Social Capital and Technology Adoption on Small Farms: The Case of Banana Production Technology in Uganda.

by

Enid Mbabazi Katungi

Submitted In partial fulfilment of the requirements for the Degree of

Doctor of Philosophy (Agricultural Economics)

in the

Department of Agricultural Economics, Extension and Rural development
Faculty Of Natural and Agricultural Sciences
University of Pretoria

Pretoria
South Africa

November 2006
DECLARATION

I declare that the dissertation, which I hereby submit for the degree of Doctor of Philosophy in Agricultural Economics at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other University.

__________________________________
DEDICATION

To: Stephen, Davis, Daphine and my parents
ACKNOWLEDGEMENTS

I am indebted to Prof. Charles Machethe for his guidance during the development and completion of this dissertation. The challenges he gave me during the initial stages of the proposal development inspired me into this fascinating research. I am also immensely grateful to Dr. Melinda Smale for her unconditional guidance and tireless effort she put in to help me shape this research. Thank you also for the encouragement and moral support during hard times.

I thank the Gatsby charitable organization and the National Banana Research Programme for funding my PhD programme. I thank in particular, the National Banana programme leader, Dr. Tushemereirwe who gave me this opportunity and granted me a study leave to undertake a PhD course and got funding for me. I was fortunate to collaborate with IPFRI and INIBAP that sponsored the design and collection of part of the data that was used for this dissertation. I thank Mr. E. Kikulwe, Mr. F. Bagamba and all those who contributed to the success of the project.

IFPRI also invited and supported me for a month at their office in Washington DC where I consolidated my research thinking. I would like to acknowledge in a special way, the contribution of Dr. Smale and Dr. S. Edmeades towards this achievement. While in Washington DC, I also enjoyed a friendly atmosphere from the IFPRI Staff, particularly, Dr. E. Nkonya, Dr. Siwa, Mr.E.Kato, Ms. Niane Aimmee and Mr.S. Baruah. Thank you all for your friendship and the moments we shared.

I am also most indebted to the following people: Mrs Charlotte Kock, thank you for the moral support and organizing those meetings with my profssor. Dr. and Mrs Kamuzinzi for being a good network to me. You provided me with social insurance while in South Africa. Dr. L. Collet and E. Malleson for the year we lived together as sisters, and for the moral support in times of need. R.Emongor for the wonderful tea in your room and the time we shared. The following colleagues have also provided invaluable advice and encouragement: Patrick, Chilot, Jethro, Yemana, A. Barekye, and P. Ragama.
I would be unfair if I do not acknowledge the contribution of all those who participated in the data collection and management. Pamela Asiimwe was an incomparable data entrant. To all the field enumerators who faithfully dedicated their time to ensure good quality of the data, thank you. It was the patience and trust of our good farmers who volunteered the information that made it possible to accomplish this research.

I fondly remember the support and encouragement I received from my parents, brothers and sisters during my early days of life. Without their hard work and determination, the dreams of a PhD would not have come true. Thank you!

Finally, it was the unconditional love of my husband Stephen Katungi and my children Davis and Daphine that kept me strong and work through the challenges of a PhD programme up to the end. To Davis and Daphine, I am looking forward to being a mother again. Stephen has never hesitated to support my pursuit of a doctoral degree. It is to him and our children Davis and Daphine that I dedicate this work.
Social Capital and Technology Adoption on Small Farms: The Case of Banana Production Technology in Uganda.

by

Enid Mbabazi Katungi

Degree: Doctor of Philosophy (Agricultural Economics)
Department: Agricultural Economics, Extension and Rural Development, University of Pretoria
Supervisor: Professor Charles L Machethe
Co-supervisor: Dr Melinda Smale

ABSTRACT

In recent years, development practitioners and policy makers have increasingly become interested in social capital as an additional instrument for economic development. However, within the applied economics literature on the adoption of agricultural technologies, research on the role of social capital in adoption decision-making is scant. Furthermore, there is a paucity of information regarding the determinants of social capital accumulation among rural households in developing economies. This study examines the nature of the relationship between social capital and crop management decisions of Ugandan banana farmers.

This dissertation develops a model of technology adoption that incorporates social capital and offers two explicit mechanisms through which social capital may influence technology adoption. A model of the agricultural household, which considers the effects of incomplete markets in farm production decisions, provided the theoretical framework for an econometric analysis to predict the choice and demand of improved banana management technology. The core theoretical framework was extended by explicitly incorporating social capital as a component of exogenous income and information accumulation processes.
Empirical analysis was based on the primary data collected in a survey of 400 banana-producing households in Uganda through face-to-face interviews with the primary production decision makers. The households were selected from the three major banana-producing regions of Uganda using multi-stage random sampling methods.

A combination of econometric methods was employed. A Probit model was used to estimate the probability of using an improved banana management practice and participation in an association. The extent of use of improved banana management practices was estimated by 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 with a Poisson model. A negative binomomial model that allows for over dispersion in the data was employed to identify the determinants of the intensity of participation in private social networks.

The results of the study indicate that different aspects of social capital shape the decision to use and the extent of use of an improved management practice, but the nature of effect is specific to the practice as well as the form of social capital. Participation in associations and the characteristics of those associations are important determinants of banana production management decisions. Participation in associations and private social networks is, in turn, influenced by household wealth, education, institutional environment, and social heterogeneity of the community. Aside from social capital, other factors that are significant in explaining variation in use of improved crop management practices among farmers have been identified. Market incentives and household factor endowments were the most important of these factors in decisions regarding use of improved banana management practices. The existence of separability between consumption and production decisions, a major analytical feature of the model of the agricultural household, also appears to be practice-specific, which suggests that production orientation is associated with the use of practices.

Key words: Social capital, technology adoption, Bananas, Uganda.
TABLE OF CONTENTS

ACKNOWLEDGEMENTS...............................................................................................................4

ABSTRACT....................................................................................................................................6

LIST OF TABLES..........................................................................................................................12

LIST OF FIGURES .......................................................................................................................14

ACRONYMS AND ABBREVIATIONS .........................................................................................15

CHAPTER 1: INTRODUCTION................................................................. Error! Bookmark not defined.
1.1. Background .............................................................................................................. Error! Bookmark not defined.
1.2. Statement of the research problem ...... Error! Bookmark not defined.
1.3. Objectives of the study ......................... Error! Bookmark not defined.
1.4. Hypotheses ........................................................... Error! Bookmark not defined.
1.5. Organization of the dissertation............. Error! Bookmark not defined.

CHAPTER 2: BANANA PRODUCTION AND ITS ECONOMIC IMPORTANCE
IN UGANDA ........................................................................................................... Error! Bookmark not defined.
2.1 The economic importance of bananas ... Error! Bookmark not defined.
2.2. Banana production ................................ Error! Bookmark not defined.
2.3. Banana production management technology .........................................................16
2.4. Dissemination of banana management practices. Error! Bookmark not defined.
2.5. Factors affecting banana production ..... Error! Bookmark not defined.
2.5.1. Characteristics of improved banana management technology.... Error! Bookmark not defined.
2.5.2. Socio-economic factors.............................................. Error! Bookmark not defined.
2.6. Summary ................................................................. Error! Bookmark not defined.

CHAPTER 3: DETERMINANTS OF TECHNOLOGY ADOPTION ............... Error! Bookmark not defined.
3.1. Determinants of farm-level adoption behaviour in the literature .... Error! Bookmark not defined.
3.2. Determinants of the adoption of low external input crop management
.......................................................................................................................................... Error! Bookmark not defined.
3.3. The role of institutions and social networks in adoption decisions.Error! Bookmark not defined.
3.4. Agricultural household models and technology adoption ............ Error! Bookmark not defined.
3.5. Summary

CHAPTER 4: SOCIAL CAPITAL AND TECHNOLOGY ADOPTION

4.1. Manifestations and definitions of social capital in the literature

4.1.1. Manifestations of social capital

4.1.2. Social network definition of social capital

4.2. Social networks and technology adoption

4.2.1. Social network and information accumulation

4.2.2. Social networks, bilateral transfers and technology adoption

4.3. Overview of the literature on the determinants of social capital

4.3.1. Determinants of participation in associations

4.3.2. Determinants of private social networks

4.4. Summary

CHAPTER 5: CONCEPTUAL FRAMEWORK: CHOICE OF A CROP MANAGEMENT TECHNOLOGY IN AN AGRICULTURAL HOUSEHOLD MODEL WITH SOCIAL CAPITAL

5.1. Choice of a crop management technology under incomplete markets

5.2. Choice of a crop management technology when markets are complete

5.3. Choice of a crop management technology under technology relevance uncertainty

5.4. A summary of the household choice of a crop management technology

5.5. Concluding remarks

CHAPTER 6: DATA SOURCES AND SAMPLE CHARACTERISTICS

6.1. Data sources

6.2. Sampling frame

6.3. Selection of the sub-samples for the present study

6.4. Data collection methods

6.5. Basic characteristics of the sample

6.6. Summary

CHAPTER 7: MEASUREMENT AND ESTIMATION PROCEDURES
7.1. Econometric estimation procedure

7.1.1. Data aggregation, reduction and factor analysis

7.1.2. Econometric modeling and estimation of banana production management decisions

7.1.3. Econometric estimation of household participation in associations and private social networks

7.2. Definition and measurement of variables

7.2.1. Econometric approaches in technology adoption studies

7.2.2. Dependent variables for adoption models

7.2.3. Dependent variables for social capital models

7.2.4. Independent variables used in adoption equations

7.2.5. Independent variables used in social capital models

7.3. Summary

CHAPTER 8: DESCRIPTIVE STATISTICS ON BANANA MANAGEMENT AND SOCIAL CAPITAL

8.1. Banana management

8.2.1. Local associations

8.2.2. Characteristics of associations

8.2.3. Household private social networks

8.2.4. Bilateral transfers

8.3. Summary

CHAPTER 9: RESULTS OF THE STUDY

9.1 The decision to use improved management practices

9.1.1. Effect of household characteristics

9.1.2. Effect of farm characteristics

9.1.3. Effect of market factors and characteristics

9.1.4. Effect of information diffusion parameters

9.1.5. Effect of social capital

9.1.6. Likelihood ratio test of joint significance of groups of factors

9.2. Extent of use of management practices

9.2.1. Effect of household characteristics

9.2.2. Effect of farm characteristics

9.2.3. Effect of market factors and characteristics

9.2.4. Effect of information diffusion parameters

9.2.5. Effect of social capital variables

9.2.6. Joint significance test of a group of factors

9.3 Determinants of household social capital

9.3.1. Membership in associations

9.3.2. Social capital intensity at the household level

CHAPTER 10: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

U niversity of Pretoria etd, Katungi E M (2007)
10.1. Summary of the study

10.1.1 Background

10.1.2 Purpose of the study

10.1.3 Research methods

10.2 Major findings of the study

10.2.1 Use of banana management practices

10.2.2 Determinants of use of banana management practices

10.2.3 Social capital in the banana-growing areas

10.2.4 Determinants of social capital

10.3. Implications for policy

10.3.1 Implications of social capital as an asset in agricultural development

10.3.2 Improving the smallholder access to markets

10.3.3 Implications for banana production management technology

10.4. Limitations of the study and recommendations for future research

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

10.4.2 Gender and social capital formation

10.4.3 Measurement of social capital

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

10.4.5 Modeling and estimation approaches

Appendix A. Farmer classification as of banana management practices according to whether the practice is considered to be ancestral or introduced

Appendix B. Correlation matrix of explanatory variables used in the analysis

Appendix C. Estimation results for factors affecting use of improved banana management practices

Appendix D: Estimation results of factors influencing social capital accumulation
LIST OF TABLES

Table 1. “Head count” percentage of the Ugandan population living in households with a real private consumption per adult equivalent below the poverty line for their region .............................................. Error! Bookmark not defined.

Table 2. Sources of information on banana management practices. Error! Bookmark not defined.

Table 3. Selected indicators of social homogeneity in the rural villages of Uganda ................................................................. Error! Bookmark not defined.

Table 4. Sampling fractions for primary sampling units (PSUs) in the survey domain ................................................................. Error! Bookmark not defined.

Table 5. Survey sites (primary sampling units) as represented by elevation and diffusion status in Uganda ................................. Error! Bookmark not defined.

Table 6. Descriptive statistics of the surveyed sample Error! Bookmark not defined.

Table 7. Rotated factor loadings of the soil fertility management practices on the four latent variables (indices)* .......................... Error! Bookmark not defined.

Table 8. A likelihood ratio test for the null hypothesis that the coefficients on the two management decisions are the same ........ Error! Bookmark not defined.

Table 9. Summary statistics of the adoption-dependent variables.. Error! Bookmark not defined.

Table 10. Descriptive statistics of the social capital dependent variables .......... Error! Bookmark not defined.

Table 11. Descriptive statistics of household characteristics (Ω_{HH}) ............... Error! Bookmark not defined.

Table 12. Descriptive statistics of farm characteristics (Ω_{F}) .......................... Error! Bookmark not defined.

Table 13. Descriptive statistics of market characteristics.......... Error! Bookmark not defined.

Table 14. Descriptive statistics of the parameters of information diffusion....... Error! Bookmark not defined.

Table 15. Descriptive statistics of social capital variables (Ω_{SS}) ... Error! Bookmark not defined.

Table 16. Household-level factors hypothesized to influence social capital...... Error! Bookmark not defined.
Table 17. Village-level factors hypothesized to influence social capital. Error! Bookmark not defined.

Table 18. Percentage of farmers using selected banana management practices, by elevation and exposure. Error! Bookmark not defined.

Table 19. Percentage of farmers using selected management practices by landholding size and infrastructure development. Error! Bookmark not defined.

Table 20. Share of banana mats managed with recommended practices among users. Error! Bookmark not defined.

Table 21. Percentage of farmers who know about and use the recommended banana management practices. Error! Bookmark not defined.

Table 22. Percentage of households belonging to associations by elevation and infrastructure development. Error! Bookmark not defined.

Table 23. Household membership in associations by region (%). Error! Bookmark not defined.

Table 24. Distribution of households by intensity of membership in associations (%). Error! Bookmark not defined.

Table 25. Percentage of households giving the major reasons for joining informal associations*. Error! Bookmark not defined.

Table 26. Average number of associations in a village by elevation and infrastructure development. Error! Bookmark not defined.

Table 27. Percentage of households belonging to village informal associations by socio-economic characteristics. Error! Bookmark not defined.

Table 28. Households belonging to informal village associations by group functioning (%). Error! Bookmark not defined.

Table 29. Size of the entire social network by relationship and occupation by elevation. Error! Bookmark not defined.

Table 30. Size of the entire social network by region. Error! Bookmark not defined.

Table 31. Major purpose of transfers accruing to the household from its social network. Error! Bookmark not defined.

Table 32. Household participation in bilateral transfers (%). Error! Bookmark not defined.
Table 33. Average net transfers and the size of ex ante insurance social networks by elevation ................................................................. Error! Bookmark not defined.

Table 34. A summary of the probit estimation of factors affecting the probability of using improved banana management practices .......... Error! Bookmark not defined.

Table 35. Results of the likelihood ratio test of the joint significance of hypothesized factors in the decision to use specific management practices .......... Error! Bookmark not defined.

Table 36. Estimation of the factors influencing the extent of use of selected banana management practices ................................................. Error! Bookmark not defined.

Table 37. Results from the F-test of the joint significance of hypothesized factors in the extent of use of management practices Error! Bookmark not defined.

Table 38. Probit estimation of the factors influencing membership in associations (standard errors in parentheses) ..................... Error! Bookmark not defined.

Table 39. Factors affecting the intensity of membership in associations and private social networks at the household level ...... Error! Bookmark not defined.

LIST OF FIGURES

Figure 1. Area planted with major food crops in Uganda Error! Bookmark not defined.

Figure 2. Proportion of agricultural households with banana plots in Uganda .......... Error! Bookmark not defined.

Figure 3. Trend in banana production from 1961 to 2003 ......... Error! Bookmark not defined.

Figure 4. A socio-economic model of the decision-making process for the use of improved banana management practices ... Error! Bookmark not defined.

Figure 5. Sample Domain: elevation overlaid with exposure/non-exposure ..... Error! Bookmark not defined.

Figure 6. Sites sampled for the first survey ............... Error! Bookmark not defined.
# ACRONYMS AND ABBREVIATIONS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBW</td>
<td>Banana Bacterial Wilt</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organization</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>INIBAP</td>
<td>International Network for the Improvement of Banana and Plantain</td>
</tr>
<tr>
<td>Km</td>
<td>Kilometre</td>
</tr>
<tr>
<td>LC</td>
<td>Local Council</td>
</tr>
<tr>
<td>MAAIF</td>
<td>Ministry of Agriculture, Animal Industry and Fisheries</td>
</tr>
<tr>
<td>MFEPD</td>
<td>Ministry of Finance, Economic Planning and Development</td>
</tr>
<tr>
<td>NARO</td>
<td>National Agricultural Research Organization</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental Organization</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
</tr>
<tr>
<td>SD</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>SWC</td>
<td>Soil and Water Conservation</td>
</tr>
<tr>
<td>UBOS</td>
<td>Uganda Bureau of Statistics</td>
</tr>
<tr>
<td>Ugsh</td>
<td>Uganda Shilling</td>
</tr>
</tbody>
</table>