricultural technologies. The insignificance of bilateral transfers with

regard to most technologies and the small coefficients regarding the use of manure may be related to the nature of the technologies studied. Their effect in other studies should also be investigated.

10.2.2.2 Other determinants of the use of banana production management practices

Other important determinants of the adoption of banana management practices identified in the study include market infrastructure, educational programmes that influence farmers' perceptions of soil fertility problems and knowledge about management practices, and poverty in general. Market-related factors (production returns relative to the cost of hired labour, physical market access and imperfections in the factor markets) are the most important factors in explaining variations in decisions regarding the use of improved banana management practices. The coefficient on the banana market price relative to the cost of labour was positive and significant in both the probability and the extent of use of all technology equations. This means that raising the output price relative to the cost of labour is likely to have the greatest impact of any single factor.

Infrastructure development and implicitly, physical access to markets increase the probability that a farmer will choose to use mulching, manure and post-harvest residue management practices, all of which are related to soil fertility management. A possible reason for this is that on plantations in the proximity of good roads, increased commercialisation of banana production may accelerate soil fertility depletion, which in turn, stimulates farmers' perception of the soil fertility problem, thus inducing a higher probability of using soil fertility management practices.

Physical access to markets does not seem to be important in decisions regarding the proportion of the banana area treated with organic fertilizers (mulching or manure). Only the extent of use of residue recycling techniques responds to increases in physical access to markets, perhaps because they can be implemented piecemeal and hence spread over time. This could make these practices appear to be less labour-intensive when evaluated within a short-term horizon. The low significance of market access in the scaling-up of the adoption of mulching and manure application may be associated with the high opportunity cost of labour for households with better access

to markets in general. Moreover, the supply of organic materials depends on other farm activities, which, in turn, depend on family labour.

The study also indicates that household endowments as in the form of family labour and other production assets (such as livestock and per capita land availability) are critical for the good management of banana plantations, reflecting market imperfections for banana production inputs. Market imperfections are particularly important for practices related to soil fertility management. This is because the organic materials used to mulch and make manure are not sold in markets but produced on the farm as by-products of other farm activities. This causes their supply to be inelastic and dependent on household resources such as landholdings, livestock capital and family labour, which, in turn, influence the activities that produce them.

Land quality attributes also shape decisions regarding the choice and extent of use of banana production management practices. High erosion potential encourages the use of practices related to mulching (mulching with grass or crop residues and residue management) but discourages the use of manure, since the production function shifts inwards when the erosion potential is perceived to be high. This suggests that other techniques that reduce the erosion potential need to be promoted along with manure application, while the positive effect of mulching in curbing the erosion potential should be emphasized in extension messages.

The positive role of information diffusion in banana management decisions is also evident from this study. This result is in line with the observation by Schultz (1975) that if the technology is forever changing to adapt to the changing environment or new components that are introduced, the state of disequilibrium will persist and continued dissemination of information will then be necessary for adoption to occur. Banana management practices are knowledge-based and frequent modifications in management practices to cope with the increase in biotic pressures mean that information dissemination is necessary for their adoption.

10.2.3 Social capital in the banana-growing areas

The study found that across the banana growing regions farmers foster active social participation, though membership in associations was relatively low in the Central region. The most common associations were burial societies and economically oriented associations (i.e. informal credit, agriculture, trade), though less than half of those interviewed report membership in economically oriented associations. The study findings also show that most organizations drew their membership from within the village's geographical boundaries. A possible reason for this is that high transaction costs constrain interactions beyond the village. The social composition of most associations also reflects that of the village, implying a bridging type of social capital when evaluated at the village level.

In addition, rural households also belong to private social networks, which are less formal than associations. Within these social networks, households exchange a variety of economic goods that range from food and labour to consumer durables and cash gifts. Almost every household had transferred part of its income to its social network, while most of them (about 70 %) had also received income from the social network. The least accessed benefit from social networks was zero-interest credit.

10.2.4 Determinants of social capital

The study findings support the prior expectations that there are disparities regarding access to social capital among rural households in Uganda. Households with physical (landholding and livestock) and human capital (education) have better access to associations and private social networks compared to poorer households. It is not clear what lies behind these disparities. This may imply higher returns for the wealthier or barriers to participation for the relatively disadvantaged households. Most of the economically oriented associations that offered immediate benefits in the form of credit required an entry fee, which may inhibit poorer households from joining. Social associations, such as religious and cultural associations, which have comparatively low membership fees, may not offer attractive incentives for the poor, since their immediate need is survival. None of the production assets representing wealth explained membership in agriculturally oriented associations, suggesting that

these are neutral to wealth. Most of the agriculture-based associations are initiated with the support (in the form of training, seed or livestock) of external agencies, and entry is normally free.

Other household characteristics found to influence social capital accumulation were the age of the household, gender and initial endowments of social capital. There are gender disparities in social capital accumulation, with men being less likely to participate in social associations than women. However, since the effect of gender was explored by including a dummy of gender for the household head, this result is inconclusive. For, example, the demand for membership in associations may be related to factors unique to female-headed households but not to gender.

The age of the household head also tends to reduce the propensity to accumulate social capital in the form of associations. Research findings further indicate that the initial stock of social capital in the form of a network of relatives is an important source of both "acquired" social network (i.e. network of friends) and social capital in the form of associations. This is because access to a network of relatives generates positive externalities such as trust and reduces risk aversion, both of which encourage social capital accumulation.

The social and economic heterogeneity of the village also has some role to play in social capital accumulation, but the effect depends on the nature and objectives of the associations. Ethnic fragmentation increases the village's rate of participation in socially oriented associations because the village population stratifies into homogenous groups when it comes to participation in socially oriented associations. Economic fragmentation also appears to increase participation in rotating credit and savings associations because these associations tend to be economically homogeneous. Economic fragmentation is an important source of social network intensity because social capital accumulation in the rural areas is economically motivated. However, asymmetries in benefits associated with economic fragmentation tend to discourage household-level accumulation of social capital in the form of associations.

10.3. Implications for policy

The findings of the study have several implications for policy. Although the study has focused on bananas in Uganda, results can be generalized to technology adoption for other crops or to other countries within a similar context.

10.3.1. Implications of social capital as an asset in agricultural development

The results of the study have major implications for incorporating social capital in development projects and technology dissemination strategies. Taken as a whole, the recommendations outline a strategy for incorporating social capital into development interventions in such a way as to make a substantial contribution to agricultural development.

Perhaps the most important implication of the study is that farmers should be encouraged to participate in associations. Through interaction in associations, members can share information from their experiments. Because the information gained comes from other farmers whose opinion the adopter trusts, the potential adopter may skip the stage of experimentation and hence adopt the technology more extensively. Secondly, if more household members participate in associations, they can pool information, so that the influence of the association carries over to the farm, persuading those who manage the banana groves to conform. Furthermore, associations may generate other externalities, such as trust, cooperation and learning how to interact with others, which, in the long run, will have a positive effect on production decisions. The positive interaction between private social networks and the accumulation of social capital in the form of associations also suggests that associations may generate positive externalities in strengthening community networking and hence provide access to resources from others that could be used in agriculture (e.g. borrowing farm implements, land and exchange labour).

Household participation in associations is, however, not enough to make a significant difference on its own, as the structure of participation and the characteristics of the associations concerned also matter. Associations led by individuals with a higher education and livelihood status and who are therefore implicitly more capable of

organizing, coordinating and linking the association members with other groups, generate positive externalities in the community that will increase the use of crop management practices. This aspect of social capital was significantly positive for most studies of the management practices. The important implication to be derived from this finding is that when using group-based approaches to intervene in the agricultural development process, there is a need to consider sensitising people as to the role and importance of good leaders. In addition to being well educated and of a higher livelihood status, good leaders need to be trustworthy. This has implications for extension methodology. Extension should not only emphasize the benefits of the technology but also include programmes that encourage community members to form associations with key features that will generate positive externalities for technology adoption in the community.

The relatively low participation rate in each organization also means that incentives and constraints to participation in organizations are likely to be specific to the organization. This implies that while certain organizations may exist in the village, their contribution towards solidarity and collective action for the community's welfare will be limited if people are divided into small groups. Hence, there is a need to encourage organizations with diversified activities while minimizing barriers to participation so as to increase community representation in each organization. This is also important for information pooling and diffusion in the community, which is necessary for the adoption of new agricultural technologies.

The study findings also reveal that while associations may bridge across different social groups, they are limited to the village's geographical boundaries. This implies that associations are likely to be effective in diffusing technologies within a village but limited in their scope as regards the extent to which they can diffuse technologies beyond the village. The implication for extension is that the dissemination of technologies may need to take place at the village level. Unfortunately, this may not be achievable within the current government budget. The formidable challenge is to find out how to stimulate the effective demand among agricultural households for membership in associations beyond village boundaries. There is need to analyse constraints to social interactions beyond the village and identify policies that can broaden the scope of social interactions beyond the village.

The findings of the study also have positive and negative implications for group-based approaches to agricultural extension. An important policy implication in favour of group-based approaches to agricultural extension is that household wealth is unimportant for membership in agriculture-based organizations. This implies that participation in these organizations is wealth-neutral. Thus, promoting agriculturally oriented organizations is less likely to isolate the poor. However, there is a need to sensitise the masses with the aim of making them aware of their mutual interdependence in order to reduce the biases created by formal education in regard to membership in agriculture-based organizations. In addition, most of the agriculture-based associations were externally initiated and more research is needed to understand whether their income-neutrality holds without external influence.

The negative implication is that participation in agriculture-oriented organizations is lower in communities with a high level of ethnic fragmentation. The study shows that an increase in ethnic fragmentation is likely to reduce the propensity to participate in agriculture-based organizations. This could reduce the effectiveness of group-based approaches as a method of agricultural extension, which implies that group-based approaches alone may not be a viable strategy for disseminating technologies in communities with a high degree of ethnic heterogeneity. The same may apply in the case of communities dominated by households with an off-farm production orientation.

The study also reveals that social capital can have positive as well as negative consequences for technology adoption. The negative correlation between participatory norms of decision-making and the adoption of corm paring implies that accounting for social capital in agricultural development projects will need to be based on a thorough analysis of the institutional context, relating this context to the properties of the technology. This could be done as part of the baseline studies and would help in the design of dissemination strategies that are appropriate for the target community as well as the technology being disseminated. The inequalities in social capital accumulation also imply that policies promoting the use of grass-root level associations as an instrument of economic development could widen the gap between rich and poor. Therefore there is a need to design strategies that will encourage poor households and those with a low level of formal education to participate in local

organizations. These challenges mean that incorporating social capital in development projects is more of a process than an event, which may demand skills and resources that will be worth investing only if the outcome is a net benefit to the development effort.

10.3.2 Improving the smallholder access to markets

Improving banana farmers' access to markets is another area that, though well recognized, still requires further attention. As the results of the study demonstrate, market-related factors are the most important determinants of banana production management decisions, which implies that banana farmers do respond strongly to market incentives. By implication, government interventions via research and extension in the absence of market incentives would most probably be unsuccessful and would lead to the inefficient use of scarce resources.

Areas where intervention would be useful include investment in rural roads; development of marketing associations on a voluntary basis to reduce the transaction costs in the banana markets; creating an enabling environment for increasing private trader participation; and increasing producer access to market information (e.g. through marketing associations). Investment in the post-harvest processing of bananas to broaden their utilization would also expand the market for bananas and may encourage farmers to invest in production management technologies. The high perishability of bananas precludes storage, implying that the farmers must sell their bananas when mature to avoid losses even when the price of bananas does not cover the cost of production. Consequently, the farmer loses negotiating power when selling his/her bananas. Investment in post-harvest processing should target periods of high production. However, greater commercialisation of banana production would perhaps increase soil depletion. Thus, in addition to improving farmer access to markets, there is a need to address other constraints that, if not dealt with, could render efforts to enhance market access useless.

10.3.3 Implications for banana production management technology

One of the findings of the study is that the use of banana management practices partly depends on household factor endowments (i.e. labour, landholdings and livestock units). This is because of imperfections in the factor markets. Banana management practices are labour-intensive and organic fertilizers (mulching and manure application) are produced on the farm as by-products of other activities, implying that household endowment regarding these inputs is critical for the good management of banana plantations.

However, landholdings are becoming smaller due to population pressure. The opportunity cost of labour may also increase with the general increase in market access. Access to family labour for agriculture is further limited by the current increase in school enrolment following the new policy of universal education in the country and the HIV/AIDS pandemic that has claimed the lives of many young people. Access to livestock is also constrained by poverty in general. Therefore, there is a need to identify and promote banana production technologies that demand less of the farmers' resources. Specifically, there is a need to explore alternative inexpensive sources of fertilizers and to recommend them to farmers. This is particularly important for the farmers operating near paved roads because improvements in market access may be associated with greater soil fertility depletion due to the increased marketing of the fruit to urban centres.

As the study results indicate, a general improvement in access to markets increases the probability of use of soil fertility management practices (mulching and manure application), because of the greater perception of the soil fertility problem that may be associated with the high commercialisation of bananas near good roads, but does not seem to motivate the extent of the use thereof. Instead, farmers rely on the recycling of banana residues to maintain the fertility of the soil in banana plantations. Relying on post-harvest residue to restore soil fertility in these areas is not an adequate method of managing soil fertility in banana plantations, given the high levels of commercialisation.

The results of the study also support the intensification of educational programmes as a means of promoting the use of good management practices. Hence, more support to extension programmes would increase the use of these techniques.

10.4. Limitations of the study and recommendations for future research

This section summarizes some of the limitations of the study and suggests further research.

10.4.1 Additional mechanisms through which social capital influences the adoption of management technologies

The study investigated two mechanisms (information and bilateral transfers) through which social capital may influence the adoption of banana management practices but did not test whether social capital and social learning were actually related. After controlling for bilateral transfers, it was assumed that the remaining effect was attributable to information diffusion. As the results of the study show, information diffusion could not explain all the patterns of correlation in the data, suggesting that there could have been other mechanisms through which institutional social networks worked to influence the use of banana management practices in addition to information diffusion. Future research should therefore test for correlations between these forms of social capital and information acquisition. More research needs to be done to identify alternative mechanisms through which social capital could influence technology adoption. There is also a need for a more detailed study of social capital that examines resource allocation to social capital and the extent to which associations and private social networks are used to overcome market imperfections so as to fully link social capital to other household production processes. Such research might also clarify why poorer households participate less in associations.

10.4.2 Gender and social capital formation

This study explored the effect of gender on social capital accumulation by including a dummy of the gender of the household head. One drawback of the conventional approach is that it does not reveal anything about the behaviour of women who live in

male-headed households. Failure to distinguish between women who live in male-headed households and those who live in female-headed households could give rise to a serious omission because their constraints may be different. Therefore, future research should investigate how gender influences participation in associations.

10.4.3 Measurement of social capital

This study relied mainly on quantitative methods, one of the methods used to measure social capital. However, at community level in particular, some issues regarding social capital could be better captured with qualitative methods. Hence, future work should use a combination of these methods.

10.4.4 Scale of the data used to analyse the determinants of social capital

Other limitations are associated with the scale of data collection. The determinants of social capital were investigated on a sub-sample due to budget and logistical constraints, thus limiting the inclusion of some community attributes that might be interesting for policy. In some cases, a lack of variation in the data could have failed to reveal important relationships. Furthermore, social capital is known to be location-specific and future research that has a wide coverage of the rural areas would help to identify more determinants of social capital that are important for policy.

10.4.5 Modeling and estimation approaches

Some orientation as regards the future estimation of the relationship between perceptions, social capital and management decisions can also be derived from the results. The estimation approach adopted in this study is one of the approaches that can be used to analyse the interesting relationships discussed in the conceptual framework. Perceptions depend on physical changes in the environment as well as people's awareness of such changes. Awareness, in turn, is influenced by social capital. While the approach used in this study is simple and appropriate in its own right, an analysis that employs a two-stage procedure would yield more information on the interaction among these three aspects. An estimation approach that uses an objective measure of perceptions (soil fertility problems and diseases) as explanatory

variables in a two-stage estimation procedure would clearly show the influence of social capital in the different stages of the crop management decision-making process. Moreover, an analysis of interactions between different management practices would shed more light on the adoption of the banana management package and its implications for dissemination strategies.

Finally, this research attempted to analyse the factors that influence banana management decisions assuming the homogeneity of banana varieties. Previous studies also identified factors that were important in banana variety choice while taking crop management as a given. Different banana varieties may require different management efforts to be productive. Future research could, therefore, attempt to model these decisions simultaneously rather than sequentially.