GEORG-AUGUST-UNIVERSITÄT GÖTTINGEN

GlobalFood

Capacity development of small-scale farmers in developing countries: Analysis of preferences and the role of information and communication technologies

Dissertation to obtain the doctoral degree in the International Ph. D. Program

for Agricultural Sciences in Göttingen (IPAG)

at the Department of Agricultural Economics and Rural Development

Faculty of Agricultural Sciences

Georg-August-University Göttingen, Germany

presented by

Dirk Hauke Landmann

born in Göttingen, Germany

Göttingen, May 2018

D7

First supervisor:	Prof. Dr Ludwig Theuvsen
Second supervisor:	Prof. Dr Carl Johan Lagerkvist
Third supervisor:	Prof. Dr Jan-Henning Feil
Date of dissertation:	19.07.2018

I hereby express my deepest respect and gratitude to all the farmers interviewed for this dissertation. Each and every one has her or his place in this dissertation and I sincerely hope that the papers of this dissertation will be helpful for you one day! You are the reason why we are doing this.

Summary

Capacity development through agricultural training is a proven approach to enhance the management skills of small-scale farmers in developing countries, aiming to increase their standard of living in the long run. Yet, little is known about their preferences for different types of agricultural training as well as the impact of trainers' qualification on participants' learning success and satisfaction. Moreover, modern information and communication technologies are increasingly promoted as means to spread agricultural knowledge because of their large technical possibilities, wide coverage, and high exchange rate of information. In particular, the use of smartphones is discussed as a new way to train farmers in developing countries. However, the drivers of small-scale farmers' intention to use smartphones still seem largely under-explored. Besides modern technologies, innovation platforms also called learning alliances are another method to develop farmers' capacities, where all stakeholders involved into agricultural production try to solve problems and improve the value added for everybody. Yet, frameworks to evaluate these alliances are rare. Against this background, this dissertation presents four papers, which focus on capacity development from small-scale farmers' perspectives regarding their preferences, intentions to use smartphones, learning success, satisfaction and trust.

Capacity development in agriculture still follows standardised top-down models driven by the public sector in most developing countries. In contrast, in industrialised countries training activities are increasingly privatised and service provision demand-driven. This is due to the increasing specialisation and industrialisation of agricultural production in recent decades. The trend is prompting researchers and other stakeholders to re-think the contextual fit of capacity development models whereby small-scale farmers in developing countries are passive knowledge recipients rather than holders of traditional know-how and capacities that can be exploited and further developed in customised training. To analyse this research gap, paper one examines the preferences of small-scale farmers for agricultural training with respect to training method, trainer, duration and location of training, and additional offers. A discrete choice experiment was conducted with 664 randomly selected farmers in Bihar state, India, in 2016. The data obtained are analysed using a mixed logit model in a willingness-to-pay space, including analyses for different subgroups. Based on their particular willingness-to-pay for the studied attributes, the analysis depicts small-scale farmers' preference for training activities that include demonstrations, additionally offered inputs (seeds, fertilisers, credit) and an academic trainer.

The second paper builds on the findings of the first paper and focuses on trainers' qualification. Within capacity development, the type and quality of the trainer play a crucial role in promoting farmers' capacity, which is underlined by the results of our first paper. Whilst several studies have addressed the identification of farmers' capacity development preferences, few have investigated the relationship between trainer qualification, learning success and satisfaction of participants. Hence, the main purpose of this paper is to examine the relationship between trainers' qualification and learning success as well as satisfaction of small-scale farmers. Moderated mediation analysis is utilised to measure the influence of direct and indirect effects through trainers' qualification on learning success and satisfaction. In this framework, psychological and relevant proven constructs from the Theory of Planned Behaviour are taken into account: attitude and perceived control operate as mediators, subjective norm acts as moderator, and gender and age are considered as covariates. This framework is applied on primary survey data from 217 farmers collected in Bihar state, India, in December 2016, by the use of a structured questionnaire. The results show no difference in the degrees of satisfaction among farmers related to trainers' qualification. However, learning success decreases with an academically educated trainer. The change of attitude during the training has a significant positive effect on satisfaction. Subjective norms also affect the participants' satisfaction positively. With respect to the theories used, the results indicate that the behavioural constructs are relevant in the field of agricultural education and extension to explain participants' satisfaction. Theoretical implications can be drawn regarding the improvement of this conceptual framework and other related studies.

Besides the trainer, also the method of training is important, whereby the smartphone is one possible device and method to transfer knowledge. The use of smartphones is increasingly supported by non-governmental organisations as well as governmental institutions as a modern information and communication technology to spread agricultural information. However, uptake of the smartphone usage in agriculture is still relatively low in developing countries. Up to now, psycho-economic drivers of farmers' adoption behaviour are mostly not taken into account, or the stakeholders are unaware of the possible importance of non-monetary factors. The aim of the third paper is to identify and quantify drivers of farmers' adoption behaviour through the development of a complex conceptual framework, based on the Theory of Planned Behaviour and its further advances. This framework is applied to primary survey data from 664 farmers collected in Bihar state, India, in 2016, using a structured questionnaire. The results of a partial least squares analysis

indicate that subjective norms, attitude, self-control, as well as positive and even negative emotions exert positive influences on the intention to use a smartphone for agricultural purposes. With these results, the paper extends the academic literature through new conceptual insights and provides application-oriented implications for stakeholders, such as non-governmental organisations, extension services and research institutes.

Another approach to strengthen small-scale farmers' capacities is to use multi-stakeholder innovation systems or learning platforms, such as the Nicaraguan Learning Alliance. However, tools for the evaluation of multi-stakeholder innovation systems are rare so far. The fourth paper reports the application of a conceptual framework to evaluate multi-stakeholder innovation systems using the Nicaraguan Learning Alliance in this paper. The assessment focuses on the business relationship constructs of trust and capacity development. In total, 90 survey interviews of producer organisations, 20 in-depth interviews, and six focus group discussions were collected from agribusiness stakeholders linked with the Nicaraguan Learning Alliance and from a control group of stakeholders involved with other networks. The quantitative data were analysed through factor and regression analyses. Results from the quantitative analyses were triangulated with qualitative data. The analysis shows that the Nicaraguan Learning Alliance has been successful in developing smallholder farmers' capacities as a result of trust developed through its dedicated project managers. Nonetheless, the Nicaraguan Learning Alliance has not been more successful at developing agribusiness capacities among Nicaraguan farmers than other networks with the same goals. Results from this study point to the need for facilitating more interactions between the different networks of farmers' cooperatives and organisations with other stakeholders already active within the Nicaraguan agrifood innovation system.

Based on the results of the four presented paper a series of practical recommendations for training activities apply. One of those is to combine the strength of an expert trained on-the-job as the main trainer with an academically educated trainer. The academic trainer could be integrated directly in some parts of the training activities or via modern technologies such as videos or smartphones. This seems to be the most promising approach with respect to the farmers preferences and in order to achieve the greatest learning success and satisfaction of the participants. Furthermore, by the usage of modern information and communication technologies the effectiveness of the training could also be increased. Besides the professional background of the trainer, it is important that trainers gain qualifications in teaching methods and other soft skills. With respect to modern

information and communication technologies like smartphones, our results indicate that presenting trainers and later farmers with the various possibilities of smartphones and creating a positive image of these technologies could help to reinforce the willingness to adopt this new method of communication for agricultural purposes. Hereby, also the social environment needs to be addressed, for example within the training. Smartphones cannot replace direct contact, but their importance regarding capacity development will increase rapidly as previous developments in mobile phone use have shown.

These findings provide politicians and other stakeholders with tangible recommendations to improve their training programmes. Ultimately this could make capacity development more attractive and therefore more likely to be attended by small-scale farmers in the short and long-term. These consequences in return could have further implications for the agricultural productivity and poverty reduction.

Acknowledgements

First, I want to thank my supervisor, Prof. Ludwig Theuvsen, for his endless trust in my work and the freedom he gave me to bring in own research ideas. Your fundamental positive way of thinking and your overall support were exceptional and gave me diverse possibilities and opportunities. My decisions were always backed by you which helped me finish this dissertation. Second, I would like to thank Prof. Carl Johan Lagerkvist for welcoming me into his research team and providing me with profound scientific feedback and guidance during my research stay in Sweden and beyond. Without your expertise and inspiration as my second supervisor, mentor and co-author, the papers presented in this dissertation would not be the same. I am also thankful for Prof. Jan-Henning Feil, whom I got to know in my early years of my academic career. Today you are also a professor, supervisor, and co-author. Your scientific support and your professional guidance and personal advice motivated me in the good and in the bad times. I owe gratitude to my co-author Dr Verena Otter for her feedback and time. I am very thankful for working with Sabrina Kimmig. You have been a great student, a helpful field manager, a co-author, and I am glad to say, nowadays also a supportive and very good friend. Jo Cadilhon supervised and guided me in an outstanding and great way through my master thesis. You inspired me by your scientific ideology, your feeling for social justice and at the same time of your spirit regarding work-life balance. Your inspiration was one reason why I did my PhD and you are now part of it as a co-author. Thanks for that.

The financial support of this research received from the German Research Foundation (DFG) through the 'GlobalFood' programme (RTG 1666) and the Fiat Panis Foundation is gratefully acknowledged. The data collection and field survey were implemented in close collaboration with the International Livestock Research Institute (ILRI), 'Preservation and Proliferation of Rural Resources And Nature' (PRAN) and Farms and Farmers Foundation (FnF). I thank Sneha, Dharmendra, Vivek, Vikash and all enumerators for managing and collecting the data presented in this dissertation, which was not always easy. I also thank Anil Kumar Verma, Devesh, Pramodh, Shiv Prakash and his colleagues from PRAN and also Shashank Kumar, Manish Kumar and their colleagues from FnF for your organisational support during our time in Bihar.

The field work for my fourth paper, which is presented in this dissertation was undertaken and funded as part of the CGIAR research program humidtropics and the program Policies, Institutions, and Markets (PIM) led by the International Food Policy Research Institute (IFPRI). I thank Falguni

Guharay for guidance as well as for the tremendous support and good discussions during my stay in Nicaragua. I am also thankful for the colleagues at the 'International Center of Tropical Agriculture' (CIAT) in Nicaragua for supporting and assisting in the fieldwork.

The GlobalFood team has always been an outstanding place for scientific discussion and still is my safe harbour respecting my work, social, and private relationships. The fruitful interactions with different principal investigators and the scientific input of postdocs and PhD students during presentations and discussions were essential and helped me to build up my research ideas and my field studies. I am especially thankful for Prof. Matin Qaim, the speaker of the training group, and the coordination office, with Melanie and Katrin who made bureaucracy an easy task even for me and for the assistants who are office neighbours for me and good friends. GlobalFood was very important for me as a social environment and positive working atmosphere, and I am proud to call myself a 'GlobalFoodie'! I am also thankful for the international colleagues of the Theuvsen chair and the extend GlobalFood-family. My special thanks go to Kathrin, Lutz, and Malte who formed my knowledge regarding Stata, nutrition, gender and tried hard to teach me a sense of 'normal' humour. Further, I would like to thank my friends and colleagues Lisa, Andrea, Denise, Caetano, Marion, Jana, Thuy, Jessie, Susa and Ayo.

Supervising students was not only a learning process for Thatiana, Sofia, Hanno, Julian, Stephanie and Emilie. It was also a fruitful and a good experience for me, and I am grateful for that.

I would also like to thank my family and close friends Valerie, Klaas, Mareike, and Sebastian, for their encouragement, creative ideas, and their honest friendship. Especially, I want to thank my biggest and oldest supporter Annegret. You have not only formed me as an adolescent, you also inspired my studies in Göttingen as a grandmother, housemate, and as a friend. Due to your big heart and endless positive energy in every situation, you will always be an unreachable idol for me!

Finally, I am grateful to my parents who enabled and always supported me in this long academic journey and who encouraged me to proceed.

Table of content

List of tables

List of figures

1 General introduction

The majority of the world's poor population in developing countries are dependent on the agriculture, particularly in the form of small-scale farming. The output of small scale farming is influenced by access to factors such as markets, inputs, technical equipment and the farmers capacity. This dissertation aims at improving the output of small-scale farmers by capacity development (CD). CD has been a key position on the agenda of the United Nations (UN) and other parties in order to reduce poverty and inequality in these countries (World Bank 2007, 2013; UN 2015; Vallejo and Wehn 2016). The UN defines CD as a 'process through which individuals […] obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time' (UNDP 2008, 4). In the context of small-scale agriculture in developing countries, training activities are crucial for developing and enhancing farmers' capacities and ultimately improving their livelihoods (de Rosa et al. 2016; Horton et al. 2003).

1.1 Background

In the early 2000s, the World Bank identified the great potential of the so-called 'community-driven approach' to develop capacities of rural people living below the poverty line. The potential of this approach lies in its demand-driven character based on farmers' own control over resources and decisions that could be complemented by new technologies and communication possibilities (Fukuda-Parr, Lopes, and Malik 2002; Gillespie 2004; World Bank 2002; Fu and Akter 2016). Currently, CD models are characterised by ineffectiveness. This has also prompted institutions and organisations in developing countries including India – the country a large part of the dissertation focusses on - to make further attempts directed towards decentralisation, privatisation, and use of demand-induced community-driven approaches in their CD work (S. Ghosh 2012; Kotvojs and Hurworth 2013).

The community-driven approach is also implemented in other practical approaches such as the Nicaraguan Learning Alliance (NLA). These can be assimilated to innovation platforms, defined as a group of individuals with diverse backgrounds and interests, who come together to diagnose and solve problems they face by fostering knowledge sharing and innovations (Homann-Kee Tui et al. 2013; Klerkx, Aarts, and Leeuwis 2010). Hereby, synergistic relationships between different members are created and a network across multiple levels is build up (CRS 2009). The NLA is an alliance of organisations formed in 2003. The organisations train their partners on agribusiness management and access to markets. This knowledge is then replicated through different geographical and organisational levels along its

partner network down to farmers (AdA 2014; World Bank 2012). Trust also has a major role in the interplay of different individuals and can be seen as a factor, which substantially influences individuals, organisations, partner's competence, processes, institutions, economics, intentional relations, technology or services. It is an important component in value chains and has gained more attention from scientists within the recent decades. Thus, trust is described as a complicated and multifaceted concept with no uniform definition and measurement method available up to now. However, trust has a great influence on perception and individuality, which depends on participants (Laeequddin et al. 2010).

Apart from trust other agricultural training measures also become more diverse in terms of their institutionalisation, training methods and content (Prasad, Sulaiman, and Mittal 2015; Robinson-Pant 2016). Demand-induced use of these training measures in combination with (partial) privatisation of providers has particular potential to meet small-scale farmers' constantly changing needs to be more flexible in times of fast information and innovation change (Chikaire et al. 2015).

However, until today, preferences of small-scale farmers regarding traditional knowledge-transfer and modern ICT remain unclear. Therefore, the preferences regarding CD activities of small-scale farmers, especially in developing countries and regions, should be analysed in the context of specific training measures (Charatsari, Papadaki-Klavdianou, and Michailidis 2011). Against this background, we analyse the CD demand of small-scale farmers in a developing country using a discrete choice experiment.

One specific aspect of training measures is the trainers' qualification. A wide range of agents is involved in the extension system for agricultural development such as scientists, producers, trainers, and extension agents (Ludemann et al. 2012). These agents and trainers need expertise, a special skill set and experiences with small-scale farmers' demands in order to work successfully (Hellin 2012; Höckert and Ljung 2013). The concept of teaching small-scale farmers by academics was used around 30 years ago and was declared as not successful in comparison to the participatory approach (Ferroni and Zhou 2012). The participatory approach and also the community-driven approach, which nowadays is the most common concept, was developed to be more efficient, more sustainable regarding the duration of professional relationships, and is considered to be more flexible regarding its adaptation to local circumstances (Birner et al. 2009). Other approaches such as the 'agricultural knowledge and information system' create direct links between scientists and farmers via modern communication technologies to strengthen the communication (J. R. Anderson 2007).

Information and Communication Technology (ICT), such as smartphones, provide a great possibility to develop farmers' capacities also impersonally over long distances through specific applications by offering fast access to continually updated and reliable information (Aker, Ghosh, and Burrell 2016; Aker 2011). These possibilities seem specifically promising for regions characterised by poor infrastructure such as Bihar, India.

The majority of paper (chapter two, three and four) within this dissertation analyses data collected in Bihar state, India. Whereas one paper (chapter five) is based on data collected in Nicaragua. Bihar was chosen as a suitable study site for the first three papers since it shows certain characteristics typical for the agricultural sector in developing countries and, thus, allows for partial transferability of results. The state of Bihar has a high population density of 1,106 habitants per square kilometre and more than 100 million habitants, 34 per cent of them living below the poverty line of 1.90 USD per day. With 89 per cent, a large proportion of the population lives in rural areas in a geographically diverse terrain, mostly in scattered villages. Correspondingly, around 62 per cent of the population is working in the agricultural sector (World Bank 2016a; Census Organisation of India 2015). As in many other developing countries, agriculture in Bihar shows low crop productivity, lack of water management, low investment rates, and weak infrastructure with regards to transport and marketing (World Bank 2005; Bansil 2011; Rodgers et al. 2013). Various non-governmental organisations (NGOs) such as 'Farms and Farmers Foundation' (FnF) and 'Preservation and Proliferation of Rural Resources and Nature' (PRAN) target the rural population living under these unfavourable conditions through CD activities, amongst others.

Nicaraguan farmers, which have a crucial role in one paper of this dissertation, are organised in a dense network of cooperatives (Lafortezza and Consorzio 2009). However, at present many farmers are not well equipped to link themselves to suppliers and customers in today's market-oriented system. International and local organisations identified this lack of capacity as training opportunity to help rural farming communities link to markets. Based on this situation the NLA launched in 2003 (Lundy and Gottret 2005). The NLA's idea is to use the existing network of agricultural cooperatives to snowball the training to individual farmer households. Three learning cycles of the NLA included 77 producer organisations and reached a total of 19,350 farming families involved in the production of various crops (AdA-Nicaragua 2012; Landmann and Cadilhon 2016).

1.2 Problem statement and research gaps

Agricultural sectors in developing countries are making steady progress towards greater market orientation and competitiveness (Kahan 2013). However, in practice, CD still follows standardised top-down models driven by the public sector in most developing countries (Birner et al. 2009), whereas in industrialised countries CD is increasingly characterised by privatisation and demand-driven service provision due to increasing specialisation and industrialisation of agricultural production in recent decades (Rivera 2011). This trend is prompting researchers and other stakeholders to re-think the contextual fit of CD models in which small-scale farmers in developing countries are passive knowledge recipients rather than holders of traditional know-how and capacities that can be exploited in customised training (Baser et al. 2008; Birner et al. 2009).

Only a few previous case studies have sought to identify small-scale farmers' preferences and to quantify their willingness to pay (WTP) for CD measures in developing and transition countries. For example, using probit model estimations and survey data, Holloway and Ehui (2001) detected a substantial WTP for advisory services under the assumption of privatisation among Ethiopian farmers. Moreover, using a probit regression model in combination with survey data, Oladele (2008) identified a partial WTP for privatised advisory services among farmers in Nigeria. Mwaura (2010) also used a probit regression model for analysing the influence of socio-demographic characteristics on WTP for advisory service in Uganda. Aydogdu (2017), Budak et al. (2010) and Ajayi (2006) applied similar methods to measure farmers' WTP for public advisory services in Nigeria and Turkey, after determining their needs for specific advisory content using the contingent valuation method. The existing research, therefore, indicates some WTP for CD among farmers in developing countries. However, small-scale farmers' preferred form of training within a CD context has hardly been investigated.

The trainer's level of education is one important attribute influencing the preferred training form of the farmers and plays a crucial role in the improvement of educational systems around the world. In comparison to the agricultural domain, many other economic sectors seem to be characterised by a higher level of 'professionalism', i.e. they have more profound specifications regarding a trainer's qualification. The 'Global Forum for Rural Advisory Service' (GFRAS) conducted a scoping study in 2016 to improve their offers and to encourage certification and standards regarding training on a worldwide level (Terblanche 2017). According to Davis (2015), extension should be recognised as a profession and guarantee that the staff is connected to societies of the farmers to allow for professional education and development. Apart from the

trainer, the farmers participating in the training continually modify, revise, and even set back their personal beliefs, opinions, views, and own behaviours (Bhattacherjee and Premkumar 2004). However, investigation of beliefs influencing learning success and satisfaction have not been done yet.

Besides the preferences of farmers for certain trainer's qualification and their effects on the participants, there are also different types of training methods. One method to train farmers could be to use modern ICT and more specifically smartphones. However, the use of smartphones for these purposes among small-scale farmers in rural areas of developing countries is still limited, even though ownership of smartphones increases in developing countries and also in India rapidly (Statista 2018). Furthermore, the success of implementation programmes conducted by NGOs and governmental institutions is also limited, even though the general availability of smartphones is increasing (Deichmann, Goyal, and Mishra 2016; World Bank 2016b). This disparity has recently motivated researchers to recommend stakeholders to better respect those farmers' needs during the implementation process of modern digital technology (Mundy, Addom, and Bheenick 2017). However, this recommendation is still lacking psycho-economic dimensions and foundations since existing studies on ICT usage in developing countries' agricultural sectors either focus mainly on socio-economic adoption drivers or on usage-related performance effects (Deichmann, Goyal, and Mishra 2016; Mittal and Tripathi 2009; Ganesan et al. 2013; Jain, Kumar, and Singla 2015).

Smartphones seem to be important in the future and innovation platforms are seen as a successful tool and used in many different countries and value chains right now. However, the literature on the assessment of innovation platforms is very rare. Existing literature mostly focuses on the analysis of particular cases with a specific method, thus restricting the transfer to other platforms (Nederlof, Wongtschowski, and van der Lee 2011). The conceptual framework already embeds certain variables, factors, and other influences relevant to the development and aims of innovation platforms. This is the only conceptual framework that combines the different categories structure, conduct, and performance with the topics of transaction costs and marketing concepts for the purpose of monitoring and evaluation of the impact of innovation platforms (Cadilhon 2013).

With the present work, we aim to add to the scarce literature on farmers preferences for CD services, the importance of trainer characteristics for the success of these services, as well as the drivers of smartphone use for agricultural CD. Furthermore, we analyse the case of one

learning alliance regarding trust with the purpose to develop farmers' business capacities. The ultimate goal is to derive well-informed policy recommendations regarding CD interventions.

1.3 Research objectives and approach

Therefore, the main research objective of the dissertation is to improve and uptake CD activities by analysing farmers demand and the possibility to use other approaches, such as learning alliances and different trainers' education, and new technologies (e.g. smartphones).

The first paper in the second chapter of this dissertation has more specifically the objective of 'Analysing small-scale farmers' preferences for capacity development activities using an experimental approach'. For this purpose, we used a discrete choice experiment (DCE), which allows us to determine preferences for different alternatives without explicitly asking for them (e.g. Train 2003). In our DCE, farmers in Bihar were asked to make a choice on their preferred CD activities from training alternatives specified by relevant attributes such as qualification of the trainer, method of training, additional offers connected to the training as well as location and duration of the training. Moreover, the cost of training was included as a monetary attribute, to apply a mixed logit model in WTP space to estimate the marginal WTP measures. This is a particularly relevant approach in view of the fact that NGOs such as PRAN intend to introduce payment systems in the near future in order to offer improved CD activities (PRAN 2016). To our knowledge, this is the first study to estimate marginal WTP measures for different types of agricultural CD methods especially in a developing country context with small-scale farmers. The results obtained could directly support NGOs in improving and pricing training measures in order to increase their effectiveness.

The second paper in chapter three of this dissertation is based on the attribute trainers' qualification of the first paper. It deals with 'Understanding the relationship between trainers' qualification, learning success and satisfaction for agricultural capacity development in rural Bihar'. For this purpose, we investigate whether the change of attitude and perceived control of farmers participating in training for agricultural capacity development mediate the effect of learning success or perceived satisfaction depending on the type of trainer. Finally, we test whether the relation between trainer type and learning success or perceived satisfaction is moderated by farmers' subjective norms. To this end, attitudes, perceived control, subjective norms, as well as perceived satisfaction for participation in agricultural training, can be expected to represent key determinants to learning success and satisfaction of the agricultural training and can be expected to act as catalysts in accordance with the learning success and

perceived satisfaction (Topală 2014; Ko and Chung 2014; Chatman and Sparrow 2011; Bihler 2006).

In order to close the gap of understanding the psycho-economic dimension during the implementation process of modern digital technology in the academic literature the third paper in chapter four focusses on 'Determinants of Smallholder Farmers' Intention to use smartphones for generating agricultural knowledge'. In this regard, a complex conceptual framework is developed based on the Theory of Planned Behaviour (TPB), a theory originating in social psychology and first introduced by Ajzen (1991). In doing so, conceptualizations from the Technology Acceptance Model 2 of Venkatesh and Davis (2000), Cheon et al. (2012) as well as Perugini and Bagozzi (2001), who further elaborated the concept of emotions as psycho-economic drivers, are also taken into account. The research framework developed in this study further enhances these attempts by adapting the circumstances of small-scale farmers in developing countries and testing it in the agricultural sector of Bihar, India, one of the poorest regions in the world.

The focus of the fourth paper presented in chapter five is to evaluate 'The role of trust and networks in developing Nicaraguan farmers' agribusiness capacities'. Trust is seen in this context as a factor, which substantially influences individuals, organisations, processes or institutions (Laeequddin et al. 2010). Capacity development is a principal goal of the NLA to increase the replication efficiency of the knowledge being produced within the network. To contribute to the evaluation of the NLA's activities, the fourth paper aims to answer the research question: How does the NLA strengthen producers' capacities through its structure and network of members and partners? The contribution of this article to the literature on innovation platforms as a collaborative agricultural education mechanism is the pilot-testing of a conceptual framework characterizing how innovation platforms work in a Latin American context through mixed research methods. Although learning alliances and innovation platforms are common, this study aims to contribute a conceptual framework to evaluate them. This framework uses quantitative and mixed methods which have not been combined before.

The results of these analyses are expected to provide policymakers and training organisations with profound insights into the underlying psychological factors that influence the participation in agricultural training. The insights of this dissertation can be used to adjust current policies and to develop new initiatives in order to stimulate knowledge transfer and participation in agricultural training programmes by small-scale farmers (e.g. by smartphone support).

Chapter six draws broader conclusions and policy implications based on all four papers. Both questionnaires used in 2016 are displayed in the general appendix. Details about the sampling procedure are included in the three essays themselves.

2 Analysing small-scale farmers' preferences for capacity development activities in developing countries - an experimental approach[1]

Abstract

Capacity development through agricultural training is a proven approach for improving small-scale farmers' management capacities in developing countries, thereby raising their long-term standard of living, but little is known about their preferences for different types of agricultural training. Therefore, this study examines the preferences of small-scale farmers for agricultural training with respect to training method, trainer, duration, location and additional offers. A discrete choice experiment (DCE) was conducted with 664 randomly selected farmers in Bihar state, India. The data obtained are analysed by using a mixed logit model in willingness-to-pay (WTP) space, including analyses for different subgroups. Based on their marginal WTP for the attributes studied, it is found that small-scale farmers prefer training measures which include demonstrations, would like to receive additional offers (seeds, fertilisers, credit) during training and would prefer an academic trainer. These findings provide politicians and other stakeholders with concrete indications to improve their training programmes and ultimately make capacity development more attractive for small-scale farmers.

Keywords

capacity development, discrete choice experiment, willingness to pay, small-scale farmers, developing countries, India, Bihar

[1] This chapter is co-authored with Jan-Henning Feil (JHF), Carl Johan Lagerkvist (CJL) and Verena Otter (VO). The authors' contributions are as follows: Dirk Landmann (DL) designed the research and collected the data. DL analysed and interpreted the data. JHF and CJL assisted in the analysis and interpretation of the results. DL wrote the paper. JHF, CJL commented at the various stages of the research and contributed to writing and revising the paper. VO contributed to writing of the paper. All authors read and approved the final manuscript. This manuscript is submitted to the Journal 'Development and Change'. The share of the total work done by DL is 70 per cent.

2.1 Introduction

The Millennium Development Goals set by the United Nations (UN) have been a turning point in global efforts regarding poverty reduction and equality improvement in developing countries (UN 2015). Most measures for achieving these goals directly target the agricultural sector and, more specifically, capacity development (CD), since most of the poor in developing countries are dependent on small-scale farming in rural areas (World Bank 2007, 2013; UN 2015; Vallejo and Wehn 2016). The UN defines CD as a 'process through which individuals […] obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time' (UNDP 2008, 4). Farmers' capacities are mostly developed by training activities (Horton et al. 2003).

In the early 2000s, the World Bank identified the great potential of a so-called 'community-driven approach' for enhancing the standard of living of rural people living below the poverty line. The potential of this approach lies in its demand-driven character based on farmers' own control over resources and decisions that could be complemented by new technologies and communication possibilities (Fukuda-Parr, Lopes, and Malik 2002; Gillespie 2004; World Bank 2002). The ineffectiveness of current CD models has also prompted institutions and organisations in India and other developing countries to make further attempts for decentralisation, privatisation and use of demand-induced community-driven approaches in their CD work (S. Ghosh 2012; Kotvojs and Hurworth 2013). Thus agricultural training measures are becoming more diverse in terms of their institutionalisation, training methods and content (Prasad, Sulaiman, and Mittal 2015; Robinson-Pant 2016). Demand-induced use of training measures in combination with (partial) privatisation of providers has particular potential to meet small-scale farmers' constantly changing needs more flexibly in times of fast information and innovation change (Chikaire et al. 2015). Therefore, the preferences of small-scale farmers, especially in developing countries, should be analysed in the context of implementing specific training measures as capacity is built (Charatsari, Papadaki-Klavdianou, and Michailidis 2011). A few previous case studies have sought to identify small-scale farmers' preferences and to quantify their willingness to pay (WTP) for CD measures in developing and transition countries. For example, using probit model estimations and survey data, Holloway and Ehui (2001) detect significant WTP for advisory services under the assumption of privatisation among Ethiopian farmers. Moreover, using a probit regression model in combination with survey data, Oladele (2008) identifies WTP for privatised advisory services among farmers in Nigeria. Mwaura (2010) also uses a probit regression model for analysing the

influence of socio-demographic characteristics on WTP for advisory service in Uganda. Aydogdu (2017), Budak et al. (2010) and Ajayi (2006) apply similar methods to measure farmers' WTP for public advisory services in Nigeria and Turkey, after determining their needs for specific advisory content using the contingent valuation method. Existing research, therefore, indicates that a WTP for CD among farmers in developing countries generally exists. However, the preferred form of training of small-scale farmers within the CD context has not yet been identified and its respective WTP determined.

The objective of this study is therefore to investigate the preferences of small-scale farmers in developing countries for CD activities. To this end, we use a discrete choice experiment (DCE), which permits data collection under controlled conditions and, based on this, allows preferences for action alternatives to be determined without explicitly asking for them (for instance Train, 2003). In our DCE, farmers living in rural Bihar, India, were asked to make choices on their preferred CD activities among training alternatives specified by relevant attributes such as qualification of the trainer, method of training, additional offers connected to the training and location and duration of the training. Moreover, the cost of training is included as a monetary attribute, to allow the 'implicit price' to be calculated for a change in each of the above mentioned non-monetary attributes. This is done by applying a mixed logit model in WTP space to estimate the marginal WTP measures. This is a particularly relevant approach in view of the fact that non-government organisations (NGOs) such as Preservation and Proliferation of Rural Resources and Nature (PRAN) intend to introduce payment systems in the near future in order to offer improved CD activities (PRAN 2016). To our knowledge, this is the first study to estimate marginal WTP measures for different types of agricultural CD methods and it is also the first to do so in a developing country context with small-scale farmers. The data obtained could directly support NGOs in improving and pricing training measures in order to increase their effectiveness.

The remainder of the paper is structured as follows: The section below describes the most important characteristics of CD reported in the literature, the experimental design and the data analysis method used. The empirical results obtained are presented and discussed, respectively, in the next two sections. The final section provides a brief summary and suggests some implications for experts conducting CD activities in the field and for policymakers.

2.2 Literature review and conceptual framework

Capacity development can occur in three different dimensions, that is at the systematic, organisational and individual level. In this study, we focus on CD at the individual level, which

includes changes in behaviour and attitudes brought about by developing personal skills or important knowledge through training (UNDP 2010; Mizrahi 2004; Fukuda-Parr, Lopes, and Malik 2002). While CD also includes incentives and governance, its main focus is on the process, followed by knowledge and skills acquisition (OECD 2006; Prasad, Sulaiman, and Mittal 2015). Below we provide an overview of different criteria and dimensions, also defined as attributes and levels, describing the CD process.

Training methods can be characterised as coaching, mentoring, short courses, formal education, face-to-face interaction and distance/e-learning (Ludemann et al. 2012). Birner et al. (2009) divide types of training into demonstrations, field days, short courses and farmer-to-farmer exchanges. Rivera and Alex (2008) refer to sources of knowledge and information and split these sources into schools, advisory services, in-service training and mass media and distance learning. In the present study, this attribute is called 'method of training' and three levels are defined: mass media, classroom training and classroom training with demonstration (Table 1).

Ludemann et al. (2012) divide different types of training provider into the categories scientists, producers, research managers, education staff, trainers, advisory agents and staff from support services. In the present study, these categories defining the attribute 'trainer' from small-scale farmers' perspectives are clustered into three levels: expert trained by university, expert trained on the job and farming colleague.

Farmers are often supported with different goods and services. Besides the training and education activity itself, other offers are credit (financial support), production inputs (trials of seeds and fertiliser) and network activities (for example self-help groups) (Bingen, Serrano, and Howard 2003; Gray et al. 2009; Peterson 1997; UNDP 2010). In the present study, this attribute is called 'additional offer' (besides the training itself) and four levels are defined: credit, production inputs, network activities and no offer at all.

Olenik and Fawcett (2013) split training duration into long-term courses, short-term courses and flexible schedules, but do not provide explicit definitions of the terms. Therefore, we analyse the duration of current training offered to farmers. Based on the terms used by Olenik and Fawcett (2013) and the qualitative information collected, the attribute 'training duration' is defined on three levels: half a day, one day and two days.

Training can be given at different locations. Robinson-Pant (2016) defines the location as schools or other places such as community centres. However, UNESCO defines location by the frequency of visits to participants (Robinson-Pant 2016). In this study, we focus on the distance, explained in such a way that the participating farmers understood the levels. Thus, the attribute

'location of training' is divided into three levels: village, region with compensation for travel costs and distant location, also with compensation for travel costs.

Table 2.1: Training attributes and attribute levels used in the discrete choice experiment

Attribute	Level
Method of training	Mass media
	Classroom training
	Classroom training with field demonstration*
Trainer	Farming colleague*
	Expert trained on the job
	Expert trained by university
Additional offer	Credit (financial support)
	Inputs (trials of seeds/fertiliser)
	Regular network activities with colleagues
	No offer*
Duration of training	Half a day*
	One day
	Two days
Location	Village*
	Regional, with compensation for travel costs
	Distant, with compensation for travel costs
Training costs	50 Indian rupees (INR)
	100 INR
	150 INR

*This attribute level is common for farmers working with PRAN and was set as a reference level

In developed countries, there is a trend towards privatisation of advisory services provided by companies, but also by parastatals or agencies working for the government, but this trend is more visible on commercial farms than on small-scale farms. Generating an income through agricultural training offers stakeholders more possibilities for providing a supply of training and also for meeting the specific demands of farmers (Ponniah et al. 2008). Research by Essers et al. (2010) and Pederson et al. (2011) shows that the introduction of cost attributes does not lead to changes in preferences of respondents. Based on focus group discussions with farmers and expert discussions with stakeholders working in this region, we conclude that small-scale farmers are price sensitive and that the average WTP for agricultural training is 100 Indian rupees (INR; 100 INR = 1.56 USD). To assure the quality of the data, we set a linear price attribute so that the difference between each price level is equal (Fifer, Rose, and Greaves 2014). Based on the qualitative data and literature, we define the attribute 'cost of the training'

on three levels: below assumed WTP (50 INR), at assumed WTP (100 INR) and above assumed WTP (150 INR).

2.3 Methods

Research area and sample

In order to collect empirical data, 664 smallholder farmers living in 27 villages in Bihar state, north-east India, were interviewed in 2016. In Bihar state, 89 per cent of the population live in rural areas and 62 per cent work in the agricultural sector (Census Organisation of India 2015; World Bank 2016a). Agriculture in Bihar is characterised by low crop productivity relative to potential yield, lack of water management, low investment rates and weak transport and marketing infrastructure (World Bank 2005).

The farmers interviewed live in the districts of Nalanda, Gaya and Vaishali and were selected in consultation with two partner organisations, Farms and Farmers Foundation (FnF) and PRAN. To our knowledge, farmers in Bihar building agricultural capacity currently do not pay for agricultural training, so we set the base price at zero INR. The villages in which the interviewees live were also randomly chosen from a list of all villages in the region provided by the partner organisations. We used a stratified random sampling method with the sampling strategy to interview a minimum of 250 farmers working with a partner organisation and a minimum of 250 farmers not working with a partner organisation. In the final sample, 196 respondents work together with PRAN and 98 together with FnF. Both organisations focus on the agricultural sector and, until a couple of years ago, PRAN only worked with female farmers, but nowadays male farmers also attend the agricultural training. FnF is more involved in business activities than PRAN and is seeking to link advisory channels between farmers and FnF business partners through modern communication technology, such as mobile phones and smartphones. The FnF business partners mainly provide crop production inputs. The reference level of the training attributes (Table 1) is based on training carried out by PRAN, as this is best known to the respondents. The reference level is also the most common method currently used to train farmers.

In our analysis, we use a qualitative approach as basis for the design of the DCE. Data from pre-field visit was used to confirm the relevance and importance of the attributes and levels used in the study, which are based on existing literature. During the pre-field visit, 16 key informant interviews and five focus group discussions with a total of 71 participating farmers were conducted. The focus group discussions were held in the villages. First, the groups and

key informants were asked about their understanding and definition of certain terms, such as 'training' and 'capacity development'. Second, they were asked open questions about the characteristics of training which matter to them and why. Third, farmers were asked to rate the importance of characteristics defined as important in the literature, but not mentioned by the farmers themselves.

The interviews in 2016 to collect the DCE data were carried out face-to-face by eight trained Indian students using tablet computers with 'Sawtooth Software' (SawtoothSoftware 2017). Before starting the interview, the interviewers checked that the main income of the household comes from agricultural activities and that the interviewee works on the household's farm. This ensured that only small-scale farmers were interviewed. Graphics (Figure A2.1) were used before starting the DCE, to explain the training characteristics, and during the DCE, to ensure that all respondents understood the definitions in the same way (Mangham, Hanson, and McPake 2009).

Experimental design

An unlabelled choice task approach is adopted in the DCE. The heading of each alternative (within choice tasks) was generic (training 1, training 2) and the only way to discriminate between the two alternatives were through the attributes. In the DCE, farmers' training for CD was characterised by six attributes (Table 1). The experimental design using Sawtooth software (SawtoothSoftware 2017) meant that a total of 972 (3^5 x 4^1) training options were possible. A balanced overlap heterogeneous design, rather than a homogeneous design, was used to increase statistical efficiency in providing more variation across respondents and to reduce problems with scale effects (that is variations in preferences due to the block of the design from which data were generated) (Sándor and Wedel 2005). In this study, a heterogeneous design meant that respondents were randomly assigned to one of 85 versions of the full design, each of which includes seven randomised choice sets. An example of a choice task used for the DCE is given in Figure 1. After the respondents had chosen one out of two possible options, they were asked the closed-ended question: 'Would you really choose the option selected, given your current situation?'. This so-called 'dual-response question' was presented after each choice set. Existing research suggests that inclusion of a dual-response question increases statistical efficiency (Brazell et al. 2006).

Modelling and data analysis

Choice experiments are based on Lancaster's theory of consumers and Mc Fadden's random utility theory (Abebe et al. 2013; McFadden 1973; Lancaster 1966). Following Lancaster

(1966), respondents chose the option with the highest level of utility. The utility of respondents (U_{in}) is represented as:

$$\boldsymbol{U_{in} = V_{in} + \varepsilon_{in}} \qquad (1)$$

where V represents the deterministic part where factors observable by the analyst are included and ε is a random component, which represents the non-observable components (Abebe et al. 2013).

The data are analysed using a mixed logit model estimated in WTP space. This method is accepted practice in economics (Train and Weeks 2005; Sonnier, Ainslie, and Otter 2007; Scarpa, Thiene, and Train 2008; Balcombe, Chalak, and Fraser 2009; Thiene and Scarpa 2009). The utility function to be estimated is:

$$U_{njt} = a_n p_{njt} + \beta_n' x_{njt} + \varepsilon_{njt} \qquad (2)$$

where n denotes the individual, j describes alternatives and t the choice situation. p_{njt} represents the price function, while x_{njt} represents other attributes (non-price attributes) of the alternatives with a non-monetary value. a_n represents specific individual coefficient for price and β_n' for the other attributes. ε_{njt} is a random term of the function.

Following Train and Week (2005), we assume that ε_{njt} is an extreme value distributed with variance $\mu_n^2(\frac{\pi^2}{6})$. Dividing equation **Fehler! Verweisquelle konnte nicht gefunden werden.** b y μ_n does not affect behaviour and results in a new error term that is independent and identically distributed with variance of $\frac{\pi^2}{6}$:

$$U_{njt} = \lambda_n p_{njt} + c_n' x_{njt} + \varepsilon_{njt}$$
$$\text{with: } \lambda_n = \frac{\alpha_n}{\mu_n} \text{ and } c_n = \frac{\beta_n}{\mu_n} \qquad (3)$$

Equation **(3)** then represents the utility function in preference space.

The WTP for the attributes can be written as $\gamma_n = \frac{c_n}{\lambda_n}$. Then equation **(3)** can be converted into:

$$U_{njt} = \lambda_n [p_{njt} + \gamma_n' x_{njt}] + \varepsilon_{njt} \qquad (4)$$

which is what Train and Weeks (2005) call the mixed logit model in WTP space.

2.4 Results

Descriptive statistics

The sample (N=664) consists of 450 (68 per cent) male farmers and 214 (32 per cent) female farmers, with an average age of 43 years (Table 2). The data used in this study is representative for Bihar state based on the comparison with data of the Government and World Bank (Census Organisation of India 2015; World Bank 2016a).

These farmers cultivate on average 1.8 acres (0.7 ha). Crop production is the most important agricultural activity for 600 respondents (90 per cent), crop production and livestock production are equally important for 49 respondents (7 per cent) and livestock is more important than crop production for 15 respondents (2 per cent).

In total, 355 respondents (53 per cent) work together with a partner organisation, defined here as any organisation working in the agricultural sector and supporting the farmers. Of the farmers working with a partner organisation, 196 are PRAN members, 98 are members of FnF and 61 are members of another organisation, mostly a government organisation such as Jeevika or 'Krishi Vigyan Kendra' (KVK). Of the 664 respondents, 449 (68 per cent) had not received training in the past year, 100 farmers had participated in one training event in the past year, 66 farmers in two training events, 32 farmers in three training events, 14 farmers in four training events and three farmers had participated in more than five training events (mean 0.61 events in the year; standard deviation 1.06; max. 7; min. 0).

As regards the DCE decision, 96 per cent would also have been taken under real circumstances following the dual-response answers given by the interviewees. This is the reason why all observations are taken into account in the analysis, even though the respondents were forced to choose.

Table 2.2: Demographic data on respondents, households and farms (N= 664)

Respondent	**Freq.**	**Per cent**	**Mean**	**SD**	**Min**	**Max**
Age in years			43.06	12.61	13	90
Share of female farmers	214	32				
Female head of household	49	13				
Male head of household	329	87				
Able to read (literacy rate)	490	74		0.44		
Level of education						
No degree	224	34				
Primary school	187	28				
Secondary school	179	27				
Graduate and post-graduate	74	11				
Hindu (religion)	658	99				
General category	79	12				
Other backward class	476	72				
Scheduled caste	69	11				
Another caste	34	5				
Owner of a mobile phone	492	74		0.44		
Owner of a smartphone	99	15		0.36		
Household						
Number of household members			6.06	2.49	1	15
Access to electricity	613	92		0.27		
Access to internet	30	5		0.21		
Access to television	217	33		0.47		
Farm						
Most important sector of farming						
More crops than livestock	600	90				
Crop and livestock equally	49	7				
More livestock than crops	15	2				
Working with PRAN	196	30		0.46		
Working with FnF	98	15		0.36		
Working together with a partner organisation	355	53		0.50		
Own land, total (acre)			1.76	3.38		
Cultivated land, total (acre)			1.84	3.39	0	41
Participation in agricultural training events (no. in the past year):			0.61	1.06	0	7
0	449	68				
1	100	15				
2<	115	17				

(Source: authors own data and calculations)

Farmers' preferences for capacity development

Total population

In the comparison of all attributes and levels, training method is found to be the most important for the farmers interviewed, followed in order of rated importance by: additional offers, duration of training, trainer and (least important) location of training. For the training method attribute, classroom training with demonstration is set as the reference level and the levels 'mass media' and 'classroom training' are both rated highly significantly negative relative to this. 'Mass media' (-175 INR) is less preferred than 'classroom teaching' (-152 NR) (Table 3). Regarding the three levels of the attribute additional offer, the respondents report greatest positive marginal WTP for inputs such as fertiliser or seeds (159 INR), followed by credit (135 INR) and network activities (121 INR). This indicates that any additional offer is more preferred than the reference level (no additional offer). Regarding the attribute training duration, the reference level of half a day is the most preferred, followed by one-day training (-30 INR) and then two-day training (-84 INR). Regarding the attribute trainer, the reference level (farming colleague as a trainer) is the least preferred, expert trained on the job is intermediate, with a significant coefficient of 22 INR, and the most preferred level is academic trainer, with a highly significant coefficient of 60 INR. The attribute location was the least important attribute and within this attribute, the reference level of village training is the most preferred. The other two levels (regional and distant training location) are represented by negative coefficients, with the coefficient for training in a distant location being significant (-45 INR).

Comparison with partner organisation, training participants and gender

Differences between sub-groups of farmers are examined based on a data split per sub-group. Model estimations using covariates were unfeasible because the model was not identifiable (lack of degrees of freedom) (Kwak, Wang, and Louviere 2016). Farmers working together with a partner organisation usually have more contact with consultants and staff of the organisation, which might influence their preferences for training. In our sample, 53 per cent of farmers work with a partner organisation. Furthermore, farmers experienced in training may have different preferences (Dror et al. 2016; Birner et al. 2009). In our sample, 68 per cent of farmers did not receive any training in the previous year. Besides the great variation in training experience, Bihar is also still affected by a gender gap in access to advisory services (World Bank 2010; D. M. M. Ghosh and Ghosh 2014), making it necessary to analyse the different preferences of males (68 per cent in our study) and females.

Table 2.3: Mixed logit model in a willingness to pay space

		Mean (All)			Mean (Partner Org)			Mean (No Training)			Mean (Male)		
		Rank	Marginal WTP	Std. Err.	Rank	Marginal WTP	Std. Err.	Rank	Marginal WTP	Std. Err.	Rank	Marginal WTP	Std. Err.
Method of training	Mass media	**3**	**-174.84*****	-26.00	3	-181.85***	35.85	2	-173.45***	33.30	**3**	**-224.17*****	58.31
	Classroom	**2**	**-152.39*****	22.77	2	-142.13***	28.25	3	-175.72***	32.62	**2**	**-217.57*****	54.48
	Classroom with demonstration	1	Reference		1			1			1		
Additional offer	Credit	**2**	**134.80*****	21.80	2	147.29***	30.08	2	148.89***	32.20	3	165.91***	45.70
	Inputs	**1**	**158.79*****	23.83	1	151.93***	31.36	**1**	**175.47*****	33.51	**1**	**199.42*****	52.37
	Network activities	**3**	**120.60*****	20.46	3	119.98***	27.11	3	124.73***	27.94	2	180.03***	49.42
	None	4	Reference		4			4			4		
Duration of training	Half a day	1	Reference		1			1			1		
	One full day	**2**	**-29.53****	14.68	2	-9.07	18.33	2	-38.92**	19.44	2	-29.57	26.11
	Two full days	**3**	**-84.33*****	18.09	3	-82.39***	25.08	3	-82.74***	22.98	**3**	**-94.73*****	33.42
Trainer	Farmer	3	Reference		3			3			3		
	Expert	2	22.46*	12.67	2	20.18	16.31	2	3.63	16.18	2	33.90	24.36
	Academic	**1**	**60.46*****	15.54	**1**	**72.25*****	21.73	**1**	**36.46****	18.41	**1**	**104.99*****	34.49
Location	Village	1	Reference		1			1			1		
	Regional	2	-11.79	11.94	2	-2.27	15.56	2	-16.02	15.66	2	-2.49	21.98
	Remote	**3**	**-44.93*****	14.03	3	-31.52*	17.68	3	-46.13**	18.65	**3**	**-72.59***	29.22
Price	PP		-5.45	0.15		-5.32	0.19		-5.48	0.19		-5.77	0.23
Log Likelihood			-2938.46			-1548.42			-1981,74				-2006.42
Observations			9296			4970			6286				6300

(Note: *P<0.10 ,**P<0.05, ***P<0.01. Source: authors own data and calculations)

The most obvious difference between the results for the whole sample and for the different sub-groups is that the marginal WTP among respondents who work with a partner organisation and respondents who are male is higher than the WTP in the whole sample. In the following, the results for the different attributes are explained one by one, each covering the three different subgroups.

For the attribute method of training, respondents working with a partner organisation and male respondents most preferred the reference level classroom training with demonstration and least preferred mass media as a training method, for which their marginal WTP is -182 INR and -224 INR, respectively. Male respondents indicate a greater aversion to mass media training than all other groups in the total sample. Those who had not received any training in the previous year show only a minor difference in WTP for mass media training (-173 INR) and classroom training (-176 INR) in relation to the total sample.

The levels defining the attribute trainer are ranked similarly by the whole sample and all three subgroups. The reference level (farming colleague as a trainer) is the least preferred and academic trainer is the most preferred level of this attribute, with the main difference being the marginal WTP for each group. The marginal WTP for an academic trainer is on average 61 INR for the whole sample, 72 INR for respondents working with a partner organisation, 36 INR for those without training in the past year and 105 INR for male respondents.

Regarding the attribute additional offer, the whole sample and all subgroups are most interested in crop production inputs. The whole sample, respondents working with a partner organisation and respondents without training in the past year show more interest in credit as an additional offer than in network activities. The only exception is the male respondent's sub-group, which is more interested in network activities (WTP 180 INR) than in credit (166 INR).

For the whole sample and all subgroups, the reference level of training in the village is the most preferred training location. As regards training duration, the reference level of half a day training is most preferred by the whole sample and by all sub-groups.

2.5 Discussion

This study investigates the preferences of Biharian small-scale farmers regarding capacity development (CD) activities. The results reveal that the most important attribute for farmers regarding agricultural training is training method, with classroom training with demonstrations being most preferred. This probably reflects the fact that most of the farmers in the study region have a low education level. Mass media devices such as smartphones are the least preferred

level of the training method attribute. This can be explained by lack of experience of these devices, based on lack of ownership, with the consequence that the interviewees could not see the potential benefits of using smartphones. However, the accessibility of smartphones is increasing rapidly worldwide (Karlsson et al. 2017). The low rating given to mass media training contradicts previous findings on the ongoing development of ICT in agriculture in developing countries (Aker 2011). One possible reason for this contradiction is that Aker (2011) focus on mobile phones as an ICT device, whereas our study also includes smartphones, tablets, television and radio. Use of ICT may also increase in Bihar in future when farmers see the benefits and added value of using mass media for the development of agricultural capacities. The organisation FnF is currently advising and providing farmers in the region individually with relevant agricultural information through mobile phones now and smartphones in the future.

To further support the use of mass media in agricultural capacity development, the target group must already use a form of mass media and the providers of knowledge must be able to supply the information by way of this mass media channel. In our study, the mass media training method was less acceptable to male participants than to the entire sample, contradicting findings by Antonio and Tuffley (2014) that men in developing countries, including India, have a higher technology participation rate. However, Antonio and Tuffley (2014) also reported that women have the capacity and desire to use more ICT devices such as smartphones. From this, it could be assumed that there would be greater benefits for families and communities if women engaged more in ICT use (Antonio and Tuffley 2014). Based on our results and the literature, it can be recommended that, besides empowerment of females in developing countries, it is also reasonable to support female adoption of mass media in order to develop capacities, because this also strengthens families and communities.

The attribute ‘additional offer’ was rated the second most important overall and, within this attribute, crop production inputs, such as fertiliser and seeds, was the most preferred level. According to Peterson (1997), the reasons why farmers have a lack of inputs include limited financial resources (for example credit), which is rated as the second most preferred additional offer in this study. Credit would enable farmers to invest in inputs, which would increase yield and farm income directly, in comparison with other additional offers (Bingen, Serrano, and Howard 2003; Gray et al. 2009; Peterson 1997). Within the additional offer attribute, male participants show greater WTP for network activities than for credit, which distinguish them from the entire sample. In the study region, men are normally in charge of the household budget,

although financial empowerment of women can have positive influences on nutrition, education and health (Fletschner 2009). Our results confirm that it would be more beneficial for smallholder households if women had more control over financial decisions in agriculture.

Our results also show that, regarding the attribute 'trainer', respondents prefer an academic over an expert trained on the job or a farming colleague, despite having least experience of academic trainers. Male farmers and farmers working with a partner organisation show even greater WTP for an academic trainer compared with the whole sample. This preference is reasonable because researchers and scientists are generally seen as the most important source of information for advisory services in developing countries (van den Ban 1997). However, small-scale farmers were often trained by academics around 30 years ago and it was found to be less successful than the participatory approach (Ferroni and Zhou 2012; Glendenning, Babu, and Asenso-Okyere 2010; Jones and Garforth 1997). At present, training in developing countries is predominantly carried out using self-help groups, innovation platforms or train-the-trainer, without any payment system, as PRAN is doing (Waddington et al. 2014). In Bihar, government organisations such as KVK work together with agricultural universities at the district level (Glendenning, Babu, and Asenso-Okyere 2010), but local farmers rarely cooperate with organisations such as KVK. Thus, there seems to be a contradiction between our results and the development of agricultural CD in recent decades. In future, research institutions and actors involved in CD activities should seek to include academics in a successful way in training activities.

With respect to the attribute 'duration', farmers prefer half-day training. The most reasonable explanation is that farmers would like to include agricultural training without disrupting their daily schedule, which depends on seasonal aspects, workload and production technique. Women, in particular, take care of most daily responsibilities (FAO 2011). PRAN already takes the preferred duration into account in its organised training sessions, so that more farmers are able to participate.

Concerning the attribute 'location', respondents preferred the reference level of village-based training, a preference which is already taken into account by local NGOs such as PRAN but not by government organisations as KVK. Location of training was the least important attribute in this study, confirming findings by FAO (2011). Farmers working with a partner organisation revealed higher preferences for one-day training in a different village, possibly because of positive experiences of their partner organisation and their training. Likewise, male respondents

reported a higher preference for training in another village than all respondents, possibly due to less daily responsibilities.

Overall, the results add to the discussion on the private sector's role in agricultural advisory systems in developing countries raised by for example Feder, Birner and Anderson (2011). Their study mentioned examples including India, where input suppliers are the most important source of information for farmers. A pluralistic demand-induced community-driven approach for India has been requested by previous studies (Babu et al. 2013). Involving private training suppliers can be a good contextual fit, as it corresponds most closely to farmers' preferences. For example, FnF is already working with input suppliers and agricultural advisors. While privatisation of agricultural training is not visible in our study area, it can be a way to meet farmers' demand for agricultural CD in future. Ensuring that poor farmers have access to knowledge is one of the greatest challenges in the privatisation of advisory services (Feder, Birner, and Anderson 2011). PRAN wants to apply a payment system for training activities in the near future. One possible way to implement such a payment system could be to expand into new regions and conduct scientific studies to analyse the effects.

2.6 Conclusion

Bihar is one of the poorest states in India, with a large share of the population living in rural areas with poor infrastructure and resource scarcity, a common feature in developing countries. To produce agricultural goods and gain a stable and sufficient income, small-scale farmers living in rural areas need to develop their agricultural capacity. To improve agricultural capacity development, it is necessary to understand farmers' needs and demand for capacity-building measures. There is little guidance in the literature on farmers' preferences regarding agricultural training. To our knowledge, this study is the first to analyse farmers' preferences as WTP for aspects of agricultural training such as training method, type of trainer, additional offers, training duration and training location and the first to attempt this with a discrete choice experiment. The data are analysed using a mixed logit in WTP space.

Overall, the results indicate that policymakers and stakeholders in agriculture in developing countries should continue to shift from standardised top-down models towards decentralisation, privatisation and demand-induced community-driven approaches, in order to achieve greater mutuality, flexibility and customisation of training measures.

Training method prove to be the most important attribute of training, and within this attribute, classroom training with demonstrations is most preferred, as PRAN is mostly doing. Farmers

indicate an aversion to using smartphones in agricultural training, despite global digitalisation trends and current efforts to include modern ICT in agricultural capacity development. Mass media would allow academic trainers (the most preferred type of trainer) to be involved in training without increasing the costs and would allow agricultural production and marketing information to be disseminated. Thus, policymakers should seek to overcome psychographic and regional barriers to the implementation of mass media in capacity development.

The expressed preference for academic trainers questions the use of current approaches such as 'train-the-trainer', involving farmers in the knowledge replication process. Other approaches as the 'agricultural knowledge and information system' already create direct links between scientists and farmers by way of modern communication technologies.

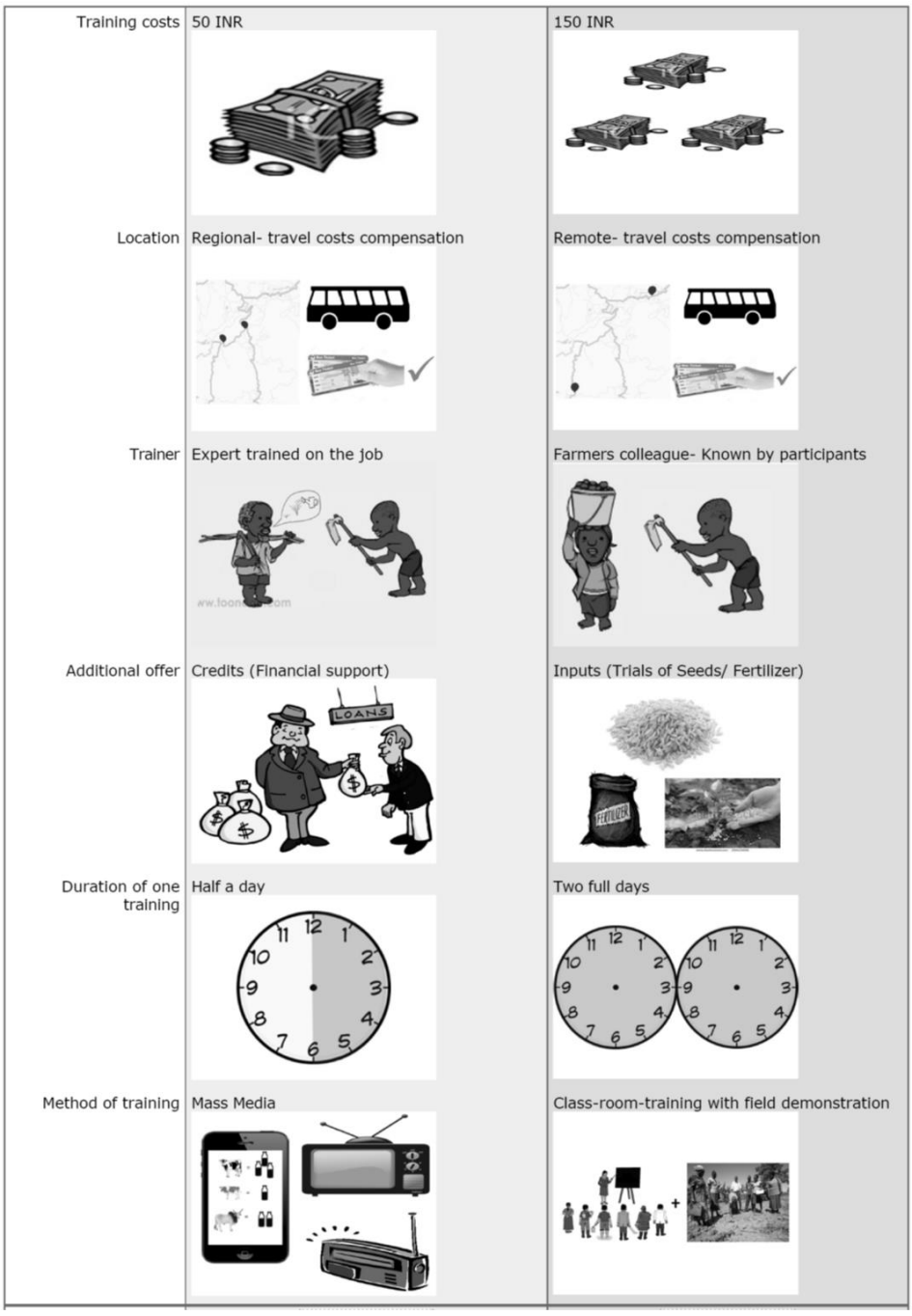
Farmers prefer any kind of additional offer to no offer and most prefer an offer of crop production inputs or credit, which are the best options for increasing agricultural yield and could be included by training organisations. The respondents, especially women, prefer having training close to home and fitting within a day, allowing them to perform their daily responsibilities in the household. However, these are the least important attributes in the study.

The additional costs of demand-driven upgrading of capacity development activities could be covered by a fee that complies with farmers' WTP. To avoid exclusion of the poorest farmers and also meet farmers' demands, different additional services and goods, such as seeds, could be introduced based on a voluntary payment system.

The hypothetical nature of the experiment is opposing one limitation of this study as it is not able to measure actual behaviour of the respondents. Another way to analyse the preferences of small-scale farmers regarding agricultural training in developing countries would be to use data of a field experiment. However, the approach taken is appropriate because DCE permits data collection under controlled conditions in an indirect survey, which is difficult to achieve by other experiments and the number of respondents represented in this sample.

2.7 Appendix 2

Figure A2.1: Example of an unlabelled choice card



(Source: authors own graphic)

3 Understanding the relationship between trainers' qualification, learning success and satisfaction for agricultural capacity development in rural Bihar[2]

Abstract

Within capacity development, the type and quality of the trainer can play a crucial role in promoting farmers' capacity. Hence, the main purpose of this paper is to examine the relationship between trainers' qualification and learning success and satisfaction of small-scale farmers during training activities in Bihar, India. Moderated mediation analysis is utilized to measure the direct and indirect effects of trainers' qualification on learning success and satisfaction. Therefore, the psychological constructs of attitude and perceived control from the Theory of Planned Behaviour (TPB) operate as mediators, subjective norms act as moderator, and gender and age serve as covariates. The results do not indicate a distinction of satisfaction among farmers regarding trainer qualification. However, learning success decreases with an academically educated trainer. The change of attitude during the training has a significantly positive influence on satisfaction. Subjective norms also influence the participants' satisfaction positively. Thus, we suggest for practical implications combining an expert trained on-the-job as the main trainer with an academically educated trainer integrated via modern technologies. In addition, the social environment has to be addressed within the training. Besides the professional background, it is important that trainer gets trained on teaching methods and other soft skills. The results further show that the behavioural constructs are relevant in the field of agricultural education and extension. Theoretical implications can be drawn regarding the improvement of this conceptual framework and other related studies. Whilst various studies have addressed the identification of farmers' capacity development preferences, few have investigated the relationship between trainer qualification, learning success and satisfaction.

Keywords

Agricultural training, trainer qualification, moderated mediation, small-scale farmers, India

---

[2] This chapter is co-authored with Sabrina Kimmig (SK) and Carl Johan Lagerkvist (CJL). The authors' contributions are as follows: Dirk Landmann (DL) designed the research. DL and SK collected the data. DL analysed and interpreted the data. CJL assisted in the analysis and interpretation of the results. DL wrote the paper. SK and CJL commented at the various stages of the research and contributed to writing and revising the paper. All authors read and approved the final manuscript. This manuscript is published in the 'GlobalFood Discussion Paper Series' and submitted to the 'Journal of Agricultural Extension and Education'. The share of the total work done by DL is 70 per cent.

3.1 Introduction

Agricultural training activities are integrated into the programmes of international development organisations such as the FAO (Food and Agriculture Organization of the United Nations), which utilize training as the primary method to strengthen the capacities of actors - such as small-scale farmers – in the areas of agriculture, nutrition, food security and rural development (World Bank 2007; de Rosa et al. 2016). A wide range of agents is involved in the extension system for agricultural development including scientists, producers, managers, education staff, trainers, extension agents and staff of support services (Ludemann et al. 2012, 19–21). Extension agents play a major role in promoting farmers' capacity. Extension agents and trainers need expertise, a special skill set and experience with addressing the needs of small-scale farmers in order to work successfully (Hellin 2012; Höckert and Ljung 2013). Teaching of practical skills for agricultural purposes involve the use of accurate explanations to allow participating farmers to follow the processes and apply the skills. Therefore, teaching needs a high level of competency in a teacher to both disseminate knowledge and demonstrate precise step-by-step guidance (Swailes and Roodhouse 2004).

The approach of teaching small-scale farmers by academics was used around 30 years ago and was declared as not successful in comparison to the participatory approach (Ferroni and Zhou 2012). However, researchers and scientists are seen as the most important source of information for extension services in developing countries (van den Ban 1997). The participatory approach, which is currently more often used, was developed to be more efficient, more sustainable regarding the duration of professional relationships, and more adaptable to local circumstances (Birner et al. 2009). Other approaches such as the 'agricultural knowledge and information system' create direct links between scientists and farmers via modern communication technologies to strengthen communication (J. R. Anderson 2007). Teachers' education has a crucial role in the improvement of educational systems around the world. In comparison, businesses worldwide have a certain level of 'professionalism,' meaning standard qualifications such as master's degree. 'Extension and Advisory Services' (EAS) for agricultural development have only recently begun to increase their level of professionalism. Hence, in 2016 the 'Global Forum for Rural Advisory Service' (GFRAS) conducted a scoping study to evaluate their regional networks and draw conclusions to improve their services. Additionally, it aimed to encourage information exchange regarding training, talent and career development, performance incentives, certification and standards (Terblanche 2017). According to Davis (2015), extension should be recognised as a profession and staff should be connected to

societies to allow for professional education and development. This also includes a better balance between technical and practical skills.

Relevant to the participation in training programs, farmers continually modify, revise and even set aside their personal beliefs and views as they learn more about the subject of interest, their own behaviours and social environments (Bhattacherjee and Premkumar 2004). To this end, the attitude and perceived control for participation in agricultural training can be expected to represent key determinants to learning success and satisfaction of agricultural training while acting to induce behavioural change in accordance with the training activity (Topală 2014; Ko and Chung 2014; Chatman and Sparrow 2011; Bihler 2006).

The aim of the present study is to examine whether there is a distinction in learning success and perceived satisfaction of agricultural training among farmers as a result of the trainer's educational qualification. For this purpose, we investigate whether the change of attitude and perceived control of farmers participating in training for agricultural capacity development mediate the effect of learning success or perceived satisfaction depending on the type of trainer. Finally, we test whether the relation between trainer type and the learning success or perceived satisfaction is moderated by farmers' subjective norms.

The results of this paper are expected to provide policymakers and providers of extension services with insight into the underlying psychological factors that influence participation in agricultural training. These insights can be used to adjust current policies and to develop new initiatives to stimulate knowledge transfer and participation in agricultural training programmes by small-scale farmers.

3.2 Literature review and present study

Lack of information and knowledge is a frequently cited barrier to the adoption of new agricultural practices in developing countries (Aker 2011; Norton, Alwang, and Masters 2006). Often, farmers are simply not aware of new techniques and associated benefits, or they do not possess the necessary skills or know- how. Hence, active promotion - as well as provision of accurate information, extension and education on technologies - are frequently identified as indispensable for building awareness and improving farmers' knowledge and skills (Knowler and Bradshaw 2007). Providing agricultural extension services to farmers can bridge the knowledge and capacity gap by educating farmers in agricultural production and management. Furthermore, extension is an opportunity to answer to farmers' needs concerning knowledge and skills. Extension serves as the intermediary between farmers and scientists(J. R. Anderson

2007). Depending on the farmers' knowledge, the trainer can fulfil different roles, from the traditional role of an expert delivering answers to specific questions, to a facilitator engaging in a joint learning process together with the farmer (Ingram 2008; Leeuwis and van den Ban 2004). Therefore, trainer and extension agents should be qualified with regard to technical and functional skills (J. R. Anderson 2007; K. Davis 2015).

However, some actors within the extension system may have a vested interest in maintaining the status quo, hidden agendas or a reluctance to deal with more marginalized areas (Chowdhury, Odame, and Leeuwis 2014; Muyanga and Jayne 2008). This means a good working programme needs clear rules, education and training for staff and adequate financial resources. Otherwise, the system risks becoming relatively ineffective (Norton, Alwang, and Masters 2006).

The conceptual framework developed for the present study describes the relationship between trainer type and learning success (Figure 3.1) as well as learning satisfaction (Figure 3.2). For this study, attitude defines the respondent's unfavourable or favourable evaluation regarding the agricultural training programme. Perceived control describes the perceived ease or difficulty to behave in a certain way. Subjective norms denotes social pressure to act in a specific way or not (Ajzen 1991). There are various causes why farmers are affected by their social environment: they aspire for respect, they want to demonstrate their commitment to family values, or they aspire to improve through advise and additional knowledge of a third person (Martínez-García, Dorward, and Rehman 2013).

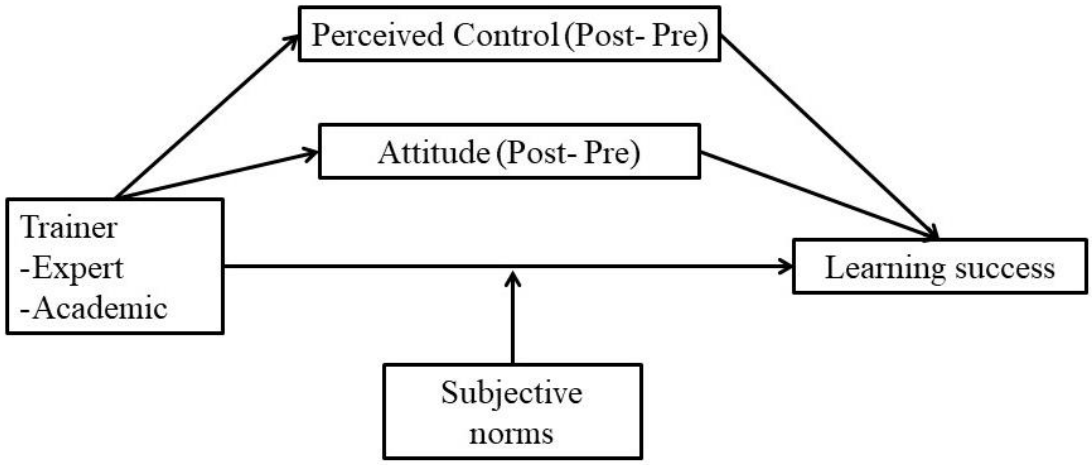
Learning success

According to Gardner (2009), success means to improve the results of one's actions in a particular situation, e.g. learning success within an agricultural training as a purposeful activity to change one's own capacities. Learning can occur with the most varied results, and therefore it is necessary to measure learning success and to set precise learning goals. The learning control describes the outcome of the offered training. The acquisition of knowledge can be subdivided into declarative and percentage knowledge. Declarative knowledge involves the more factual knowledge as well as complex content. Percentage knowledge controls the execution of the skill. Therefore, it is important to integrate various types of knowledge acquisition methods to prevent conveying information that cannot be applied (Kirkpatrick and Kirkpatrick 2012).

A further distinction is made related to quantitative knowledge, which includes professional development, and qualitative knowledge acquisition describing a deeper discussion with interdisciplinary connections. In the context of learning success quantitative and qualitative

knowledge increasement have emerged. Another important point which is influenced by further training is the change of motivational factors. Individuals' interest arises when a person is concerned with specific learning objects. In this context, interest development should be directly related to the subjective experience that influences the experience (Bihler 2006).

Figure 3.1: Research model 1 with y = learning success



(Source: own depiction based on Hayes 2012; Ajzen 1991)

In the first research model (Figure 3.1), changes in attitudes and perceived control due to the training can potentially influence the relation between trainer type and learning success. The direct relationship between trainer type and learning success are also assumed to be moderated by farmers' subjective norms. Additionally, gender and age are introduced as covariates.

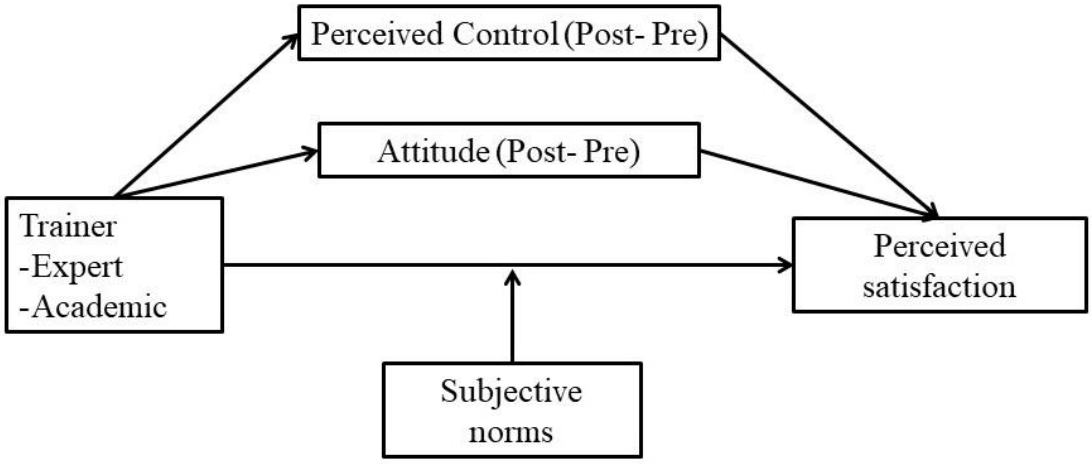
Perceived satisfaction

Satisfaction of training is described as a cognitive-evaluative attitude of the person related to his or her educational situation. Satisfaction is characterised by a subjective perception, which is a comparison of perceived and assessed characteristics of a training situation compared to personal expectations. If the individual expectations exceed the assessed training situation, dissatisfaction develops. In general, perceived satisfaction does not always lead to learning success and is not directly related to performance, but it is a value to compare and evaluate further training. Perceived satisfaction and learning success can be used as a reference variable to measure the quality of an agricultural training activity. The more demanding a situation or task the more important is the promotion of professional competencies among the trainers in further training measures (Bihler 2006).

In the second research model (Figure 3.2), perceived training satisfaction refers to outcome expectancies (i.e. a comparison between perception and evaluation of the learning situation). It

is hypothesized that changes in attitudes and perceived control due to the training mediate the relation between trainer type and learning satisfaction and the individual expectations. The direct relationship between trainer type and learning success are again assumed to be moderated by farmers' subjective norms.

Figure 3.2: Research model 2 with y = perceived satisfaction



(Source: own depiction based on Bihler 2006; Hayes 2012)

3.3 Materials and methods

Data collection and sample

This study is based on face-to-face interviews as part of a questionnaire that was developed following literature review, discussion with NGOs and related stakeholders in Bihar state in the North-East of India.

Bihar state has a population of 104 million people (2011), owing to a population growth of 25 per cent in the last decade. In India, Bihar is one of the poorest states in India, with a per capita Net State Domestic Product of 235 USD (Rodgers et al. 2013). In 2011, 62 per cent of the total population were literate. In rural areas of Bihar, the literacy rate for males and females stood at 70 per cent and 44 per cent. However, only 24 per cent of adults have a secondary education or higher. Agriculture is the most important employment sector in Bihar, since 81 per cent of the entire population work in the agricultural sector (Government of India 2008). Yet the agricultural share of the Bihar GDP decreased from 43 per cent in 1980-1981 to 18 per cent in 2009-2010 (Sharma and Rodgers 2015). In rural Bihar, agriculture remains the primary livelihood of individuals. The sector is dominated by small-scale farmers and is central in improving living standards (Rodgers et al. 2013).

During December 2016, a total sample of 217 randomly selected farmers from ten villages of Nalanda and Gaya completed the survey. The data collection and training carried out as part of the study were conducted in cooperation with the local NGO 'Preservation and Proliferation of Rural Resources and Nature' (PRAN). The focus of PRAN's work is to improve the standard of living regarding food security and to generate income through climate resilience technology (PRAN 2015).

Participants were recruited through stratified random sampling. A minimum of 100 farmers receiving agricultural training given by an expert trained on the job were interviewed. Likewise, a minimum of 100 farmers receiving a training by an academically educated trainer were interviewed. Both training covered 'good agricultural practices' and used a similar method to train on the management and intensification of wheat production.

The questionnaire first explored sociodemographic variables, attitude, subjective norms, perceived control before the training. Following a short introduction and after receiving a consent to participate, participants were randomly allocated to one out of a total of ten training sessions. Out of these ten sessions, five were given by a PRAN trainer who was trained on-the-job and five by an academically educated trainer. Each training session lasted approximately three hours. After the training, participants completed a follow-up survey detailing attitude, perceived control, and other aspects related to training experiences including satisfaction and learning success.

Out of the entire sample size, the proportion of male respondents is 34 per cent, while that of female respondents is 66 per cent, which is to be expected given that PRAN worked only with women until a couple of years ago. The age range of the participants is between 19 and 90 years with an average age of 44 years. The education is shown to be mainly low. A large per centage of the surveyed farmers have no degree (59 per cent). On the other hand, 24 per cent attended primary school, another 11 per cent secondary school, and five per cent graduated. Approximately 32 per cent reported having participated in one agricultural training course, 26 per cent having taken part in two agricultural trainings in the last 12 months, and 33 per cent have not attended a training session. The farmers focus mainly on crops, especially wheat, paddy and vegetables. The characteristics of the sample are presented in Table A3.1.

Measures

Measures for the psychological constructs of the TPB are adapted from items according to Ajzen (2006). The participants were asked how likely they were to agree about e.g. importance and usefulness of agricultural training using Five-point Likert scales, ranging from 'strongly

disagree' (1) to 'strongly agree' (5). Similar statements are used to measure attitude towards information exchange, self-organisation, application of training content and how instructive the session was. The same statements were asked before and after the agricultural training. The construct 'attitudes' (Cronbach's alpha = 0.63) is created through factor analysis with the differences of equally asked statements before and after the training session.

The same process is applied for perceived control. Dimensions are adapted from other literature. The farmers were asked how much they would agree with statements regarding their ability to improve their income, their ability to acquire new agricultural techniques, their desire to develop themselves, opportunities for future agricultural training and the overall effect generated by agricultural training. The construct 'perceived control' (Cronbach's Alpha = 0.39) is built by aggregating the different responses to the same statements before and after the training through factor analysis.

Respondents were asked to what extent family members expect them to succeed and improve their knowledge through agricultural training. Additionally, questions related to support of the family, close relatives and the overall social environment in relation to agricultural training were asked. The construct 'subjective norms' (Cronbach's Alpha = 0.72) is developed by aggregating the statements through factor analysis.

The measurement of perceived satisfaction is particularly difficult due to differences in opinion, in that the same results cannot be expected despite the same survey instrument Žabkar, Brenčič, and Dmitrović (2010). To operationalize the construct 'perceived satisfaction', we use a set of various statements belonging to different criteria, such as reason to attend, knowledge transfer, training content, trainer and duration (Cronbach's Alpha = 0.81).

Participants were asked ten questions related to the training content such as the quantity of seeds per land unit, the requirements for wheat seed sowing and information related to irrigation and fertilizer application. The respondents had the choice between four answers of which one statement is clearly correct. If a respondent answered all ten questions correct, a total score of 100 per cent is achieved.

Data analysis

Statistical analyses are performed with the software programme SPSS 24. Descriptive statistics such as chi-square association tests and independent sample t-tests are applied to profile respondents according to their familiarity with agricultural training. The adequate internal reliability consistency of the multi-item scales is assessed with Cronbach's alpha. Kline (1993)

quotes that even values below 0.7 are acceptable regarding psychological constructs because of the construct's diversity. Individual item loadings for constructs with a value greater than 0.5 are acceptable. Kaiser-Meyer-Olkin (KMO) measurements and Bartlett's test of sphericity are also tested for scale reliability and validity (Field 2009).

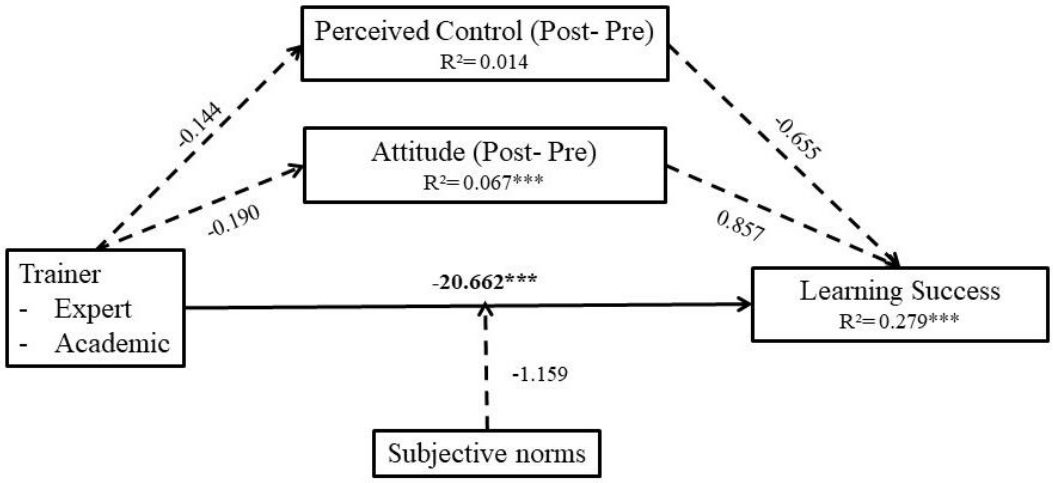
A general linear modelling approach was adopted to estimate the direct and indirect effects in Figure 3.1 and 3.2 respectively based on the literature on moderated mediation (Hayes 2012; Hayes and Preacher 2014; Preacher and Hayes 2004; Hayes 2015). Changes in perceived control and changes in attitude of farmers during the training were used as mediators.

3.4 Results

Learning success

Figure 3.3 shows the results from the moderated-mediation model one in which the trainers' qualification predicts the dependent variable learning success. Learning success explains 27.9 per cent of the total amount of variance, which is described as medium effect size by Cohen (1992), and is highly significant (Table A3.2). The variable trainers' qualification has a highly significant negative influence (Coeff. = -20.662; Table A3.3) on learning success, meaning that farmers' learning success drops by 21 percent if they were taught by an academically educated trainer.

Figure 3.3: Path coefficient of the research model 1- learning success



(Source: authors own illustration; *** p < 0.01; Note: solid lines represent statistically significant relationships)

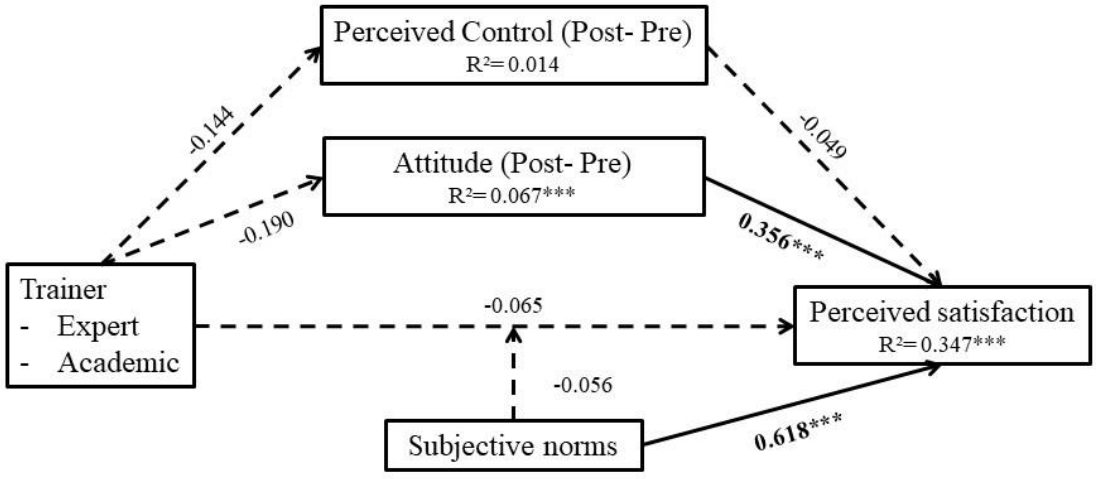
The indirect effects of mediators and the behavioural constructs of attitude and perceived control cannot be confirmed respecting the score based and performance-driven variable

learning success. This interpretation is based on the fact that the confidence interval produced by bootstraps includes the value of zero (Table A3.4). The results in Table A3.5, show that the product of the trainers' qualification and the factor subjective norms does not have a significant influence on learning success. By this fact we cannot confirm a moderating role of subjective norms.

Perceived satisfaction

Figure 3.4 presents the results from the moderated-mediation model two in which the trainers' qualification predicts the dependent variable perceived satisfaction, explaining a medium effective size (34.7 per cent). The perceived construct satisfaction is highly significant (Table A3.2) but is not driven by the trainers' qualification. However, the behavioural construct attitude has a positive significant influence (Coeff. = 0.356; Table A3.3) on participant satisfaction. This means the change of respondents' attitude during the training has a positive influence on satisfaction. The mediator attitude is significant but only explains 6.7 per cent of the total amount of variance, which can be described as a small effect size magnitude but is still acceptable in social science (Cohen 1992).

Figure 3.4: Path coefficient of the research model 2 -perceived satisfaction



(Note: *** p < 0.01; solid lines represent statistically significant relationships;

Source: authors own data, calculations and illustration)

The indirect effects of attitude and perceived control cannot be confirmed regarding perceived satisfaction (Table A3.4). Perceived control is also not significant and explains 1.4 per cent of the total amount of variance. The moderator and independent variable subjective norms (formed for example by neighbours or colleagues) influence the satisfaction positively (Coeff. = 0.618).

However, we cannot confirm a moderating role of subjective norms between trainers' qualification and satisfaction (Table A3.5).

With respect to the covariates, gender - more specifically being a male respondent - has a negative significant influence on perceived satisfaction (Coeff. = -0.255). The covariate gender also has a highly significant but positive influence (Coeff. = 0.483) on the construct attitude (Table A3.3). This means that being a male respondent has a positive influence on the change in attitude during the training.

3.5 Discussion

This study investigated how learning success and satisfaction of agricultural training participants were influenced by trainers' qualification and to what extent this influence was affected by gender, age, attitude, perceived control and subjective norms. The results from this study, therefore, contribute to the existing literature on farmer training and agricultural extension by using psychological constructs from the TPB to explore the relationship between trainers' qualification and learning success as well as satisfaction. To our best knowledge, this is the first study providing such in-depth account of physiological constructs in the context of agricultural training. The paper shows that farmers' learning success is reduced if an academically educated trainer conducts the training. However, the reduced learning success in the first model confirms (e.g. Hellin 2012) that trainers need to be well educated and require a special skill set along with experience of working with small-scale farmers in order to achieve the desired effect of the training. This leads to the conclusion that, based on our study, the missing experience of the academic trainer related to the agent causes lower learning success of the participants. The change in attitude does not mediate the relation between trainer and learning success in a statistically significant way in the first model. The interpretation for this could be that farmers are not aware of their own learning performance. Furthermore, the change of perceived control did not mediate the relation between trainers' qualification and learning success. The most reasonable explanation for the low influence of perceived control could be that this behavioural construct does not change during the time of training. Also, subjective norms have no significant direct effect on learning success. A possible interpretation of the insignificant influence of the behavioural constructs is the low importance regarding learning success due to the fact that learning success is a score based and performance driven variable.

The results of the second model, including the depended perceived satisfaction, do not show a distinction in the perceived satisfaction as a result of the trainers' qualification, even though the learning success decreases with an academically educated trainer. Training given by academics

is declared as not successful in comparison to the participatory approach (e.g. Ferroni and Zhou 2012; Birner et al. 2009). Even if these arguments sound reasonable after analysis of the literature, it might not be the case from the small-scale farmer point of view in developing countries (e.g. van den Ban 1997). The second model also indicates that the changes of attitude over the training do not function as a mediator on perceived satisfaction. However, the change of attitude influences the perceived satisfaction positively and significantly. It is well known from social-psychology literature that attitudes are important determinants of subsequent behavioural change (Ajzen 1991). A positive influence towards satisfaction can be a sign that the trainer, at least to a certain extent, is able to reach the farmers with the content of the training, and this leads to a higher possibility of knowledge transfer as well as implementation and replication of what was discussed during the training. The prospect of improvement of agronomic practice and farm management as a result of the training is an important factor. If farmers are not interested in improving their skills and knowledge, the training is superfluous and will likely not involve the farmers asking questions or starting a discussion. Farmers who do not want to learn new skills or gain from other associated benefits do not attend training at all. A positive attitude can be a driver for successful participation in an agricultural training. In this regard, opinions and behaviour of peers are important factors influencing the formation of the decision-maker's attitude (Rogers 1995).

Furthermore, the change of perceived control did not mediate the relation between trainers' qualification and perceived satisfaction. Possible explanations could be that perceived control is not important regarding perceived satisfaction, or the construct perceived control does not change during the training.

Next, subjective norms were found to have a significant direct effect on perceived satisfaction. However, subjective norms do not moderate the relationship between trainers' qualification towards perceived satisfaction or learning success. Subjective norms are important in individuals' behaviour and perception because individuals are not unbiased of cultural and social effects. Instead, they continuously refer their behaviour to individuals who are of fundamental importance (Burton 2004). In this way, peers can actively bias farmers' intention to participate in agricultural training courses by motivating them and making evident their positive attitude towards participation and application of the new methods. Even though a farmer holds a positive attitude towards the adoption of a certain technology such as the system of wheat intensification, social influence can inhibit this attitude from being presented in real behaviour (Burton 2004). However, the social environment can stimulate a farmer to adopt a

new methodology, even while that farmer has a negative attitude towards the behaviour. These individuals can be used as central key to influence and motivate farmers to adopt a new methodology (Garforth et al. 2004; Martínez-García, Dorward, and Rehman 2013). In the context of the present case, farmers may be encouraged by individuals such as their spouse, village chief, farmers group, and extension workers to participate in agricultural training activities. Against this background, the social environment plays a pivotal role with regard to the quality of the training.

The results of this study are expected to provide policymakers and NGOs with insights into the underlying psychological factors that influence the participation in agricultural training. These findings can be utilized to adjust current policies and to develop new activities to promote knowledge transfer and participation in agricultural training programmes among farmers. We suggest combining the strengths of both trainer types. An expert trained on-the-job could be the main trainer, while an academically educated trainer could support or lead one of the number of training using modern ICT. With this method, the benefits of both trainer types could be utilized without increasing costs. Our results also indicate that farmers are influenced by individuals who are close to them, such as family, friends, neighbours as well as fellow farmers.

Therefore, actors involved in the provision of extension should keep in mind that a good image and support among local stakeholders is of upmost importance in order to have quality participation among targeted farmers and encouragement of the social environment. Training activities in line with the preferences of farmers as well as, for instance, open days to promote the NGO approach can help in this regard. Besides the professional background, it is important that training of trainers is undertaken integrating cultural sensitivity, various teaching methods and other soft skills. In addition, policymakers can prioritize expanding training opportunities for extension workers in order to improve trainers' qualification and thus increase access to quality information among small-scale farmers.

3.6 Appendix 3

Table A3.1: Characteristics of respondents, and farms (N= 217)

Respondents	**Per cent**	**Production focus**	**Per cent**
Gender		Only crops	46
Female	66	More crops than livestock	53
Male	34	**Crop type*[1]**	
Average age (years)	44	Paddy	95
Education		Wheat	91
No degree	59	Vegetables	83
Primary school	24		
Secondary school	11		
Graduate	5		
No training experience	33		

(Description: *[1] Yes/No answers; Source: authors own data and calculations)

Table A3.2: Model summary

Construct	**R**	**R-sq**	**MSE**	**F**	**df1**	**df2**	**p**
Attitude	0.259	**0.067**	0.962	4.828	3	201	**0.003**
Perceived control	0.118	0.014	1.015	0.952	3	201	0.417
Learning success	0.528	**0.279**	307.408	10.894	7	197	**0.000**
Perceived satisfaction	0.589	**0.347**	0.671	14.925	7	197	**0.000**

(Source: authors own data and calculations)

Table A3.3: Direct effects of mediators, moderators and covariates on the dependent variables

Dependent variable	Independent variable	Coeff.	se	t	p	LLCI	ULCI
Attitude							
	Constant	0.325	0.290	1.120	0.264	-0.247	0.896
	Treated	-0.190	0.143	-1.331	0.185	-0.471	0.092
	Gender [1]	**0.483**	0.148	3.257	**0.001**	0.191	0.775
	Age	-0.009	0.006	-1.534	0.127	-0.020	0.003
Perceived control							
	Constant	-0.196	0.298	-0.658	0.512	-0.783	0.391
	Treated	-0.144	0.147	-0.980	0.328	-0.433	0.145
	Gender [1]	0.010	0.152	0.066	0.947	-0.290	0.310
	Age	0.006	0.006	1.077	0.283	-0.005	0.018
Learning success							
	Constant	79.998	5.241	15.264	0.000	69.663	90.334
	Treated	**-20.662**	2.572	-8.032	**0.000**	-25.735	-15.589
	Attitude	0.857	1.422	0.603	0.547	-1.947	3.661
	Perc. control	-0.655	1.291	-0.507	0.613	-3.202	1.891
	Subjective norms	1.680	1.881	0.893	0.373	-2.031	5.390
	Int_1	-1.159	2.542	-0.456	0.649	-6.171	3.853
	Gender [1]	4.382	2.742	1.598	0.112	-1.026	9.789
	Age	-0.103	0.104	-0.987	0.325	-0.309	0.103
Perceived satisfaction							
	Constant	0.320	0.245	1.307	0.193	-0.163	0.803
	Treated	-0.065	0.120	-0.538	0.591	-0.302	0.172
	Attitude	**0.356**	0.066	5.366	**0.000**	0.225	0.487
	Perc. control	-0.049	0.060	-0.816	0.416	-0.168	0.070
	Sub. norms	**0.618**	0.088	7.028	**0.000**	0.444	0.791
	Int_1	-0.056	0.119	-0.475	0.636	-0.291	0.178
	Gender [1]	**-0.255**	0.128	-1.993	**0.048**	-0.508	-0.003
	Age	-0.005	0.005	-0.948	0.345	-0.014	0.005

(Note: [1] 0= Female; 1= Male; Int_1 : treated x FacSN; Source: authors own data and calculations)

Table A3.4: Indirect effects of mediators on dependent variables

Dependent variable	Mediators	Effect	BootSE	BootLLCI	BootULCI
Learning success					
	TOTAL	-0.069	0.376	-0.914	0.660
	Attitude	-0.163	0.320	-0.903	0.413
	Perceived control	0.094	0.271	-0.405	0.736
Perceived satisfaction					
	TOTAL	-0.061	0.050	-0.164	0.033
	Attitude	-0.068	0.050	-0.172	0.028
	Perceived control	0.007	0.015	-0.016	0.043

(Note: Boot= bootstrapping; Source: authors own data and calculations)

Table A3.5: Test(s) of highest order unconditional interaction(s)

Dependent variable	Independent variable	R2-chng	F	df1	df2	p
Learning success	X*W	0.001	0.208	1	197	0.649
Perceived satisfaction	X*W	0.001	0.225	1	197	0.636

(Source: authors own data and calculations)

4 Determinants of small-scale farmers' intention to use smartphones for generating agricultural knowledge in developing countries - evidence from rural India[3]

Abstract

Access to and usage of smartphones for agricultural purposes amongst small-scale farmers in rural areas of developing countries is still limited. Smartphones may provide an opportunity to develop farmers' capacities with specific applications offering fast access to continually updated and reliable information. This study investigated the behavioural drivers of smallholder farmers´ intention to use a smartphone in a developing country context. For this, survey data was collected from 664 randomly selected small-scale farmers in Bihar State, India in 2016. The analysis included a partial least square estimation of the behavioural model. The results confirm positive influences on the intention to use a smartphone for agricultural purposes through subjective norms, attitude, self-control, as well as positive and negative anticipated emotions. There is no evidence that negative anticipated emotions related to failure outweighed other factors. These results extend the academic literature with new conceptual insights and provide application-oriented implications for stakeholders, such as NGOs, extension services and research institutes.

Keywords

Smartphone, agriculture, small-scale farmers, Theory of Planned Behaviour (TPB), Structural Equation Modeling (SEM), Partial Least Squares (PLS), developing countries, India

[3] This chapter is joint work with Carl Johan Lagerkvist (CJL) and Verena Otter (VO). The contributions are as follows: Design of the research Dirk Landmann (DL), CJL, VO; Literature review: DL, VO; Data collection: DL; Analysis of the data: DL; Interpretation of the results: DL, CJL, VO; Writing the paper: DL, VO. The share of the total work done by DL is 60 per cent.

4.1 Introduction

Agricultural production is complex, and farmers need to make proper and timely decisions on a range of several agricultural subjects at different stages of the production cycle. To this end, external information sources may provide farmers with input to help with the best time for seeding, to improve market access or to adopt more efficient technologies (Aker 2011; Mittal, Gandhi, and Tripathi 2010). In this regard, it is not only the pure access to information but also the generation of knowledge through combining, reflecting and concluding on information sought, that should enhance farmers' capacities (Aker, Ghosh, and Burrell 2016). Smallholder farmers in the rural areas of developing countries are still especially disadvantaged with regard to capacities involving modern sustainable farming practices. In such a developing country context, the most common measures with which to disseminate knowledge over the past decades have been extension services such as Farmer-Field-Schools or Self-Help-Groups based on frontal teaching methods to farmers or with direct interaction with experts through a participatory and demand-driven approach (Phillips, Waddington, and White 2014). The necessity of personal presence and the resulting inequalities of access have been criticised as inhibiting such measures' efficiency (Phillips, Waddington, and White 2014).

Information and Communication Technology (ICT) provide potential for developing farmers' management capacity. Additionally, ICT can also be catalyst to improve the effectiveness of the agricultural extension system (Glendenning and Ficarelli 2012). Existing studies on ICT usage in developing countries' agricultural sectors have either focused on socio-economic adoption drivers (e.g. Aleke, Ojiako, and Wainwright 2011), on cognitive usage drivers (Verma and Sinha, 2016), or on usage-related performance effects (e.g. Aker 2011; Sekabira and Qaim 2017). Recent research has suggested that smartphones may provide an opportunity to further develop farmers' capacities through specific applications offering fast access to continually updated and reliable information (Aker 2011; Aker, Ghosh, and Burrell 2016). However, the access and usage of smartphones for agricultural purposes among small-scale farmers in rural areas of developing countries is still limited, even though this type of phone is becoming more widespread. To the best of our knowledge, no previous study has examined the drivers of farmers' smartphone usage for agricultural purposes by taking the affect into account. Based on a conceptual model which integrates Perugini's and Bagozzi's (2001) goal-based behavioural model with the model of technology acceptance by Cheon et al. (2012) and Venkatesh and Davis (2000), the objective of the present study is to develop and empirically test a comprehensive behavioural model for

identifying and quantifying the drivers of smallholder farmers´ intention to use a smartphone in developing countries. For this purpose, primary data from 664 small-scale farmers was collected in Bihar State, India, in 2016. The results of this study may provide the foundation for concrete smartphone implementation strategies in the agricultural production sectors of developing countries.

The Indian state of Bihar has a high population density of more than 100 million inhabitants, of which 34 per cent live below the poverty line - 1.90 USD per day. A large proportion of the population (89%) lives in rural areas with geographically diverse terrain and mostly in scattered villages (Census Organisation of India 2015; World Bank 2016a; Chauhan 2010). Correspondingly, 62 per cent of the population works in the agricultural sector. As in many other developing countries, agriculture in Bihar shows low crop productivity, lack of water management, low investment rates, and weak infrastructure with regards to transport and marketing (World Bank 2005; Rodgers et al. 2013). Such circumstances are addressed by NGOs such as 'Farms and Farmers Foundation' (FnF) and 'Preservation and Proliferation of Rural Resources and Nature' (PRAN) through capacity development activities (Census Organization of India, 2015). However, NGO's reach to smallholder farmers is impeded by limited information and communication technology (ICT) coverage. In 2011 mobile phone coverage still provided for only 52 per cent of the Biharian population (Census Organisation of India 2015), over 10 per cent less compared to the whole Indian population in 2010 (Jain, Kumar, and Singla 2015), but 16 per cent more compared to the Indian farmers/agricultural labour force in 2010/2011 (Cole and Fernando 2012). The share of mobile phone owners over the whole of India using smartphones increased from 21 per cent in 2014 up to 33 per cent in 2017 (Statista 2018). Furthermore, data from the Telecom Regulatory Authority of India (2017) give evidence that the number of wireless subscribers in rural India has been steadily increasing since 2012 and almost reached the 500 million mark in 2017.

4.2 The role of ICT for agricultural capacity development

Modern ICTs have enabled the increasing use of mobile phones for capacity development purposes in developing countries' agricultural sectors as they have done elsewhere. The distance-eliminating character of this technology is especially recognized as one of its major advantages. Consequently, Short Message Service (SMS) is nowadays still the most applied digital technology used in agricultural extension projects (Deichmann, Goyal, and Mishra 2016; Aker 2011) even though mobile phone successor technology, smartphones and corresponding internet applications, have been on the advance over recent years. Smartphones, with their advances in size, hardware and applications, provide additional possibilities to measure a variety of data such as the lightening

level, GPS coordinates or humidity. Furthermore, they are able to capture, store and transfer information in different formats such as text, pictures, audio, and video very rapidly.

Smartphones are considered to offer potential access to information, generational knowledge, extension services, market linkages, distribution networks, financial resources, new technologies and other inputs (Deichmann, Goyal, and Mishra 2016; Aker 2011). Such access has already been identified in predecessor ICTs' usage with numerous studies on various cases all over the world looking at increasing household/farm marketing performance (Beheraa et al. 2015; Sekabira and Qaim 2017; e.g. Aker 2011), production performance (e.g. Aker 2011; Cole and Fernando 2012) or both (Deichmann, Goyal, and Mishra 2016; Rao 2007; e.g. Ali and Kumar 2011). Consequently, smartphone usage can be expected to improve income generation and thus poverty reduction in developing countries' agricultural sectors. Simultaneously, smartphone technology can allow stakeholders, such as NGOs or financial institutions, to have a targeted design and to share customised, more detailed information at lower cost. Smartphones represent an upcoming tool which can generate agricultural knowledge through capacity development measures more efficiently than frontal teaching methods or even other ICTs can (e.g. Aditya and Sing 2014).

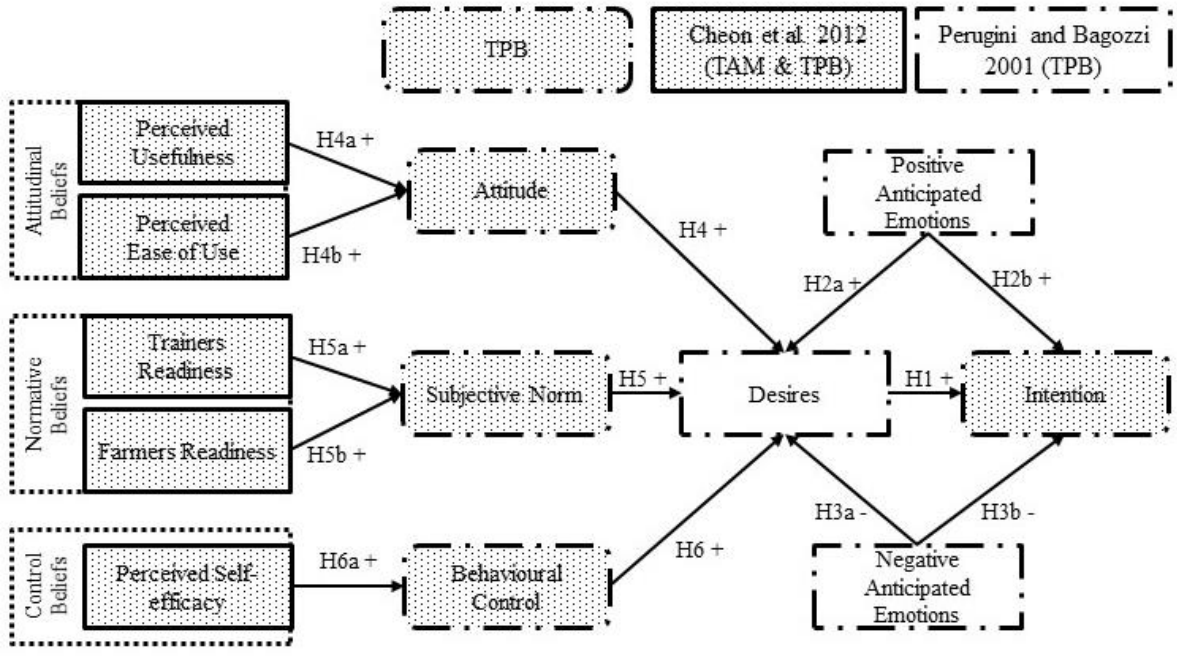
Despite this potential and increasing access to the technology, adoption and usage rates among farmers in developing and emerging economies are still relatively low. Such disparities have already been observed for predecessor ICTs and motivated researchers to take account of psychological usage drivers– conceptually as well as empirically. In their qualitative argumentation, Kameswari et al. (2011) include psycho-economic factors by highlighting "socio-cultural context" factors. Trust within farmers' business networks, combined with favourable production conditions are regarded as crucial for ICT usage in general and information search in particular, within the Indian agricultural sector. The study by Venkatesh and Sykes (2013) extended conceptual ideas on the role of social networks for the successful implementation of digital divide initiatives in rural India. They developed and tested a framework based on social network theory in comparison to traditional theory of planned behaviour (TBP) and technology acceptance model (TAM) applications. These are well-established in academic literature on non-agricultural cases. Here farmers' PC usage behaviour was based on shared use of PCs provided in an internet kiosk and under supervision. For this type of intermediated ICT use, the social network framework's greater explanatory power was observed, although also recognising that for other types of use, different models have to be developed. In line with this finding, Verma and Sinha (2016) successfully applied TAM to analyse mobile-based agricultural extension service under independent individual usage in India. Nevertheless, further development of such individual-

centric approaches beyond purely cognitive considerations remains neglected in the academic literature on individual ICT usage among farmers in developing countries.

4.3 Conceptual framework

The conceptual framework in Figure 1 puts forward a combination of the goal-based behavioral model (MGB) (Perugini and Bagozzi 2001) based on the Theory of Planned Behavior (TPB) (Ajzen 1991), and the Technology Acceptance Model (TAM) and its further advances based on Cheon et al. (2012) and Venkatesh and Davis (2000). The TAM part of the model addresses the case-specific character of the action, namely the acceptance of a new technology as part of the intention to use it for generating agricultural knowledge. The MGB broadened the TPB by introducing desires as the most proximal determinant of intention, since the TPB is silent on how intentions become energized (Perugini and Bagozzi 2001). As the majority of Biharian farmers did not own a smartphone in 2016, actual smartphone usage behaviour for capacity development activities was not measurable. Due to these circumstances, the main outcome variable at that time of the survey was intention.

Figure 4.1: Smartphone research model with hypotheses



(Source: authors own graphic based on Perugini and Bagozzi 2001; Cheon et al. 2012)

TPB and relative approaches, especially TAM and TAM 2, have been successfully applied in earlier studies to predict behaviour regarding technology, IT-acceptance, ICT-usage and intention towards agricultural practices among others (e.g. Cheon et al. 2012; Verma and Sinha 2016; Venkatesh and Sykes 2013; Zeweld et al. 2017; Krone, Dannenberg, and Nduru 2016). The TPB

defines behavioural control, attitude and subjective norm as key-determinants of the behavioural intention. Thereby, behavioural control describes the perceived level of ease an individual ascribes to the conduction of a certain action. This self-evaluation exceeds personal opportunities and resources such as education and income. In the specific context of smartphone usage among small-scale farmers in developing countries, behavioural control reflects the perception of control over the functionality of the smartphone and its applications. Next, attitude denotes the degree of overall favourability assigned to the particular technology from an individual's perspective. In contrast, subjective norm acknowledges the role of social pressure from the personal network related to the performance or non-performance of a particular action. In this study, it can be described as the individual farmer's perception of the opinion on smartphone usage for capacity development prevailing among other individuals' in his or her social and professional network (Ajzen 1991). This study then hypothesises that the intention to use the smartphone technology is positively related to behavioural control (**H6+**), attitude (**H4+**) and subjective norm (**H5+**), however, not directly.

In relation to the TPB, desire can be described as a motivational impetus for the behavioural intention resulting from personal awareness and acceptance of the desire to act (W. A. Davis 1984). It is therefore hypothesised that desires reflect the transformation of attitude, subjective norms and behavioural control into a motivation to act **(H1 +)** (Perugini and Bagozzi 2001; Leone, Perugini, and Ercolani 1999)**.** Furthermore, Perugini and Bagozzi (2001) broadened the TPB by acknowledging the existence of personal goals associated with certain behaviour. In the case of smartphone usage for generating agricultural knowledge, such goals could be; innovativeness, technological progress and improvements in economic and farming performance (Deichmann, Goyal, and Mishra 2016). Anticipated emotions are meant to explain goal achievements (positive anticipated emotions) or goal failures (negative anticipated emotions) in the MGB (Perugini and Bagozzi 2001). In this context, such anticipated emotions are described as prefectural appraisals since they capture decision makers' imagined consequences before taking real action (Gleicher et al. 1995). Following Perugini and Bagozzi (2001), it is assumed that positive anticipated emotions and negative anticipated emotions are included as direct predictors of desire in our framework (**H2a +; H3a -**). Different to the MGB, the influence of these two variables is also tested on the construct intention (**H2b +; H3b -**) to take into account the bounded rationality of the effect (Zhang and Li 2005).

In accordance with the TAM 2 -model developed by Venkatesh and Davis (2000) and the subsequent conceptualization by Cheon et al. (2012), the main TPB-determinants to intention;

attitude, subjective norm and behavioural control are assumed to be influenced by three different types of salient beliefs: attitudinal beliefs, normative beliefs and control beliefs (Ajzen 1991).

Attitudinal beliefs comprise perceived usefulness and perceived ease of use. Perceived usefulness reflects individual user-beliefs regarding the advantageousness of a technology for own job performance and consequent life-quality (Verma and Sinha 2016). In several studies regarding ICT innovations usefulness is a proven and important motivator for acceptance (e.g. Liu, Li, and Carlsson 2010). Perceived ease of use describes users' beliefs regarding the expected individual time- and strain-effort connected to the technology usage, e.g. for learning the functionality of a smartphone (Venkatesh and Davis, 2000). These two attitudinal beliefs (**H4a +; H4b +**) are hypothesised to determine attitude.

Normative beliefs represent the individuals' perception of beliefs persisting among important actors in their social and professional network (Ajzen 1991; Cheon et al. 2012). As suggested by Cheon et al. (2012), the present study differentiates between the readiness of trainers and other farmers, both considered the most important actors in the process of agricultural knowledge generation. Since farmers include the beliefs they assimilate from trainers and other farmers' in their own belief structure, the two latent variables of trainer readiness and farmer readiness are hypothesised to influence the behavioural control positively (**H5a +; H5b +**) (Venkatesh and Davis 2000; Cheon et al. 2012).

Control beliefs describe an individuals' self-confidence towards behaviour. Thus, perceived self-efficacy, (Cheon et al. 2012; Ajzen 1991, 2002) captures the beliefs of individuals about their own motivation and ability to behave in a particular manner, such as using a smartphone for agricultural purposes. Furthermore, learning autonomy is expected to be relevant for smartphone usage for agricultural purposes, since its adoption requires a comparatively high degree of self-motivation and self-discipline as a downside to the greater flexibility and mobility it provides (Cheon et al. 2012). Hence, it is hypothesised that perceived self-efficacy (**H6a +**) as well as learning autonomy (**H6b +)** has a positive effect on behavioural control.

4.4 Methods and data

The study is based on a survey questionnaire that was developed following a literature review, with a specific focus on technology acceptance and usage. The measures used were tested in six focus group discussions each with on average 25 farmers during the pre-field visit. Third, a pre-testing of the questionnaire was undertaken. The questionnaire included 16 sections, each measured on a 5-point Likert scale format (from 1= totally disagree to 5= totally disagree). Table

2 (Appendix) presents the measurement indicators. The questionnaire first presented an info-graphic overview so as to provide a baseline of background information on smartphone usage for agricultural purposes.

From April to July 2016 a total of 664 small-scale farmers, who generate their main income from agricultural activities, were recruited to participate using a stratified random sampling strategy to achieve two relatively equal groups. Stratification was thereby related to cooperation with local NGOs involved in agricultural extension activities, such as FnF and PRAN. The interviews had an average duration of 77 minutes and were carried out face-to-face by eight trained enumerators with the help of tablets using 'Sawtooth Software'.

The characteristics of the sample are described in Table 1. The final sample consisted of 68 per cent male and 32 per cent female respondents with an average age of 43 years and a literacy rate of 74 per cent. The share of females in the sample is below the national average of ca. 48 per cent reported in the year 2011 but the majority of the farmland in India is owned by males. In this sample, 74 per cent own a mobile phone and 15 per cent own a smartphone, giving evidence of an increasing penetration of mobile devices in India in recent years. However, none of the farmers owning a smartphone use it for agricultural purposes, including capacity development as the focus group discussions clarified. The farmers cultivate 1.8 acres (0.7 ha) on average. Out of all respondents, 30 per cent are PRAN-members, 15 per cent are members of FnF and nine per cent are members of other governmental or non-governmental organisations such as Jeevika or 'Krishi Vigyan Kendra' (KVK).

The variance-based Partial Least Square (PLS) method was used to analyse the pooled data. The PLS approach is appropriate to test explorative models with complex relations between latent constructs (Chin 1998; Henseler, Hubona, and Ray 2016; Hair et al. 2017). The statistical analysis was done with the programme Smart-PLS 3. In addition to a pooled PLS-estimation, a Multi-Group-Analysis according to the stratification criterion was conducted in order to test for a potential bias of outcomes (Sarstedt, Henseler, and Ringle 2011). During the PLS-estimations, the testing of the measurement model was conducted regarding reliability (indicator reliability and composite reliability) and validity (convergent validity and discriminant validity) criteria, as well as multicollinearity before the hypotheses were tested based on R-square-values, path-coefficients and their significance-levels (Balderjahn et al. 2013; Fornell and Larcker 1981).

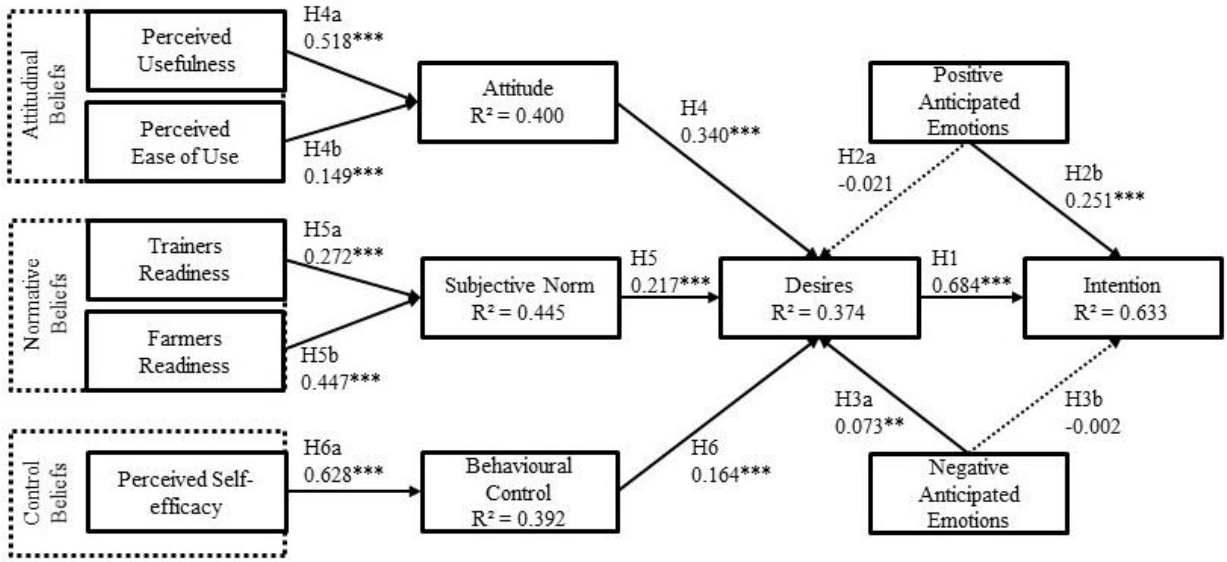
Reliability of the indicators is given if all items in the model show factor loadings above the threshold of 0.7 (Henseler, Hubona, and Ray 2016) internal consistency if the composite reliability

value exceeds 0.7 (Fornell and Larcker 1981) and convergent validity if the Average Variance Extracted (AVE) is greater than 0.5 (Bagozzi and Yi 1988). Discriminant validity is firstly checked by cross-loadings, whereby all items need to have a higher correlation with their assigned factor than with other factors (Henseler, Hubona, and Ray 2016). Secondly discriminant validity is tested using the Fornell-Larcker criterion. The criterion is fulfilled if the square root of each construct´s AVE is greater than the correlation with other constructs (Hair et al. 2017). Multicollinearity is checked with the VIF (Variance Inflation Factor). This factor should be smaller than five (Henseler, Hubona, and Ray 2016). The explanatory power is evaluated according to the power primer (R-square = 0.1: small; R- square = 0.3: middle; R-square = 0.5: large) developed by Cohen (1992).

4.5 Partial Least Square- Estimations

The parameters for the quality criteria shown in Table 3 and 4 (Appendix) proof the reliability and validity of the model estimated with the pooled data set. The Multi-Group-Analysis indicates that a bias of results from sample stratification can be rejected since no significant differences between the two strata are found. Figure 2 shows the R-square-values, path-coefficients and their significance-levels of the PLS-estimations. The R-squares range from 0.374 to 0.633 and can, thus, be interpreted as middle to large. The intention construct shows an R-square value of 0.633.

Figure 4.2: Path coefficient of the smartphone research model



(Note: * P < 0.10, ** p < 0.05, *** p < 0.01; Source: authors own data, calculations and illustration)

The TPB key-determinants attitude (0.340***; **H4**+), subjective norms (0.217***; **H5**+), and behavioural control (0.164***; **H6**+) have a highly significant influence on desires. Thereby, especially attitudes, show a greater influence than perceived social pressures from farmers' individual networks and their self-evaluation regarding own opportunities to appropriately maintain the smartphone (Venkatesh and Sykes 2013).

Desires are strong and highly significant in influencing intentions (b-value = 0.684***; **H1+),** which supports the finding by Perugini and Bagozzi (2001). However, the results for the two emotional constructs are not in accordance with the finding by Perugini and Bagozzi (2001). Positive anticipated emotions have no significant influence on desires **(**-0.021; **H2a-)** but a strong as well as highly significant influence on intentions **(**0.251***; **H2b+)**. Reversely, negative anticipated emotions have a relatively low and significant influence on desires **(**0.073**; **H3a+)** but no significant influence on intention **(**-0.002; **H3b-)**. Therefore, this results suggest that positive anticipated emotions seem to facilitate spontaneous behaviour, most likely due to their high degree of personalization and innovation (Kim and Shin 2015). Simultaneously, negative anticipated emotions should contribute to increased motivation to use smartphones for capacity development. Such influences of automation have been observed in the past for fear, shame, sadness and anger in smartphone purchase decisions among Iranian urbanites as the linking pin between cognition (attitude, subjective norm, behavioural control) and conation (intention) (Koshkaki and Solhi 2016).

Attitudinal beliefs in form of perceived usefulness **(**0.518***; **H4a+)** and perceived ease of use **(**0.149***; **H4b+**) are found to influence attitude (R-square = 0.400). Thus, concern about extraordinary time, strain and financial effort farmers using smartphones in developing countries may face as part of the digital divide debate cannot be confirmed to be present in farmer's decision processes.

Both trainer readiness **(**0.272***; **H5a+)** and farmer readiness **(**0.447***; **H5b+)** is found to influence subjective norms. These results are in line with results by Cheon et al. (2012) on US college students' ICT usage behaviour regarding trainer readiness. The result on farmer readiness suggests that within the social and professional network, peers have a comparatively greater influence on Indian small-scale farmers' subjective norms. Such findings may seem surprising after capacity development activities in developing countries over the past decades have been predominated by frontal teaching methods, for instance in Farmer-Field-Schools (Phillips, Waddington, and White 2014). However, such measures may not have reached a large share of the rural population in India, which simultaneously provides an explanation for the importance of

group dynamics in these close communities, many of which exist in developing countries' remote areas.

Regarding control beliefs, self-efficacy **(**0.522***; **H6a+)** is an influential construct of behavioural control. This supports the importance of beliefs in own motivation and ability for smartphone usage. Such self-confidence in connection with the ability to learn autonomously may help in using a smart-device successfully over distances and amongst the scattered villages in developing countries' remote areas (Aker 2011; Aker, Ghosh, and Burrell 2016; World Bank 2016b). However, since the statements included in the latent variable learning autonomy are negatively phrased, the effect observed is consequently a negative one. This contradictory influence possibly results from differences in the definition of autonomous learning among societies, since corresponding measures have been derived from a study on an industrialized country (Cheon et al. 2012).

4.6 Conclusion and implications

This study presents a comprehensive behavioural model for identifying and quantifying the drivers of small-scale farmers´ intention to use a smartphone for capacity development activities in the remote areas of Bihar, one of the poorest regions in India (World Bank 2016a). The results confirm the conceptual integration of the MGM approach and the models for technological acceptance into the framework and give evidence of its overall applicability in the context of a developing country's agricultural sectors. It explains almost 70 per cent of the variance of farmers' intention to use a smartphone for capacity development purposes, approximately 40 per cent more than averagely observed in other TPB-based studies (Sheeran, 2002) and approximately 20 per cent more than the model proposed by Venkatesh and Sykes (2013). The inclusion of the affect (desires and emotions) and its proven relevance as the linking pin between cognition and conation regarding smartphone usage for agricultural purposes (Chhachhar and Maher 2014; Koshkaki and Solhi 2016) represent an especially important finding. This finding addresses various stakeholders (e.g. researchers, NGOs and politics) involved in developing measures for the enhancement of sector-wide capacities for modern sustainable farming practices. From a research perspective, the framework provides a valid and reliable basis for future applications in similar settings, especially in the context of developing countries, where the respondents are not used to modern ICT yet and live in close communities with strong social bonds in villages scattered throughout remote areas. Empirical research may offer crucial results for leveraging efforts by politics and NGOs (Deichmann, Goyal, and Mishra 2016; Aker 2011) not only in supporting the introduction of

smartphones monetarily, so that farmers have the possibility to overcome the digital divide and benefit from rapid information access over distances, but also by acknowledging farmers' psycho-economic usage drivers to facilitate the diffusion of the technology in the sector (Venkatesh and Sykes 2013). The perceived favourability of smartphones for capacity development among farmers should be the special focus of extension programmes. Since Indian farmers seem to prefer initial guiding support when getting started with this technology and attach great importance to the opinion of other farmers, smartphones should be promoted more strongly using village-wide field demonstrations to increase usage-rates. Negative emotions arising from usage failure can thereby function as motivation-triggers as a reflection of ambition (Koshkaki and Solhi 2016) while positive emotions arising from usage success may lead to spontaneous affective usage decisions. Correspondingly, smartphone applications should be designed with user-friendly interfaces for the specific target groups.

However, due to current low smartphone coverage in the study area, actual usage behaviour could not be included as the final outcome variable. Neglecting actual behavioural action in the model hinders any drawing of conclusions on the potential existence of an intention-behaviour gap. When extending the conceptual framework of smartphone usage behaviour, it should be tested in the context of a country with appropriate smartphone coverage or in an experiment with a distribution of smartphones along with respective applications. In addition, socio-demographic characteristics are not part of the current framework so that no more specific user groups can be identified among farmers. In this regard, the framework should be further developed by implementing conceptual ideas from the Unified Theory of Acceptance and Use of Technology (UTAUT). In order to capture learning autonomy appropriately, societal differences should be accounted for during scale development in future studies.

Despite its advantages for analysing complex causalities on exploratory data, PLS is also criticised for inconsistencies and biases in estimates (Henseler et al. 2014). Additionally, the framework used in combination with PLS does not allow setting smartphone-based capacity development activities to contrast with other discrete alternatives. In this regard, farmers' preferences for different teaching methods should be further investigated using a choice experimental design.

4.7 Appendix 4

Table A4.1: Demographic data (Respondent and household and farm)

Variable (Respondent)	Freq.	Per cent	Mean	Sd	Min	Max	N
Age in years			43.06	12.61	13	90	
Share of female farmers	214	32.0					664
Female-headed households	49	13.0					378
Male-headed households	329	87.0					378
Able to read	490	74.0		0.4401			664
Level of education							
No degree	224	33.7					664
Primary School	187	28.2					664
Secondary School	179	27.0					664
Graduate	58	8.7					664
Post-Graduate	16	2.4					664
Owner of a mobile phone	492	74.0		0.44			664
Owner of a smartphone	99	15.0		0.36			664

Variable (Household)	Freq.	Per cent	Mean	Sd	Min	Max	N
Number of household members			6.06	2.49	1	15	
Access to electricity	613	92.0		0.27			664
Access to internet	30	5.0		0.21			664
Access to radio	83	12.5		0.33			664
Access to newspaper	89	13.0		0.34			664
Access to television	217	33.0		0.47			664
Own land Total (acre)			1.76	3.38			664
Cultivated land Total (acre)			1.84	3.39	0	41.4	664

(Source: authors own data and calculations)

Table A4.2: Mean, standard deviation and factor loading of statements

Code*	Statement	Mean	Standard Deviation	STD factor loadings (>0.70)
PU1[4]	I think that using a smartphone would enable me to generate agricultural knowledge more quickly.	4.024	0.904	0.801
PU2[4]	I think that using a smartphone would make it more convenient for me to generate agricultural knowledge.	4.012	0.805	0.853
PU3[4]	I think a smartphone to generate agricultural knowledge is useful.	3.962	0.901	0.829
PU4[5]	Overall, I think that using a smartphone to generate agricultural knowledge is advantageous.	4.088	0.791	0.845
PU5[6]	With using a smartphone, I can access information on agricultural practices whenever I need it.	4.003	0.866	0.854
PU6[6]	Being familiar with smartphones also enables me to work with other technological innovations.	4.014	0.822	0.828
PU7[6]	Agricultural knowledge I could obtain from smartphones is knowledge I need.	3.98	0.853	0.829
PEU1[4]	I think that using a smartphone to generate agricultural knowledge would be easy.	3.779	1.052	0.740
PEU2[5]	I think that using a smartphone to generate agricultural knowledge does not require a lot of mental effort.	3.556	1.069	0.769
PEU3[6]	Using a smartphone to generate agricultural knowledge will save time.	4.021	0.867	0.815
PEU4[4]	Agricultural knowledge presented by smartphone applications is much easier to understand than normal training.	3.874	0.932	0.814
AT1[7]	Using a smartphone to generate agricultural knowledge will be helpful.	3.961	1.015	0.881
AT2[7]	The use of the smartphone as a learning tool excites me.	3.874	1.032	0.908
AT3[7]	Using a smartphone for generation of agricultural knowledge would be a pleasant experience.	3.92	1.005	0.913
AT4[7]	Using a smartphone to generate agricultural knowledge will make my work more attractive.	3.772	1.081	0.904
AT5[4]	I would like the agricultural work more if I would use a smartphone.	3.751	1.092	0.866

[4] (Based on: Cheon et al., 2012)

[5] (Based on: Venkatesh & Bala, 2008)

[6] (Based on: Davis, 1984)

[7] (Based on: Perugini &Bagozzi, 2001)

TR1[4]	I think trainers and experts would be in favour of utilizing a smartphone to generate agricultural knowledge.	3.94	0.994	0.892
TR2[4]	I think trainers and experts would believe that a smartphone could be a useful educational tool in their training.	3.965	0.852	0.898
TR3[4]	I think trainers and experts would possess adequate technical skills to use a smartphone in their training.	3.988	0.88	0.918
FR1[4]	I think other farmers would be in favour of utilizing smartphones in their training.	3.902	0.928	0.886
FR2[4]	I think other farmers would believe that a smartphone could be a useful educational tool in their coursework.	3.814	0.949	0.877
FR3[4]	I think other farmers would possess adequate technical skills to use a smartphone in the training.	3.741	0.97	0.869
SN1[8]	Stakeholders I am working with think I should integrate smartphones to generate agricultural knowledge.	3.764	1.131	0.793
SN2[4]	Most people who are important to me would be in favour of using a smartphone to generate agricultural knowledge.	3.625	1.086	0.833
SN3[5]	Other farmers in my surrounding think I should take advantage of smartphones to generate agricultural knowledge.	3.691	1.058	0.836
SN4[5]	People whose opinions are valued to me expect that people like me should use smartphones to generate agricultural knowledge.	3.678	1.059	0.834
SN5[4]	I think other farmers in my village would be willing to adopt a smartphone to generate agricultural knowledge.	3.773	0.989	0.840
SN6[5]	Generally, it is expected of me to use a smartphone to generate agricultural knowledge.	3.805	0.966	0.848
SE1[4]	I am confident about using a smartphone to generate agricultural knowledge.	3.997	0.886	0.842
SE2[4]	Using a smartphone to generate agricultural knowledge would not challenge me.	3.753	1.053	0.800
SE3[4]	I would be comfortable to use a smartphone to generate agricultural knowledge.	3.789	0.997	0.859
BC1[5]	I think that I have the discipline to learn how to use a smartphone to generate agricultural knowledge.	4.011	0.873	0.890
BC2[5]	My own decisions and actions are decisive whether I will use a smartphone.	3.939	0.92	0.870
PE1[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Excited	3.287	1.434	0.904

[8] (Based on: Ajzen 1991)

PE2[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Delighted	3.431	1.315	0.927
PE3[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Happy	3.537	1.26	0.922
PE4[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Glad	3.421	1.297	0.920
PE5[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Satisfied.	3.475	1.323	0.929
PE6[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Proud	3.443	1.394	0.889
PE7[7]	If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel self-assured	3.712	1.27	0.875
NE1[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Angry	2.035	1.156	0.880
NE2[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Frustrated	1.941	1.178	0.895
NE3[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Guilty	1.783	1.151	0.854
NE4[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Ashamed	1.925	1.12	0.856
NE5[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Sad	2.17	1.158	0.829
NE6[7]	If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel Disappointed	2.261	1.169	0.788
DE1[7]	My desire for using a smartphone in order to increase agricultural knowledge can be described as very strong	3.968	1.029	0.952
DE2[7]	I want to use a smartphone to generate agricultural knowledge.	4.021	0.921	0.957
IT1[7]	I am planning to use a smartphone to generate agricultural knowledge.	3.847	1.042	0.909
IT2[7]	I will expand efforts on using a smartphone to generate agricultural knowledge.	4.002	0.894	0.920

*Abbreviation see also Table A4.3

(Source: authors own data and calculations)

Table A4.3: Reliability measures of the model constructs

Construct	Abbre-viation	Nr. of items	Cronbach's Alpha (>0.70)	Composite Reliability (>0.70)	Average Variance Extracted (>0.50)
Perceived Usefulness	PU	7	0.927	0.941	0.696
Perceived Ease of Use	PEU	4	0.799	0.865	0.617
Attitude	AT	5	0.938	0.953	0.801
Trainers´ Readiness	TR	3	0.887	0.930	0.815
Farmers´ Readiness	FR	3	0.851	0.909	0.770
Subjective Norms	SN	6	0.910	0.930	0.691
Self-Efficacy	SE	3	0.782	0.889	0.668
Behavioural Control	BC	2	0.709	0.873	0.774
Positive Anticipated Emotions	PE	7	0.965	0.971	0.827
Negative Anticipated Emotions	NE	6	0.924	0.940	0.724
Desire	DE	2	0.903	0.954	0.911
Intention	IT	2	0.804	0.911	0.836

(Source: authors own data and calculations)

Table A4.4: Fornell-Larcker criteria

	AT	BC	DE	FR	IT	NE	PEU	PU	PE	SE	SN	TR
AT	0.895											
BC	0.450	0.880										
DE	0.561	0.407	0.955									
FR	0.583	0.462	0.580	0.877								
IT	0.538	0.509	0.759	0.596	0.914							
NE	0.140	0.037	0.146	0.184	0.157	0.851						
PEU	0.519	0.521	0.529	0.643	0.616	0.261	0.785					
PU	0.624	0.607	0.644	0.732	0.724	0.195	0.715	0.834				
PE	0.466	0.361	0.301	0.460	0.456	0.235	0.363	0.545	0.910			
SE	0.621	0.628	0.572	0.618	0.638	0.177	0.646	0.716	0.488	0.834		
SN	0.675	0.438	0.518	0.639	0.525	0.110	0.523	0.620	0.399	0.672	0.831	
TR	0.657	0.480	0.688	0.706	0.619	0.195	0.562	0.740	0.463	0.635	0.588	0.903

(Source: authors own data and calculations)

5 The role of trust and networks in developing Nicaraguan farmers' agribusiness capacities[9]

Abstract

The main focus of most programmes in developing countries carried out by NGOs is to develop small-scale farmers' capacities. One approach hereby is to use multi-stakeholder innovation systems, such as the 'Nicaraguan Learning Alliance' (NLA). However, tools for the evaluation of multi-stakeholder innovation systems are rare. This paper reports on the implementation of a conceptual framework to carry out an impact evaluation of multi-stakeholder innovation systems using the NLA as the object of study. The assessment focused on the business relationship constructs of trust and capacity development. Survey interviews, in-depth interviews and focus group discussions collected data from agribusiness stakeholders linked with the NLA and from a control group of stakeholders involved with other networks. The quantitative data were analysed through factor and regression analyses. Results from the quantitative analyses were triangulated with qualitative data. The analysis shows that the NLA has been successful in developing smallholder farmers' capacities as a result of trust developed through its dedicated project managers. Nonetheless, the NLA has not been more successful at developing agribusiness capacities among Nicaraguan farmers than other networks with the same goals. Results from this study point to the need for facilitating more interactions between the different networks of farmers' cooperatives and organisations with other stakeholders already active within the Nicaraguan agrifood innovation system.

Keywords

capacity development, impact evaluation, innovation systems, Latin America, value chains

[9] This chapter is co-authored with Jean-Joseph Cadilhon (JJC). The authors' contributions are as follows: Dirk Landmann (DL) designed the research, collected the data and analysed and interpreted the data. JJC assisted in the analysis and interpretation of the results. DL wrote the paper. JJC commented at the various stages of the research and contributed to writing and revising the paper. JJC took a major lead in the basic development of the conceptual framework. All authors read and approved the final manuscript. This manuscript is also accepted for publication in the 'Journal of Agriculture and Rural Development in the Tropics and Subtropics' (JARTS). The share of the total work done by DL is 85 per cent.

5.1 Introduction

Traditionally, researchers and experts transferred their agricultural knowledge to their target group following a linear approach. This model has largely failed because it did not respond to the actual problems of its intended beneficiaries, it rather evaluated the knowledge of locals as inferior and did not take into account how the different stakeholders influence production one way or another (Chambers 1994; Pretty 1995; Klerkx, van Mierlo, and Leeuwis 2012).

This shortcoming formed the basis for 'model two' also known as 'Participatory-Research-Action' (PRA), in which more interactions between the different stakeholders occur and changes can be adopted more rapidly (Hall 2007). This new form of capacity development could be defined generally as an approach focusing on organisational, communal and social issues. The core of this approach is to combine theory and action in the process of collaborative learning. Reflection is taking place throughout the whole process and is also prompting the next actions (Coghlan and Brydon-Miller 2014).

The 'International Center for Tropical Agriculture' (CIAT) has developed Learning Alliances (LA) based on this knowledge (World Bank 2012). LAs can be assimilated to innovation platforms (IPs): a group of individuals with different backgrounds and interests, who come together to diagnose and solve problems they face (Homann-Kee Tui et al. 2013). The LA concept has so far been adopted in 20 countries worldwide (Lundy and Gottret 2005). Innovation systems as applied to agriculture rely on the interaction of different stakeholders to foster knowledge sharing and innovation (Klerkx, Aarts, and Leeuwis 2010). The general idea is to add value and create synergistic relationships between different members and to build up a network that transcends micro, meso and macro socio-geographical levels (CRS 2009). The Nicaraguan Learning Alliance (NLA) is an alliance of organisations formed in 2003. The alliance is training its partners on agribusiness management and access to markets to replicate this knowledge through different geographical levels along its partner network down to farmers (AdA 2014; World Bank 2012).

Although innovation platforms are seen as a successful tool and used in many different countries and value chains, literature on the assessment of innovation platforms is very rare. Existing literature mostly focuses on the analysis of particular cases with a specific method, thus restricting the transfer to other platforms (Nederlof, Wongtschowski, and van der Lee 2011). The conceptual framework developed by Cadilhon (2013) attempts to simplify complex data within the categories of structure, conduct, and performance. The conceptual framework

already embeds certain variables, factors, and other influences relevant to the development and aims of innovation platforms. This is the only conceptual framework that combines the different categories (structure, conduct, and performance) with the topics of transaction costs and marketing concepts for the purpose of analysing innovation platforms. The data of this study will help test and refine the conceptual framework for monitoring and evaluation of the impact of innovation platforms (Cadilhon 2013).

The focus of this study was to evaluate trust as a conduct variable and capacity development as a performance variable following the alliance's objectives. Trust is an important component in value chains and has gained more attention from scientists within the past two decades. This important component can be seen as a factor, which significantly influences individuals, organisations, partner's competence, process, characteristics and institutions, systems, calculations, economics, intentional relations, technology or services. Thus, it is described by many researchers as a complicated and multifaceted concept with no uniform definition and measurement method available up to now. However, trust has a great influence on perception and individuality, which varies with participants (Laeequddin et al. 2010).

Capacity development has also been discussed extensively in the last few decades (Watson 2010). It is dependent on principles, dimensions, actors, levels and strategies, and each case has to be seen as a combination of different influencing factors (Neely 2010). In an agricultural context, it often takes the form of training activities and workshops (Horton et al. 2003). Capacity development is a principal goal of the NLA to increase the replication efficiency of the knowledge being produced within the network.

However, there are no studies or data comparing NLA participants and non-participants pertaining to the cooperatives and organisations using the NLA-guides. Furthermore, there are no measures to evaluate whether the capacity of the partners is generally increasing or not. To contribute to the evaluation of the NLA's activities, this article aims to answer the following research question: How does the NLA strengthen producers' capacities through its structure and network of members and partners?

The contribution of this article to the literature on IPs as a collaborative agricultural education mechanism is the pilot-testing of a conceptual framework characterizing how IPs work in a Latin American context through mixed research methods. Although LAs and IPs are more and more common, this study aims to contribute practical tools to evaluate them using quantitative and mixed methods are rare.

5.2 Literature review

Learning Alliances in the agricultural sector

The LA approach is based on the concept of 'social learning' and 'innovation systems'. Social learning is defined as an interactive process of learning-by-doing between different stakeholders for the purpose of solving problems (Bandura 1971). LAs specifically focus on research organisations, as well as donor and development agencies. Combining these two concepts creates a process of collaborative learning, adaption, and innovation among the participants. The objectives of LAs are to develop cumulative and shared knowledge about distinct approaches, learn across different boundaries, create synergies among participants (e.g. to advance specialised knowledge), exchange information between the participants, and develop flexible mechanisms that apply to different topics (CRS 2009). It is typical for LAs to mix traditional socio-economic research with action research. The founding principles of LAs include clear objectives, shared responsibilities, costs and benefits, outputs and inputs, differentiated learning mechanisms, and long-term trust-based relationships. Every participant will have different objectives and interests, but it is crucial that common ground can be identified. A more general objective enables participation by a wider array of members. Benefits for each stakeholder must exceed the value of their individual costs. In addition, the goals and interests of the alliance should not be in conflict with other key actions. Methods, tools, and approaches should change over time corresponding to changing situations of participants. All types of participants must be considered and respected regardless of gender, race, function, and other differentiating factors. In order to accomplish this, learning methods need to be flexible, interconnected and viewed as long-term processes (CRS 2009).

The main approach in the methodology of LAs is to move from a single cycle learning process to a double loop learning process. One cycle is divided into three segments. In the first step 'Reviewing our framework,' problems are identified, learning topics are selected and defined, existing practices are analysed, and methods and tools are designed for adoption. The second step 'Implementing strategic actions,' involves planning and implementing the approaches, methods and tools of development projects. In the third step, 'Documenting and analysing results' intervention results are systemized and evaluated before the changes in the state of development are presented to the members through workshops, training programmes, platforms or other methods. After the completion of this cycle, the process starts again with the first step. This time, the results from the first cycle are taken into account (Lundy and Gottret 2005).

CIAT's experiences with LAs have been very positive since they were first initiated in the year 2000. Positive aspects are that stakeholders participate directly, pilot innovation occurs where help is needed, face to face information exchange occurs, and analyses throughout the entire experience help evaluate the alliance including its processes (Lundy & Gottret, 2005). However, LAs do not work for every project. One reason is member composition. Members have to be open to share information and reflect in order to enable the learning. This can be influenced by clusters or different methods of communication. Establishing an LA takes a considerable amount of time (CRS 2009). The initiators must invest sufficient time in managing and coordinating the alliance as well as documenting, analysing, and sharing the information and results on every level. Though time commitments may be substantial, they are crucial elements of the process. Additionally, providing funding becomes essential. It is easier to receive funding for specific projects than for projects with a wider scope. It is also vital to consider who is funding the project and to examine their motives and interests (Lundy and Gottret 2005).

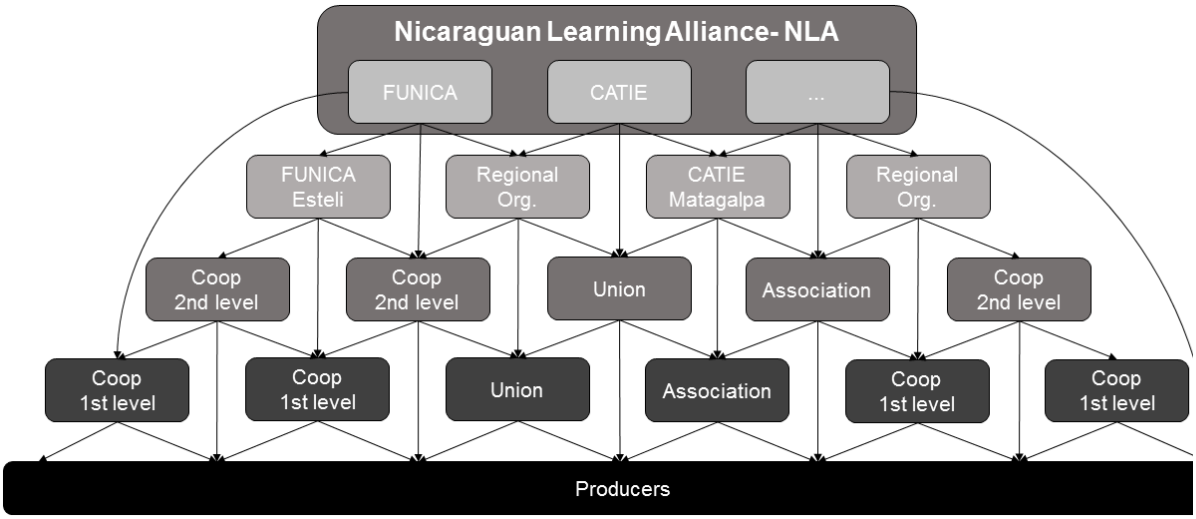
Background information on Nicaragua and the NLA

Although small in size, Nicaragua has a varied tropical landscape with fertile volcanic soil on agricultural plains, dry rangeland plateaus and hills, and humid evergreen agro-forested mountains. Agriculture is an important economic sector for the country, representing 22 per cent of the national GDP, 32 per cent of national exports and 32 per cent of employment (FAO 2014). However, Nicaragua is one of the poorest countries in Latin America (World Bank 2017). Nicaraguan farmers are organised in a dense network of cooperatives, a heritage of the former socialist Sandinista regime (Lafortezza and Consorzio 2009). Due to the current government’s connection to the previous regime, it embraces this socialist heritage and may continue to influence the structure of Nicaraguan agriculture. At present, many farmers are not well equipped to link themselves to suppliers and customers in today’s market-oriented system. Agribusiness training could thus make a big difference in empowering farmers and their cooperatives to become better managers of their enterprises and livelihoods (Landmann and Cadilhon 2016). Having identified this training opportunity as a good long-term strategy to help rural farming communities link to markets, a partnership of ten international and local research

organisations, non-government organisations, and one national-level farmers' cooperative[10] launched the NLA in 2003 (Lundy and Gottret 2005).

The objective of the NLA is farmer training on agribusiness. Much of the development of these activities and training in the first years were funded by aid money channelled through the international partners in the NLA. To achieve this, the NLA members first consulted each other to identify training topics and develop appropriate training methods. Based on this information, the NLA has established five training guides containing the skills and capacities farmers needed to improve[11].

Figure 5.1: Structure of knowledge replication within the Nicaraguan Learning Alliance



(Source: Landmann and Cadilhon 2016)

These guides use methodologies designed to target Latin American farmers' cooperatives and rely on the participation of trainees in building their own understanding of the topic. The trainees first auto-evaluate the training process, before their results can be compared to training beneficiaries at different sites. Training methods and topics are adaptable to the local context of each farmer's cooperative. The process and topics of the training also promote equity across gender and social groups. Finally, the training process encourages individual and collective

[10] CATIE (Center for Tropical Agricultural Research and Education); CIAT (International Center for Tropical Agriculture); CRS (Catholic Relief Service); FUNICA (Foundation for Technological Development of Agriculture and Forestry of Nicaragua); VECO Mesoamerica (VredesEilanden Country Office Central America); GIZ (German Agency for International Cooperation); LWR (Lutheran World Relief); FENACOOP R.L. (National Federation of Agricultural Cooperatives and Agribusiness)

[11] Guide 1: Self-evaluation provided for the management of rural associative enterprises; Guide 2: Strengthening socio-organisational processes; Guide 3: Strategic orientation with a focus on value chain; Guide 4: Development of business plans; Guide 5: Strengthening of services. These are all available in Spanish from http://www.alianzasdeaprendizaje.org/metodologia (accessed 15 January 2017)

empowerment to engage in entrepreneurial activities. The NLA's novel idea was to use the existing network of agricultural cooperatives to snowball the training to individual farmer households. The NLA members trained regional-level cooperatives, which used the same methods to train village-level cooperatives, which in turn used them to train their individual farmer members (Figure 5.1). Importantly, the NLA members assigned the training activities to one clearly identified project manager, who became the physical link between alliance members and the beneficiary cooperatives, thus creating a trusting relationship with the network of cooperatives.

Three learning cycles included 77 producer organisations and reached a total of 19,350 farming families involved in the production of various crops. Women represented 30 per cent of the trained farmers (AdA-Nicaragua 2012; Landmann and Cadilhon 2016) . Although the process was at first subsidised by international partners, later on, one of the NLA-members used the guides developed together with the other members independently.

5.3 Conceptual framework and research design

Conceptual framework to outline the analysis

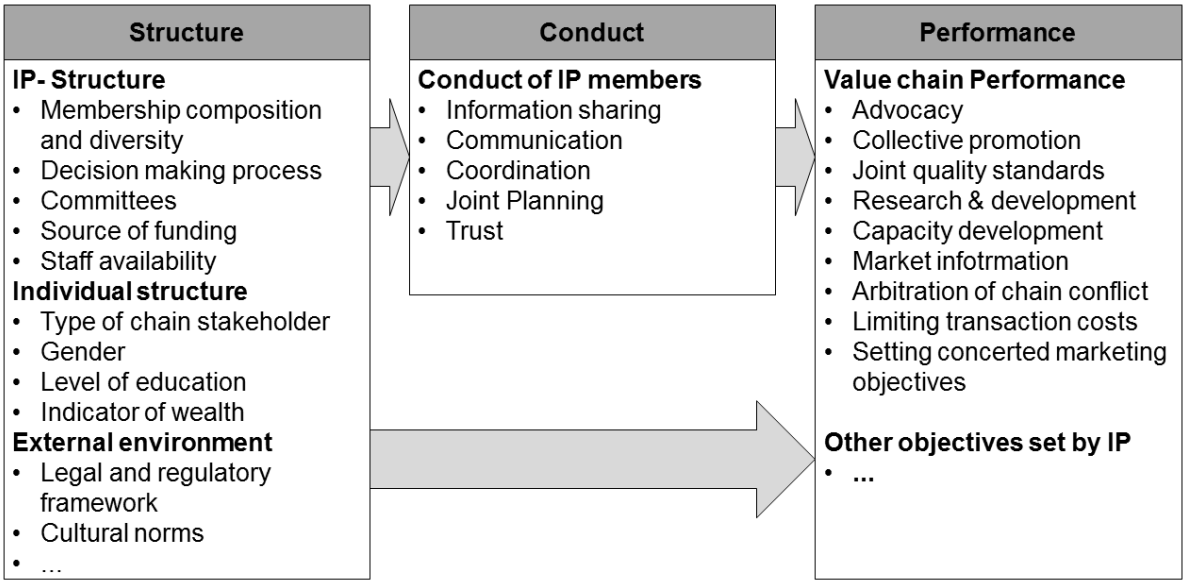
Mariami, Cadilhon, and Werthmann (2015) describe a conceptual framework evaluating the impact of IPs. The authors build their framework based on three strands of literature from socio-economic theory.

First, the authors use the Structure-Conduct-Performance (SCP) model as a general outline for the study of multi-stakeholder groups such as IPs. Although it has been criticised for its use as a tool to understand the functioning of real-life markets, the authors noted the SCP model's elegant overarching logic: the structure of IPs can impact on its stakeholders' conduct, and in turn on the performance of the platform measured by reaching its objectives. Mariami, Cadilhon, and Werthmann (2015) incorporate elements from New Institutional Economics (NIE) to complement the overall SCP logic. Indeed, the NIE literature takes into account the uncertainty endemic within the food industry: technical and economic characteristics of the products due to agricultural production seasonality, weather instability, and food market cycles (Furubotn and Richter 2010). NIE's focus on transaction costs, the organisation and development of economic activity pose a perfect complement to the SCP model in trying to understand how IPs work to reach their objectives.

Mariami, Cadilhon, and Werthmann (2015) then suggest going further into the characterisation of the way IP conduct and performance are measured by using concepts and constructs from

the marketing management literature. Endorsing transaction cost economics, this strand of research studies in great detail how organisations reach more satisfactory marketing relationships by developing information sharing (Sanzo et al. 2003), communication (Kumar 1996), cooperation, coordination and joint planning (J. C. Anderson and Narus 1984; Claro, Hagelaar, and Omta 2003), and trust (Kumar 1996; Trienekens 2011). Though IPs are not generally a means to organise the market transactions between its members, in the case of the NLA, the alliance does help its members improve the marketing orientation of their production and planning activities. Therefore, it is still relevant to use the conceptual framework proposed by Mariami, Cadilhon, and Werthmann (2015) to structure this analysis. The authors combine the three complementary theories of the SCP model, NIE, and marketing relationships management into an overarching conceptual framework to understand how IPs work and to help evaluate their impact. Figure 5.2 shows how the conceptual framework proposed by these authors has been adapted from the original to fit the specific context of the NLA.

Figure 5.2: Elements of the conceptual framework to evaluate innovation platforms



(Source: Landmann and Cadilhon 2016)

Trust has already been identified as an important component of business relationships in agricultural value chains of developing countries (Trienekens 2011). Kumar (1996) defines trust as the belief that each party in a marketing relationship is interested in the other's welfare; neither will take action without first considering its impact on the other party. Many researchers describe trust as a multifaceted concept dependent in each case on the local context. Thus, trust can be seen as a factor related to competence, process, characteristics, institutions, systems, services, and even technology (a piece of equipment). Trust can be observed in the decision and

actions of participants. From a business perspective, trust is an expected outcome of a certain event or action (Laeequddin et al., 2010). Applying the concept of trust as found in the business relationship literature to the context of IPs seems particularly relevant as the different stakeholders found in an IP also have to develop trust between each other to reach common objectives. At the same time, these value chain stakeholders can also be competitors or dependent on one another.

Capacity development is defined in many ways (Ubels, Acquaye-Baddoo, and Fowler 2010). The United Nations define capacity development as a "process through which individuals […] obtain, strengthen and maintain the capabilities to set and achieve their own development objectives over time" (UNDP 2008, 4). This definition includes social, political, and technical aspects. Bolger's (2000) review concluded that 'capacity development refers to approaches, strategies and methodologies used to improve performance at the individual, organisational, network/sector or broader system level'. Farmers' capacities are mostly developed by training activities and workshops given or provided by different actors (Hall 2007; Horton et al. 2003). In this respect, capacity development describes both the process and the outcome of these activities, whereby the outcome is defined as changes in working processes and the introduction of new production methods (Hall 2005; Lusthaus, Adrien, and Perstinger 1999).

Data collection

Data were collected in Nicaragua from NLA members, their influenced partners, non-members of the NLA and their influenced partners, as well as from agribusiness private companies and universities. The data collection took place from July to September 2014 in Managua, and in the provinces of Matagalpa, Jinotega, Estelí, Madriz, Nueva Segovia, Masaya, and Chinandega (Figure 5.3). These provinces were chosen since most NLA members are working in these regions (e.g. CATIE in Matagalpa, CRS and FUNICA in Estelí and Jinotega).

Figure 5.3: Map of Nicaragua identifying provinces where data collection took place

(Source: Landmann and Cadilhon 2016)

To collect qualitative data, key informant interviews and focus group discussions were held. Quantitative data were gathered through individual interviews using a structured questionnaire. Key informants (Table 5.1) were also interviewed with the aim of gaining a more profound understanding through a less structured conversation. The key informants in the different regions were chosen based on the different types of stakeholders involved in agricultural development: governmental organisations, non-governmental organisations, research institutes, universities, and private companies. The interviews conducted used a guide based on the individual survey and the conceptual framework. Focus group discussions were held in the regions where the NLA is active. The characteristics of the villages and the composition of the members involved in the group discussions had to be similar to those of the villages representing the area of study. Focus group discussants and key informants were not included in the sample of individual questionnaires. The locations for the focus groups were randomly selected from the different regions in our study. All interview questionnaires and guidelines are accessible on the internet (Cadilhon and Landmann 2015). Focus group discussions followed the approaches of asking specific questions about definitions and background information, while also observing the direction taken by the focus group discussion. Focus group participants were members of first-level cooperatives chosen according to their membership and partners in the NLA network and their location. Three focus group discussions with different groups of producers and key informant interviews were held at the beginning of fieldwork as pre-tests of the individual questionnaire. Results were considered before finalizing the questionnaire.

Table 5.1: Institutions of key informants interviewed

Type of institution	Name of institutions
Consultant	Kuan-Consultants & Associates
Foundation	FUNICA- Nicaraguan Foundation for Technological Development of Agriculture and Forestry
Gov. institution	CONICYT- Nicaraguan Council of Science and Technology
Gov. institution	MAGFOR- Ministry of Agriculture and Forestry
Gov. institution	MINED- Ministry of Education
NGO	CATIE- Tropical Agricultural Research and Higher Education Center
NGO	CRS- Catholic Relief Services
NGO	HEIFER International Nicaragua
NGO	LWR- Lutheran World Relief
NGO	SWISSAID
NGO	VECO MA- VredesEilanden Country Offices Mesoamerica
Private company	Exportadora Atlantic S.A.; ECOM Nicaragua
Private company	Ritter Sport
Producers org.	APEN- Association of Producers and Exporters of Nicaragua
Producers org.	FENACOOP- National Agricultural Cooperative Federation and Agroindustrial R.L.
Producers org.	MAONIC- Movement of Nicaraguan Agroecology and Organic Producers
Producers org.	UPANIC- Union of Agricultural Producers of Nicaragua
University	UCA- Centroamerican University
University	UCATSE- Agricultural Catholic University of the Dry Tropics
University	UNA- National Agrarian University

(Note: Gov. = Governmental; Org. = Organisation; Source: authors own data)

The individual questionnaire collected structural data about the organisation interviewed and used 53 Likert-scale statements to quantify the levels of conduct and performance. The respondents expressed their agreement with the statements proposed by the researcher through the Likert scale (Coding from 1 = 'strongly disagree' up to 5 = 'strongly agree' as well as N/A= not applicable).

In each location, preliminary individual interviews were held with managers of farmers' groups involved in NLA capacity development. To constitute the control group of farmers' organisations not involved in the NLA network, contact was made with other cooperatives and organisations with a similar structure in the same region. These organisations were identified by asking for references from the respondents within the NLA network, as well as by randomly interviewing numerous farmer organisations in the region where the fieldwork was undertaken.

The resulting sample of interviews in all regions was double-checked against lists of all farmer organisations active in these areas. In total, 38 NLA-members or influenced partners and 52 members of other agribusiness development networks and organisations not influenced by the NLA were interviewed.

At the end of data collection, focus group discussions with NLA-influenced and non-influenced cooperatives were held to discuss unclear topics. Overall, data from six focus group discussions, 20 key informant interviews and 90 individual questionnaires were collected (Cadilhon and Landmann 2015).

Data analysis

Graphical inspection and descriptive analysis of the structural data were undertaken first. Statistical differences were then identified between NLA members and their influenced groups as well as between the different levels of the network of the agricultural sector, compared with the reference group.

To avoid multicollinearity due to potential interrelationships between statements, factor analysis with orthogonal VARIMAX rotation reduced trust and capacity development statements to a smaller number of uncorrelated underlying factors. Reliability tests were carried out with all statements and afterwards with the calculated factors. The factors were also analysed with values of Cronbach's Alpha, Kaiser-Meyer-Olkin (KMO) measurement and Bartlett's Test of Sphericity. The acceptable factor loading chosen for this study (population of 90) is 0.564 (Field 2009).

A multiple linear regression was undertaken with the factors developed from performance variables representing capacity development as the dependent variable. Independent variables were factors representing the trust component of the NLA members' conduct and additional individual structure and conduct variables as hypothesized by the conceptual framework (Figure 5.2). To affirm the validity and robustness of the regression models, common diagnostic tests were used: R-Squared showed the overall fit of the model and Variance Inflation Factor (VIF) values were analysed (Field 2009). Landmann (2015) describes the complete process of the factor and regression analyses.

The qualitative data relating to information sharing, communication, coordination, joint planning, and trust gathered from the focus group discussions and individual interviews were transcribed into a single document. Following best practices in mixed research methods (Patton 2002), quotes from the stakeholders interviewed were selected to provide backing for the

statistically significant results of the regression. Various other quotes were chosen because they enabled the interpretation of some of the non-significant results of the regression. The results presented below build upon the triangulation of both quantitative and qualitative data, therefore, go beyond an analysis produced by Landmann and Cadilhon (2016) in a case study form.

5.4 Results

Descriptive statistics of farmers' organisations

Coffee was the most produced crop for 41 farmers' organisations sampled; 33 reported basic grains (beans, corn and rice) and 16 declared other products (cattle, milk or dairy, vegetable, honey, cocoa). Twenty-six organisations focused on only one agricultural product. In total, 12 respondents represent a national organisation (one NLA-member and 11 others). Six respondents represented regional organisations (three NLA-members and three others), two are from national-level cooperatives (one NLA-member and one other) and 14 represent regional-level cooperatives (seven NLA-partners and seven others). The sample included 54 village-level cooperatives (26 NLA-partners and 28 others). Seventy respondents out of 90 mentioned their organisation was participating in more than one capacity development group. The majority of respondent organisations performed the function of farming, marketing or processing groups. Most groups were also providing capacity development services. Two-thirds of the organisations interviewed also had some financial role in providing credit to their members.

Out of the 90 respondent organisations, 57 were established cooperatives, 14 associations, eight NGOs, five private companies, and six were related to government. The most important source of funding came from NGOs (37 cases) followed by cash from operations generated (25 cases), credit provided by the private sector (11 cases), membership fees (10 cases), while seven were government funded. Of all organisations sampled, twenty-six organisations have fewer than 100 members as producers while 27 represent between 100 and 499 producers. Organisations speaking for 500 to 999 farmers are represented by nine respondents and organisations having 1,000 to 4,999 farmers as members are represented by 16 respondents. Only ten organisations represent more than 5,000 producers. The largest organisation interviewed counts 50,000 producers as members. In terms of gender balance of the producers, 69 per cent were men and 31 per cent women (Cadilhon and Landmann 2015).

Regression analysis – structure and conduct influencing performance

The regression results presented in Table 5.2 derive from an econometric model to test selected parts of the conceptual framework depicted in figure 5.2. The variables chosen as explanatory

variables are consistent with the literature review and conceptual elaboration by Mariami, Cadilhon, and Werthmann (2015), who propose constructs that can be used to measure structure, conduct, and performance in the context of innovation platforms. Thus, Table 5.2 identifies, on the one hand, the influence of structure (characterised by the number of years the interviewee has worked for the organisation, the connection of the organisation with the NLA, and the position of the organisation inside the network) on the factor 'innovation'. Secondly, it describes the influence of the learning partners' conduct (represented by statements clustered into information sharing, coordination, joint planning and two trust factors) on the factor 'innovation'. The factor 'innovation' represents the capacities developed by the organisation in the last years measured by new products, knowledge and new techniques or machinery. 'Innovation' is based on the following statements: 1- We have developed new products in the last six years; 2- Our knowledge about our activity has improved in the past six years; 3- In the past six years, we have used new techniques or machinery in our production, production process or management. In the end, two structure variables, two joint planning statements and both trust factors show a significant impact on performance. The adjusted R-Squared of this regression is 40.4 per cent, and the whole regression is statistically significant at a level inferior to 0.1 per cent. All B-values are between one and minus one with only one exception. Respecting the conditions of the equation model meant that the influence of the independent variables on the dependent variable is relatively small (Field 2009).

The number of years working for the organisation has a significance of 0.1 per cent and a Beta-value of 0.294, which shows that the amount of time the interviewee has worked for an organisation increases the factor innovation. The connection of the organisation with the NLA does not have a statistically significant influence on the factor innovation. On the other hand, the position of the organisation inside the network does have a significant influence (Sig.= 4.8 per cent; Beta-value= -0.178). The attributes of this variable are ordered on an ordinal scale related to the position inside the network: national organisations or institutions have a value of one, regional organisations a value of two, cooperatives at third level a value of three, cooperatives at second level a value of four and cooperatives at the first level closest to the farmers a value of five. The bigger the value, the more local the organisation. Being closer to the farmers' level rather than at national level decreases 'innovation'.

Table 5.2: Regression analysis of structure and conduct indicators on the factor 'innovation'

Dependent variable: Factor: Innovation			Unstandardized Coef.		Standardized Coef.			Collinearity Statistics	
			B	Std. Error	Beta	t	Sig.	Tolerance	VIF[12]
(Constant)			-1.709	0.907		-1.883	0.064		
Structure		*Years working for the organisation*[13]	0.044	0.013	0.294	3.381	*0.001*	0.914	1.094
		Connection with NLA[14]	0.249	0.177	0.124	1.405	0.164	0.885	1.129
		Position of the organisation inside the network[15]	-0.131	0.065	-0.178	-2.01	*0.048*	0.883	1.132
Conduct	Information exchange	We usually share information about production with other stakeholders.[16]	0.172	0.117	0.13	1.467	0.147	0.881	1.135
		The NLA/ our organisation exchange information about their on-going activities with us.[7]	0.208	0.123	0.167	1.69	0.095	0.711	1.407
Conduct	Co-ordination	*We plan our activities together with the NLA/ our organisation according to our production potential and customer demand.*[7]	-0.26	0.115	-0.224	-2.265	*0.026*	0.707	1.415
Conduct	Joint planning	Our viewpoints are taken into account by the NLA/ our organisation when they plan their activities.[7]	0.028	0.142	0.022	0.201	0.842	0.558	1.791
		Joint planning of activities with the NLA/ our organisation has improved in the last six years.[7]	0.447	0.126	0.378	3.541	*0.001*	0.607	1.646
Conduct	Trust	We prefer to have long term relationships.[7]	-0.174	0.125	-0.127	-1.387	0.169	0.828	1.208
		Factor: Trustful relationships	0.252	0.096	0.248	2.613	*0.011*	0.771	1.298
		Factor: Trustful contracts	0.23	0.091	0.231	2.532	*0.013*	0.834	1.2

Notes: Variables with significant influence on factor 'Innovation' are shown in italics; R-Square= 0.480; Adjusted R-Square= .404; Significance= 0.000; level of significance $p < 0.05$

Source: Landmann & Cadilhon (2016)

[12] VIF= Variance inflation factor
[13] Scale: Years in numbers
[14] Scale: 0= No; 1= Yes
[15] Scale: 1= National organisation; 2= Regional organisation; 3= Cooperative 3rd level; 4= Cooperative 2nd level; 5= Cooperative 1st level
[16] Scale: 1= strongly disagree; 2= disagree; 3= undecided; 4= agree; 5= strongly agree

Two statements related to information sharing between the farmers and other stakeholders as well as between the NLA or their organisations and the farmers do not have a significant influence. The statement 'We plan our activities together with the NLA/ our organisation according to our production potential and customer demand' has a negative significant influence (Sig.= 2.6 per cent; Beta-value= -.224). On the other hand, the statement 'Joint planning of activities with the NLA/ our organisation has improved in the last six years' has a positive and statistically significant influence (Sig.= 0.1 per cent; Beta-value= .378) on innovation. Yet, the statements 'our viewpoints are taken into account by the NLA/ our organisation when they plan their activities' as well as 'we prefer to have long-term relationships' do not have a significant influence. Both trust factors labelled 'trustful relationships' (Sig.= 1.1 per cent; Beta-value= 0.248) and 'trustful contracts' (Sig.= 1.3 per cent; Beta-value= 0.231) have a positive significant influence on 'innovation'. The factor 'trustful relationships' is based on the following statements: 1- The NLA/ our organisation always keeps their promises; 2- The NLA/ our organisation always gives us correct information; 3- The NLA/ our organisation actions and behaviours are very consistent; 4- The NLA/ our organisation always tries to inform us if problems occur. The factor 'trustful contracts' is based on the statements: 1- We only develop a relationship with business partners who are fair to us and 2- We only maintain a relationship with our business partners with clearly written terms and conditions.

Qualitative data

According to one key informant and professor at UCATSE – Agricultural Catholic University of the Dry Tropics: "It will be given [the same] training that another organisation has conducted. It could be provided with a service complementing the organisations offers: currently this is a little bit the problem in Nicaragua. There are sixty-eight organisations working in extension, but there is nobody who offers credit or the full range of extension service". This statement underlines the findings from the regression model that joint planning of activities between farmers' cooperatives and training organisations is negatively related with innovations. Because there might be other organisations involved in training activities on similar subjects.

Information sharing is strongly linked to trust, which in return has a strong impact on fostering innovations. For example, a key informant and a board member of the national commission for coordination and management at MAONIC, the Movement of Agro-ecological and Organic Producers of Nicaragua, declared: "Each alliance depends to which extent transparency is achieved.

If the organisation is transparent, trust is existing. […] That is the condition we see, which is required. But we also ask the other partner, if he agrees on our point of view when possible." The professor at UCATSE explained the discrepancy between information sharing and innovation by a mainly top-down flow of information in Nicaraguan agricultural development and extension: "one problem of these alliances is the management of information. […] Feedback is required, as a member but also from the bottom, meaning producer of the cooperative and the organisations. There should be a bottom-up information flow but according to our experience, it doesn't work. The information does not flow with the same speed from one side to another [as easily as from the other]."

Our key informant from MAONIC supports the fact that organisations and stakeholders working with producers are mostly aware of challenges and improve farmer's training. To "focus on small producers as the core of the solution to solve problems" is one goal of MAONIC. According to the board member, the farmer himself is the "leader of change to achieve the goal of change and improvement". MAONIC is "empowering [the farmer] to improve the information about his own farm […]. If that fails, no project […and] no government will help him out of poverty."

A project manager at FUNICA – the Nicaragua Foundation for Agricultural and Forestry Technological Development, an NLA member and key informant, supports the point that trust influences the factor innovation, saying "the level of trust has an influence on capacity development within the NLA." He explains how trust was created within the NLA network and the beneficiary farmers' organisations: "meeting their expected contributions is important. For example, if there is a project and they will comply, the organisation has to contribute a certain amount of resources, generate the planned results, provide information which is requested, basically."

To illustrate the results of the 'trustful relationships' factor, we consider the declarations of a manager working for the private sector firm Exportadora Atlantic S.A. in Nicaragua and key informant. He states very generally that "everything is based on trust. Trust and transparency have to be the axis of all organisations." More specifically, he explains that farmers trust "the economic solidity of the company" as well as "the transparency" with which the company negotiates with farmers. "We also trust in producers; we deposit 2,000, 3,000, 20 or 100 million dollars that he can work and grow his fruits." The board member of MAONIC confirms the statement of the private firm by highlighting the importance of the relationship between transparency and trust but also says that, "If there is trust then, even with a few resources, much more could be done."

A consultant at CATIE – the Tropical Agricultural Research and Higher Education Centre – and key informant describes the structure of the NLA as one where "[all NLA-members] are at the same level. There is no hierarchical structure, […] There is a lot of trust, and quite some transparency in communication."

During a focus group discussion with small-scale farmers on 5th August 2014 in Chinandega, the farmers said they trust NGOs and "mistrust the governmental institutions". They linked the former to the fulfilment of promises and financial support. A consultant of MINED – the Ministry of Education – and key informant supports this argument saying that: "producers […] distrust the government […], because sometimes […] the financial expectations of producers are not fulfilled." Most stakeholders do not work together with governmental institutions. The farmers "read [the contracts and agreements of the government] […] but they do not have much confidence." The farmers interviewed explain this as follows: "we do not have all information […] and do not know the intention of the government". From the farmers' perspective, there is a lack of transparency in governmental activities.

5.5 Discussion and conclusions

Representativeness of the data

The Central American Bank for Economic Integration (BCIE) has undertaken a similar study of farmers' organisations in Central America using data from 63 representative Nicaraguan cooperatives (Lafortezza and Consorzio 2009). The results from this study are similar to those of the BCIE study: the main products produced and exported are the same, as is the gender balance within the cooperatives. The main difference between the two studies lies in the size of the organisations interviewed: our study incorporates very large cooperatives with more than 10,000 members and active at regional and village levels. The BCIE study's sample also differs from the sample of this study as 35 percent of the BCIE sample had not received any training while all the farmers' organisations sampled in this study had benefited from some sort of training. Although there are some differences between the two studies' samples, the similarity in overall results allows considering that this study's sample is also representative of farmers' organisations active in the provinces where the NLA is present.

Efficiency of the NLA's capacity development process

The old structures of cooperatives and the different levels within the cooperative network are still present and an important factor in agribusiness development. The private, public, and NGO sectors are familiar with farmers' cooperatives being widely spread out in Nicaragua and have adapted their methods to this structure. The NLA has used the wide network of agricultural cooperatives to snowball its training on agribusiness from the national level to a large number of individual farmers. However, the other support organisations in the Nicaraguan agricultural innovation system are doing the same so all farmers' cooperatives and their farmer members are connected one way or another to a source of training on agribusiness management. Every key stakeholder interviewed was practising capacity development in the study area. A majority, 77 per cent, of respondents, reported being supported by more than one organisation. This is the most reasonable explanation for the fact that a 'connection to the NLA' does not have a significant influence on 'innovation'.

The lack of significant influence of information sharing on innovation in the regression is surprising as qualitative data indicate that information sharing is strongly linked to trust, which in turn has a strong impact on fostering innovations. However, one possible explanation is that agricultural training is generally a top-down process. As a probable consequence, information sharing has no significant influence on innovation. The generalised top-down extension method also explains that only when joint planning is seen to be improving does it have a positive impact on innovation. Furthermore, the data show that the farmers' viewpoint is not taken into account. This supports the idea of rethinking and reorganizing the capacity development sector as well as the structure of agricultural organisations and institutions, just as the NLA has done. Although all providers of agribusiness training in Nicaragua are using the strong cooperative-oriented structure within the country's agricultural sector to improve farmers' knowledge of agribusiness and markets, yet, all stakeholders follow their own approaches. Cooperation and networks between different types of stakeholders are rare.

In fact, the qualitative data indicated that the organisations participating in the NLA network would greatly value an exchange of their experience and progress with other organisations. Thus, the NLA and other stakeholders working in the sector of capacity development should open their network to other stakeholder types, even though the government does not seem to show interest in such a cooperation. This could make the training method more efficient, sustainable, and successful. Using organised networks seems to be the right pathway for agricultural training given the structure

of Nicaragua's agriculture, but interactions could be improved between actors of the same level and different levels. On the other hand, there is no visible influence on the duration of a relationship on 'innovation'. One explanation could be farmers' easy access to cooperatives: out of 90 respondents, 70 were at least in two different cooperatives.

Several cooperatives consider that capacity development will be successful only if accompanied by financial support. The NLA has thus embedded financial support to put the agribusiness development skills learned during its learning cycles into practice. Financial support is necessary, but the main goal is to have successful producers who are not dependent on the financial support from NGOs (Lundy and Gottret 2005). Indeed, successful IPs in the long-term are those that manage to renew their funding source to keep covering their costs, or those that manage to change their business model in order to become financially self-sustainable (Dror et al. 2016).

The quantitative and qualitative data show on the one hand that the content and process of NLA's training are very good. On the other hand, the qualitative data show that the way the training is undertaken with farmers could be improved if adjusted to the regional circumstances. This statement was confirmed during the focus group discussions, several key informant interviews, and some individual questionnaires. The current strategies of some NLA members to adapt the training to the local environment are successful, and this is a response to some criticism from the final beneficiaries. On the other hand, it is difficult to trace the success of the NLA training. If one member changes the method and uses the information on their own, it is no longer helpful for the other NLA members. Indeed, changing the learning method to adapt it to local context jeopardizes the approach of the LAs to build up a platform to share information and learn from each other. The institutional learning platform is no longer efficient and sustainable if improvements and changes are not shared with the other NLA members. Opportunities for communication and meetings with other knowledge networks to share and exchange information are also missed by some cooperatives. Lundy and Gottret (2005) describe an approach in the method of the LA to create networks at the micro, meso, and macro levels. These intertwined networks do not exist in Nicaragua and would be the answer to some current criticisms. The NLA itself already identified enlarging knowledge networks as one weakness and included this in the changes that are planned for the coming years (AdA-Nicaragua 2012).

Trustful relationships improve the NLA learning process

The quantitative and qualitative results of this study show a clear impact of various components of trust within the NLA network and its capacity development outcomes. The regression model showed that 'trustful relationships' and 'trustful contracts' both had a positive significant influence on 'innovation'.

As described above, the farmers have a better perception of NGOs than of government. More worryingly, it seems that NGOs almost have no collaboration with governmental organisations. This, on the one hand, shows distrust of government action but on the other hand, also shows that the alliances between NLA members and governmental institutions could be strengthened.

The study's results identify the relationship existing between trust and capacity development in the case of the NLA. The regression and qualitative data triangulation indicate that structure and conduct have an influence on performance. The influence of trust on capacity development and innovation identified by this research contributes evidence for the conceptual framework of innovation platforms proposed by Mariami, Cadilhon, and Werthmann (2015). Furthermore, the influence between IP structure and conduct is also observable, for example, in the fact that NGOs, as financial sources of the farmers' organisations, have a significant influence on 'trustful relationships'. The influence of conduct on performance is visible as well: results show that 'trustful relationships' and 'trustful contracts' have a positive influence on 'innovation' emerging from capacity development variables. The findings complement those of past research identifying linkages between how an IP is structured, the conduct of its members and its expected outcomes (Badibanga, Ragasa, and Ulimwengu 2013; Kago et al. 2015; Mariami, Cadilhon, and Werthmann 2015; Pham, Cadilhon, and Maass 2015; Dror et al. 2016; Teno and Cadilhon 2016).

Reverse causality is a limitation which could occur using regressions as an analysis tool (Field 2009). In our study, we assume that this problem is relatively small as the conceptual framework is based on theories which are already used very often. Furthermore, this specific conceptual framework was already used in a similar way in different settings, moreover, we triangulated our quantitative data with qualitative data. However, to be sure that reverse causality is not occurring, more detailed data would be helpful.

The method used to evaluate the impact of the NLA could also be improved, by including financial and business figures in the questionnaire for direct comparison of economic impacts. This data

could also be collected through the auto-evaluation mechanism developed by the NLA whereby farmers' organisations evaluate their own learning progress. This would simplify making adjustments to the training method and the conceptual framework used to evaluate impact.

6 General conclusion

Small-scale farmers living in rural areas need to develop their agricultural capacity, in order to produce agricultural goods and gain a stable and sufficient income. To improve agricultural capacity development, it is necessary to understand farmers' needs and demands for capacity-building measures. With respect to agricultural capacity development, there is little guidance in the literature on farmers' preferences, the effects of trainers' qualifications, behavioural drivers of farmers to use new technology. Regarding new technology especially smartphones have a high potential for capacity development activities. Further there is little guidance to evaluate innovation platforms focusing on capacity development.

The papers of this dissertation, to my best knowledge, presents the first study analysing farmers' WTP with a discrete choice experiment for different aspects of agricultural training such as training method, location and duration, the type of trainer and additional offers. The data were analysed using a mixed logit in WTP space. Further, we analyse whether there are differences in learning success and perceived satisfaction through agricultural training among farmers due to the trainer's educational qualification. In order to close the gap of understanding the psycho-economic dimension during the implementation process of modern digital technology, the third paper presents a study identifying and quantifying the drivers of small-scale farmers´ intention to use a smartphone to acquire agricultural knowledge with a complex conceptual framework. The data of the first three papers was collected in Bihar, India. As one of the poorest states in India, a large share of the population is living in rural areas characterised by poor infrastructure and resource scarcity, a common feature in developing countries. These are common features in developing countries and this for a good possible base for external validity

The fourth paper is pilot-testing a conceptual framework with respect to innovation platforms as a collaborative agricultural education mechanism. It analyses how innovation platforms work in a Latin American context through mixed research methods.

The results from this dissertation contribute to the existing literature in the topics mentioned above and to our best knowledge, these are the first studies providing such in-depth account in the context of agricultural training.

6.1 Main findings

Overall, the results indicate that policymakers and stakeholders in agriculture in developing countries should continue to shift from standardised top-down models towards decentralisation and demand-induced community-driven approaches. This would help to achieve greater mutuality, flexibility, and customisation of training measures.

The results of the discrete choice experiment presented in the second chapter prove that the training method used is the most important attribute of training, and within this attribute, classroom training with demonstrations is most preferred, as the NGO PRAN is mostly applying. Farmers indicate an aversion using smartphones in agricultural training, despite global digitalisation trends and current efforts to include modern information and communication technology, such as mobile phones or smartphones in agricultural capacity development in developing countries. Accessibility and usage of smartphones are increasing and improving daily (Aker, Ghosh, and Burrell 2016). However, regions such as Bihar are still hardly influenced by smartphones. The conceptual framework of the third paper analyses the behavioural drivers of farmers to use smartphones and proves that the constructs of attitude, subjective norms and behavioural control influence first desire and later intentions to use smartphones in agriculture. Emotions influence desires as well as intention to use smartphones for the generation of agricultural knowledge.

The expressed preference in the discrete choice experiment for academic trainers questions the use of current approaches such as ‘train-the-trainer’, which involves farmers in the knowledge replication process. A typical example of this approach is the Nicaraguan Learning Alliance, which is analysed in chapter five. Other approaches as the ‘agricultural knowledge and information system’, already create direct links between scientists and farmers via modern communication technologies. The second paper shows that the trainers’ qualification does not cause distinction in the perceived satisfaction of the farmers, even though the learning success decreases with an academically educated trainer. The difference in the participants’ learning success is probably caused by the missing experience of the academic trainer compared to the agent.

Farmers preferred any kind of additional offer to no offer and most preferred an offer of crop production inputs or credit, which are the best options for increasing agricultural yield and could be included by training organisations. The respondents, particularly women, preferred having training close to home and lasting only half a day, allowing them to perform their daily responsibilities in the household. However, these were the least important attributes in the study.

The second paper analyses farmers' performance and satisfaction participating in agricultural training. It shows that farmers seem not to be aware of their own learning performance, as changes in the attitude and perceived control do not mediate the relation between trainers' qualification and learning success. Also, subjective norm has no significant direct effect on learning success, which could be due to irrelevance of the behavioural construct caused by the fact that learning success is a score based and performance driven variable. Even if the changes of attitude over the training neither mediate respecting perceived satisfaction, they still influence the perceived satisfaction positively. Furthermore, the results give evidence that changes of perceived control are not occurring during the training or the changes are not important regarding perceived satisfaction neither regarding learning success. Subjective norms have a positive direct effect on perceived satisfaction. However, subjective norm does not moderate the relationship between trainers' qualification towards perceived satisfaction or learning success. Against this background, it plays a pivotal role with regard to the quality of the training that the social environment for instance, their spouse, neighbours or farmers colleagues supports the participation in training sessions.

To understand the drivers of the intention to use smartphones for agricultural purposes a model based on the Theory of Planned Behaviour was developed and adapted to developing countries - in this case Bihar. The research model represents the data set to a high degree. In addition, it emphasizes the good functionality of the model and the constructs adopted from Cheon et al. (2012) and Perugini and Bagozzi (2001). The successful application of our model shows that positive and negative anticipated emotions can be considered as an important extension of the TPB. This extension of the TPB with emotions should be taken into account in conceptual frameworks of empirical studies on smartphone adoption behaviour in context developing countries where the respondents are not used to a new technology yet.

The study's results of the fourth paper identify the relationship existing between trust and capacity development in the case of the NLA. The quantitative and qualitative data indicate that structure and conduct influence performance. The influence of trust on capacity development and innovation identified by this research contributes evidence for the conceptual framework of innovation platforms proposed by Mariami et al. (2015). Furthermore, the influence between innovation platform structure and conduct is also noticeable, for example, in the fact that NGOs, as financial sources of the farmers' organisations, have a significant influence on 'trustful relationships'. The influence of conduct on performance is visible as well: results show that 'trustful relationships' and

'trustful contracts' have a positive influence on 'innovation' emerging from capacity development variables. The findings complement those of past research identifying linkages between how an innovation platform is structured, the conduct of its members and its expected outcomes (Badibanga, Ragasa, and Ulimwengu 2013; Subedi et al. 2014; Kago et al. 2015; Mariami, Cadilhon, and Werthmann 2015; Pham, Cadilhon, and Maass 2015; Dror et al. 2016; Teno and Cadilhon 2016).

6.2 Policy recommendations

The results of this dissertation are expected to provide policymakers and NGOs with insights into the underlying psychological factors that influence the participation in agricultural training. These insights can be used to adjust current policies and to develop new initiatives to stimulate the knowledge transfer and participation in agricultural training programmes by farmers.

Regarding the trainer of agricultural capacity development activities, I suggest combining the strength of local agents trained by NGOs or other institutions and an academically educated trainer. An expert educated on-the-job could be the main trainer and an academic person could supplement the extension service by giving one training in a session of many. With this method, the benefits of both trainer' types could be used without higher costs. Mass media would also allow academic trainers (the most preferred type of trainer) to be involved in the capacity development activities without increasing the costs and would allow agricultural production and marketing information to be disseminated. Thus, policymakers should seek to overcome psychographic and regional barriers to the implementation of mass media in capacity development. However, besides the professional background, discussed in the second paper, it is important that trainers are trained on the particular cultural background, different teaching methods as well as other soft skills. In addition, policy-makers can set basic standards regarding trainers' qualification, e.g. vocational training.

Our results regarding the farmers' satisfaction and their intention to use smartphones also indicate that farmers are influenced by people who are close to them, such as family members, friends, neighbours and farmers colleagues. Therefore, a good image as well as recommendations of the implementing NGO, the approach and the training sessions are required in order to have the support of the social environment. Training activities tailored to the preferences of farmers as well as, for instance, open days to promote the NGO and the training approach can help.

Seeds and fertiliser could be used as incentives for farmers to participate in agricultural training. The additional costs of demand-driven upgrading of capacity development activities could be covered by a fee that complies with farmers' WTP. In order to avoid exclusion of the poorest farmers and to meet farmers' demands, different additional services and goods, such as seeds, could be introduced based on a voluntary payment system.

If stakeholders want to support the use of smartphones, individual farmers and farmer groups should be addressed. The intention to use a smartphone is already influenced long before owning a smartphone. If one key person of a farmer's network is against smartphones for the generation of knowledge, the desire of using smartphones of the entire network could decrease. Stakeholders such as NGOs (e.g. PRAN, FnF or NLA) or governmental organisations can provide the basis for the successful establishment of smartphone-generated knowledge today. If the stakeholders produce a positive smartphone image, explain the usefulness and show that stakeholders themselves are ready for this technology, it will indirectly influence the intention of the farmers to use smartphones. However, trainers and extension workers can influence farmers' attitudes, subjective norms, and behavioural control beliefs indirectly by sharing their opinions.

The Nicaraguan data show that the farmers' viewpoint is not always taken into account, which supports the idea of rethinking and reorganising the capacity development sector as well as the structure of agricultural organisations and institutions. The NLA is one case where adjustments in the knowledge replication were done to improve the process of knowledge replication. However, as the changes do not seem to be more successful as the approaches of other capacity development actors, more changes are required, which leads to approaches presented in the first papers. The qualitative data analysing the NLA indicate that the organisations participating in the NLA network would greatly value an exchange of their experience and progress with other organisations. Thus, the NLA and other stakeholders working in the sector of capacity development should open their networks to other stakeholder types, even though the government does not seem to show interest in such cooperation's. This could make the training method more efficient, sustainable, and successful. Using organised networks seems to be the right pathway for agricultural training given the structure of Nicaragua's agriculture, but interactions could be improved between actors of the same level and different levels. The results of the NLA case prove that financial support of capacity development activities in developing countries is necessary, but the main goal is to have successful producers who are not dependent on the financial support from NGOs (Lundy and Gottret 2005).

Indeed, successful innovation platforms in the long-term are those that manage to renew their funding source to keep covering their costs, or those that manage to change their business model in order to become financially self-sustainable (Dror et al., 2016). By this fact, we suggest to also support the development of farmers' capacities via smartphones, with academic trainers or other recommendations mentioned above financially. However, we also suggest to already plan from the beginning how the activities can be financially sustainable in the long run.

6.3 Limitations and future research

The research presented in this dissertation is characterised by some limitations. First, although discrete choice experiment is a scientifically well-accepted method, it comprises a hypothetical experiment and therefore may entail a hypothetical bias to a certain extent. Thus, other studies about farmers' behaviour regarding training preferences and WTP in real decision situations are needed.

The PLS- analysis of the third paper is often presented as a method with weaknesses. Another possibility would be, to back up our results with a covariance-based structural equation modelling as recommended by Rönkkö and Evermann (2013). As we are not able to measure and observe the actual behaviour with respecting to intentional behaviour to use a smartphone, we assume, based on the analysis by Sheeran (2002), that intention later influences indirectly the adoption of smartphones for the generation of agricultural knowledge. However, the implementation of smartphones to generate agricultural knowledge could be tested by using different methods to confirm that the constructs pointed out are relevant.

As the data of the first three papers were collected in three districts in Bihar, India, the conceptual framework and approaches can only be generalised to a certain degree. To assure that the methods used, and the results presented also work in other settings and that the conclusions and recommendations can be withdrawn there as well the usage of the survey and conceptual framework have to be carried out in other developing countries.

Reverse causality is a possible limitation of all papers using regressions as an analysis tool (Field 2009). In our study, we assume that this problem is relatively small as the conceptual frameworks and constructs are based on theories which have already been used very frequently. Furthermore, the conceptual framework of the fourth paper was already used in a similar way in different settings. Moreover, we triangulated our quantitative data with qualitative data. However, to be sure that reverse causality is not occurring, more detailed data would be helpful.

References

Abebe, Gumataw K, Jos Bijman, Ron Kemp, Onno Omta, and Admasu Tsegaye. 2013. "Contract Farming Configuration: Smallholders' Preferences for Contract Design Attributes." *Food Policy* 40: 14–24.

AdA-Nicaragua. 2012. "Alianza de Aprendizaje Nicaragua- Plan Estratégico 2013-2016." *Alianza de Aprendizaje Nicaragua*, 13.

AdA. 2014. "Alianza de Aprendizaje." 2014. http://www.alianzasdeaprendizaje.org/portal/index.php.

Aditya, and S. R Sing. 2014. "Mobile Learning for Transforming Education and Improving Learning Outcomes on Agriculture in India." *International Journal of Agricultural Science, Research and Technology* 3 (3): 163–71.

Ajayi, O. A. 2006. "An Assessment of Farmers' Willingness to Pay for Extension Services Using the Contingent Valuation Method (CVM): The Case of Oyo State, Nigeria." *Journal of Agricultural Education and Extension* 12 (2): 97–108. https://doi.org/10.1080/13892240600861567.

Ajzen, Icek. 1991. "The Theory of Planned Behavior." *Organizational Behavior and Human Decision Processes* 50 (2): 179–211. https://doi.org/10.1016/0749-5978(91)90020-T.

———. 2002. "Perceived Behavioral Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behavior." *Journal of Applied Social Psychology* 32 (4): 665–83. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x.

———. 2006. "Constructing a Theory Of Planned Behavoir Questionnaire." 2006.

Aker, Jenny C. 2011. "Dial 'A' for Agriculture: A Review of Information and Communication Technologies for Agricultural Extension in Developing Countries." *Agricultural Economics* 42 (6): 631–47. https://doi.org/10.1111/j.1574-0862.2011.00545.x.

Aker, Jenny C., Ishita Ghosh, and Jenna Burrell. 2016. "The Promise (and Pitfalls) of ICT for Agriculture Initiatives." *Agricultural Economics* 47: 35–48. https://doi.org/10.1111/agec.12301.

Aleke, Bartholomew, Udechukwu Ojiako, and David W. Wainwright. 2011. "ICT Adoption in Developing Countries: Perspectives from Small-scale Agribusinesses." *Journal of Enterprise*

Information Management 24 (1): 68–84. https://doi.org/10.1108/17410391111097438.

Ali, Jabir, and Sushil Kumar. 2011. "Information and Communication Technologies ({ICTs}) and Farmers' Decision-Making across the Agricultural Supply Chain." *International Journal of Information Management* 31 (2): 149–59. https://doi.org/10.1016/j.ijinfomgt.2010.07.008.

Anderson, James C., and James A. Narus. 1984. "A Model of the Distributor's Perspective of Distributor-Manufacturer Working Relationships." *Journal of Marketing* 48 (4): 62–74. https://doi.org/10.2307/1251511.

Anderson, Jock R. 2007. "Agricultural Advisory Services." In *Background Paper for World Development Report 2008- Agriculture for Development*. Washington D.C: The World Bank.

Antonio, Amy, and David Tuffley. 2014. "The Gender Digital Divide in Developing Countries." *Future Internet* 6: 673–87. https://doi.org/10.3390/fi6040673.

Aydogdu, M. H. 2017. "Evaluation of Farmers' Willingness to Pay for Agricultural Extension Services in GAP-Harran Plain, Turkey." *Journal of Agricultural Science and Technology* 19 (4): 785–96.

Babu, Suresh, P.K. Joshi, Claire J. Glendenning, Kwadwo Asenso-Okyere, and Rasheed V Sulaiman. 2013. "The State of Agricultural Extension Reforms in India: Strategic Priorities and Policy Options." *Agricultural Economics Research Review* 26 (2): 159–72.

Badibanga, Thaddee, Catherine Ragasa, and John Ulimwengu. 2013. "Assessing the Effectiveness of Multistakeholder Platforms." 01258. IFPRI Discussion Paper. Washington, DC: IFPRI-International Food Policy Research Institute.

Bagozzi, Richard P., and Youjae Yi. 1988. "On the Evaluation of Structural Equation Models." *Journal of the Academy of Marketing Science* 16 (1): 74–94. https://doi.org/10.1007/BF02723327.

Balcombe, Kelvin, Ali Chalak, and Iain Fraser. 2009. "Model Selection for the Mixed Logit with Bayesian Estimation." *Journal of Environmental Economics and Management* 57 (2): 226–37. https://doi.org/10.1016/j.jeem.2008.06.001.

Balderjahn, Ingo, Anja Buerke, Manfred Kirchgeorg, Mathias Peyer, Barbara Seegebarth, and Klaus-Peter Wiedmann. 2013. "Consciousness for Sustainable Consumption: Scale Development and New Insights in the Economic Dimension of Consumers' Sustainability."

AMS Review 3 (4): 181–92. https://doi.org/10.1007/s13162-013-0057-6.

Ban, A.W. van den. 1997. "Successful Agricultural Extension Agencies Are Learning Organization." In *Management of Agricultural Extension in Global Perspectives*, edited by R.K. Samanta and S.K. Arora, 47–77. Delhi: B.R. Publishing.

Bandura, Albert. 1971. "Social Learning Theory." Edited by General Learning Press. New York City.

Bansil, P.C. 2011. *Bihar Agriculture. A Perspective*. New Delhi: Concept Publishing Company.

Baser, Heather, Peter Morgan, Joe Bolger, Derick Brinkerhoff, Anthony Land, Suzanne Taschereau, David Watson, and Julia Zinke. 2008. "Capacity, Change and Performance-Study Report." European Centre for Development Policy Management.

Beheraa, Bibhu Santosh, Babita Panda, Rudra Ashish Behera, Narayan Nayak, Anama Charan Beherae, and S. Jena. 2015. "Information Communication Technology Promoting Retail Marketing in Agriculture Sector in India as a Study." *Procedia Computer Science* 48. Elsevier Masson SAS: 652–59. https://doi.org/10.1016/j.procs.2015.04.148.

Bhattacherjee, Anol, and G Premkumar. 2004. "Understanding Changes in Belief and Attitude toward Information Technology Usage: A Theoretical Model and Longitudinal Test." *MIs Quarterly* 28 (2): 229–54.

Bihler, Wolfgang. 2006. *Weiterbildungserfolg in Betrieblichen Lehrveranstaltungen; Messung Und Einflussfaktoren Im Bereich Finance and Controlling*. Wiesbaden: Deutscher Universitätsverlag.

Bingen, Jim, Alex Serrano, and Julie Howard. 2003. "Linking Farmers to Markets: Different Approaches to Human Capital Development." *Food Policy* 28 (4): 405–19.

Birner, Regina, Kristin Davis, John Pender, Ephraim Nkonya, Ponniah Anandajayasekeram, Javier Ekboir, Adiel Mbabu, et al. 2009. "From Best Practice to Best Fit: A Framework for Designing and Analyzing Pluralistic Agricultural Advisory Services Worldwide." *The Journal of Agricultural Education and Extension* 15 (4): 341–55. https://doi.org/10.1080/13892240903309595.

Bolger, Joe. 2000. "Capacity Development." *CIDA, Policy Branch* Vol. 1, No.

Brazell, Jeff D., Christopher G. Diener, Ekaterina Karniouchina, William L. Moore, Válerie

Séverin, and Pierre Francois Uldry. 2006. “The No-Choice Option and Dual Response Choice Designs.” *Marketing Letters* 17 (4): 255–68. https://doi.org/10.1007/s11002-006-7943-8.

Budak, Dilek Bostan, Fuat Budak, and Özlem Özgür Kaçira. 2010. “Livestock Producers’ Needs and Willingness to Pay for Extension Services in Adana Province of Turkey.” *African Journal of Agricultural Research* 5 (11): 1187–90. https://doi.org/10.5897/AJAR09.567.

Burton, Rob J F. 2004. “Reconceptualising the ‘Behavioural Approach’ in Agricultural Studies: A Socio-Psychological Perspective.” *Journal of Rural Studies* 20 (3): 359–71. https://doi.org/10.1016/j.jrurstud.2003.12.001.

Cadilhon, Jean-Joseph. 2013. “A Conceptual Framework to Evaluate the Impact of Innovation Platforms on Agrifood Value Chains Development.” In *138th EAAE Seminar on Pro-Poor Innovations in Food Supply Chains*, 14. Ghent: EAAE.

Cadilhon, Jean-Joseph, and Dirk Landmann. 2015. “Evaluation of Nicaragua Learning Alliance.” Nairobi, Kenya: ILRI- International Livestock Research Institute. 2015. http://data.ilri.org/portal/dataset/nicaragualearningalliance.

Cadilhon, Jean-Joseph, N.D. Pham, and B.L. Maass. 2016. “The Tanga Dairy Platform: Fostering Innovations for More Efficient Dairy Chain Coordination in Tanzania.” *International Journal on Food System Dynamics* 7 (2): 81–91. https://doi.org/10.18461/ijfsd.v7i2.723.

Census Organisation of India. 2015. “Population Census 2011.” 2015. http://www.census2011.co.in/.

Chambers, Robert. 1994. “Participatory Rural Appraisal (PRA): Challenges, Potentials and Paradigm.” *World Development* 22 (10): 1437–54. https://doi.org/10.1016/0305-750X(94)90030-2.

Charatsari, Chrysanthi, Afroditi Papadaki-Klavdianou, and Anastasios Michailidis. 2011. “Farmers as Consumers of Agricultural Education Services: Willingness to Pay and Spend Time.” *Journal of Agricultural Education and Extension* 17 (3): 253–66. https://doi.org/10.1080/1389224X.2011.559078.

Chatman, Ljubica, and Betsy Sparrow. 2011. “The Feeling of Doing across Levels of Analysis-The Effects of Perceived Control on Learning.” *Horizons of Psychology* 20 (3): 73–91.

Chauhan, Nikulsinh M. 2010. “Farmers ’ Perception about ICT Application: A Case Study of

Gujarat State." *Indian Research Journal of Extension Education* 10 (3): 21–26.

Cheon, Jongpil, Sangno Lee, Steven M. Crooks, and Jaeki Song. 2012. "An Investigation of Mobile Learning Readiness in Higher Education Based on the Theory of Planned Behavior." *Computers and Education* 59 (3). Elsevier Ltd: 1054–64. https://doi.org/10.1016/j.compedu.2012.04.015.

Chhachhar, Abdul Razaque, and Zulfiqar Ahmed Maher. 2014. "Use of Mobile Phone among Farmers for Agriculture Information." *European Journal of Scientific Research* 119 (2): 265–71.

Chikaire, J.U, A.O. Ani, C.N. Atoma, and A.R. Tijjani. 2015. "Capacity Building: Key to Agricultural Extension Survival." *Scholars Journal of Agriculture and Veterinary Sciences* 2 (1A): 13–21.

Chin, Wynne W. 1998. "The Partial Least Squares Approach for Structural Equation Modeling." In *Modern Methods for Business Research*, 295–336. https://doi.org/10.1016/j.aap.2008.12.010.

Chowdhury, Ataharul Huq, Helen Hambly Odame, and Cees Leeuwis. 2014. "Transforming Roles of Public Extension to Strengthen Innovation: Lessons from Bangladesh." *The Journal of Agriculture Education and Extension* 20 (1): 7–25.

Claro, Danny Pimentel, Geoffrey Hagelaar, and Onno Omta. 2003. "The Determinants of Relational Governance and Performance: How to Manage Business Relationships?" *Industrial Marketing Management* 32 (8): 703–16. https://doi.org/10.1016/j.indmarman.2003.06.010.

Coghlan, David, and Mary Brydon-Miller. 2014. *The Sage Encyclopedia of Action Research*. Los Angeles: SAGE Reference.

Cohen, Jacob. 1992. "A Power Primer." *Psychological Bulletin* 112 (1): 155–59. https://doi.org/10.1037/0033-2909.112.1.155.

Cole, Shawn, and Asanga Nilesh Fernando. 2012. "The Value of Advice: Evidence from Mobile Phone-Based Agricultural Extension." Harvard Business School Working Paper, No. 13–047. Cambridge.

CRS. 2009. *Working Together, Learning Together- Learning Alliances in Agroenterprise*

Development. Edited by Rupert Best, Shaun Ferris, and Paul Mundy. Baltimore, USA: Catholic Relief Services.

Davis, Kristin. 2015. *The New Extensionist: Core Competencies for Individuals*. GFRAS Brie. Lindau, Switzerland: Global Forum for Rural Advisory Services (GFRAS).

Davis, Wayne A. 1984. "A Causal Theory of Intending." *American Philosophical Quarterl* 21 (1): 43–54.

Deichmann, Uwe, Aparajita Goyal, and Deepak Mishra. 2016. "Will Digital Technologies Transform Agriculture in Developing Countries?" *Agricultural Economics (United Kingdom)* 47: 21–33. https://doi.org/10.1111/agec.12300.

Dror, Iddo, Jean-Joseph Cadilhon, Marc Schut, Michael Misiko, and S. Maheshwari, eds. 2016. *Innovation Platforms for Agricultural Development. Evaluating the Mature Innovation Platforms Landscape*. Oxon (United Kingdom) and New York (USA): Routledge.

Essers, Brigitte A B, Debby Van Helvoort-Postulart, Martin H. Prins, Martino Neumann, and Carmen D. Dirksen. 2010. "Does the Inclusion of a Cost Attribute Result in Different Preferences for the Surgical Treatment of Primary Basal Cell Carcinoma?: A Comparison of Two Discrete-Choice Experiments." *PharmacoEconomics* 28 (6): 507–20. https://doi.org/10.2165/11532240-000000000-00000.

FAO. 2011. *The State of Food and Agriculture 2010-2011- Women in Agriculture- Closing the Gender Gap for Development*. Vol. 2. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).

———. 2014. "Nicaragua- Country Indicator." Rome, Italy. 2014. http://www.fao.org/faostat/en/#country/157.

Feder, Gershon, Regina Birner, and Jock R. Anderson. 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. https://doi.org/10.1108/20440831111131505.

Ferroni, Marco, and Yuan Zhou. 2012. "Achievements and Challenges in Agricultural Extension in India." *Global Journal of Emerging Market Economies* 4 (3): 319–46. https://doi.org/10.1177/0974910112460435.

Field, Andy. 2009. “Discovering Statistics Using SPSS.” *Introducing Statistical Methods*. Los Angeles [i.e. Thousand Oaks, Calif.]; London: SAGE Publications.

Fifer, Simon, John Rose, and Stephen Greaves. 2014. “Hypothetical Bias in Stated Choice Experiments: Is It a Problem? And If so, How Do We Deal with It?” *Transportation Research Part A* 61. Elsevier Ltd: 164–77.

Fletschner, Diana. 2009. “Rural Women’s Access to Credit: Market Imperfections and Intrahousehold Dynamics.” *World Development* 37 (3). Elsevier Ltd: 618–31.

Fornell, Claes, and David F. Larcker. 1981. “Evaluating Structural Equation Models with Unobservable Variables and Measurement Error.” *Journal of Marketing Research* 18 (1): 39. https://doi.org/10.2307/3151312.

Fu, Xiaolan, and Shaheen Akter. 2016. “The Impact of Mobile Phone Technology on Agricultural Extension Services Delivery: Evidence from India.” *The Journal of Development Studies* 52 (11): 1561–76. https://doi.org/10.1080/00220388.2016.1146700.

Fukuda-Parr, Sakiko, Carlos Lopes, and Khalid Malik. 2002. “Institutional Innovations for Capacity Development.” In *Capacity for Development: New Solutions to Old Problems*, edited by Sakiko Fukuda-Parr, Carlos Lopes, and Khalid Malik, 1–21. London: Earthscan Publications Ltd.

Furubotn, E. G., and R. Richter, eds. 2010. “Introduction.” In *The New Institutional Economics of Markets*. Cheltenham, UK: Edward Elgar.

Ganesan, M, Kavitha Karthikeyan, Suma Prashant, and Jayalakshmi Umadikar. 2013. “Use of Mobile Multimedia Agricultural Advisory Systems by Indian Farmers : Results of a Survey.” *Journal of Agricultural Extension and Rural Development* 5 (4): 89–99. https://doi.org/10.5897/JAERD13.0466.

Gardner, Susan K. 2009. “Conceptualizing Success in Doctoral Education: Perspectives of Faculty in Seven Disciplines.” *The Review of Higher Education* 32 (3): 383–406. https://doi.org/10.1353/rhe.0.0075.

Garforth, C, T Rehman, K Mckemey, R Tranter, R Cooke, C Yates, J Park, and P Dorward. 2004. “Improving the Design of Knowledge Transfer Strategies By Understanding Farmer Attitudes and Behaviour 1.” *Journal of Farm Management* 1212 (11): 17–32.

Ghosh, Dr. Mun Mun, and Dr. Arindam Ghosh. 2014. “Analysis of Women Participation in Indian Agriculture.” *IOSR Journal of Humanities and Social Science* 19 (5): 01–06. https://doi.org/10.9790/0837-19540106.

Ghosh, Souvik. 2012. “Innovations in Public Sector-Led Agricultural Extension.” *Scientific Research and Essays* 7 (49): 4170–75. https://doi.org/10.5897/SRE12.228.

Gillespie, Stuart. 2004. “Scaling Up Community-Driven Development : A Synthesis of Experience.” *FCND Discussion Paper*, no. 181.

Gleicher, F., D. S. Boninger, A. Strathman, D. Armor, J. Hetts, and M. Ahn. 1995. “With an Eye toward the Future: The Impact of Counterfactual Thinking on Affect, Attitudes, and Behaviour.” In *What Might Have Been : The Social Psychology of Counterfactual Thinking*, edited by N., J. Roese, and M. M. Olson, 283–304. Lawrence Erlbaum Assoc Inc.

Glendenning, Claire J., Suresh Babu, and Kwadwo Asenso-Okyere. 2010. “Review of Agricultural Extension in India: Are Farmers’ Information Needs Being Met?” *IFPRI Discussion Papers* 01048: 1–48.

Glendenning, Claire J, and Pier Palo Ficarelli. 2012. “The Relevance of Content in ICT Initiatives in Indian Agriculture.” *IFPRI Discussion Paper*. Washington D.C.

Government of India. 2008. “Bihar’s Agriculture Development : Opportunities & Challenges - a Report of the Special Task Force on Bihar,” 154.

Gray, B., J. Sebstad, M. Cohen, and K. Stack. 2009. “Can Financial Education Change Behavior ?” *Journal of Human Evolution* 61 (4): 347–62.

Hair, Joseph F., G. Tomas M. Hult, Christian M. Ringle, and Marko Sarstedt. 2017. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*. Los Angeles: SAGE Publications, Inc.

Hall, Andy. 2005. “Capacity Development for Agricultural Biotechnology in Developing Countries: An Innovation Systems View of What It Is and How to Develop It.” *Journal of International Development* 17 (5): 611–30. https://doi.org/10.1002/jid.1227.

———. 2007. “Challenges to Strengthening Agricultural Innovation Systems: Where Do We Go From Here?” *United Nations University- UNU-MERIT*.

Hayes, Andrew F. 2015. “An Index and Test of Linear Moderated Mediation.” *Multivariate*

Behavioral Research 50 (1): 1–22. https://doi.org/10.1080/00273171.2014.962683.

Hayes, Andrew F., and Kristopher J. Preacher. 2014. "Statistical Mediation Analysis with a Multicategorical Independent Variable." *British Journal of Mathematical and Statistical Psychology* 67 (3): 451–70. https://doi.org/10.1111/bmsp.12028.

Hayes, Andrew F. 2012. "PROCESS: A Versatile Computational Tool for Observed Variable Mediation, Moderation, and Conditional Process Modeling."

Hellin, Jon. 2012. "Agricultural Extension, Collective Action and Innovation Systems: Lessons on Network Brokering from Peru and Mexico." *Journal of Agricultural Education and Extension* 18 (2): 141–59.

Henseler, Jörg, Theo K Dijkstra, Marko Sarstedt, Christian M Ringle, Adamantios Diamantopoulos, Detmar W Straub, Ketchen Jr. David J, Joseph F Hair, G Tomas M Hult, and Roger J Calantone. 2014. "Common Beliefs and Reality About PLS: Comments on Rönkkö and Evermann (2013)." *Organizational Research Methods* 17 (2): 182–209. https://doi.org/10.1177/1094428114526928.

Henseler, Jörg, Geoffrey Hubona, and Pauline Ash Ray. 2016. "Using PLS Path Modeling in New Technology Research: Updated Guidelines." *Industrial Management & Data Systems* 116 (1): 2–20. https://doi.org/10.1108/IMDS-09-2015-0382.

Höckert, Jenny, and Magnus Ljung. 2013. "Advisory Encounters Towards a Sustainable Farm Development—Interaction between Systems and Shared Lifeworlds." *The Journal of Agriculture Education and Extension* 19 (3): 291–309.

Holloway, Garth John, and Simeon K Ehui. 2001. "Demand, Supply and Willingness-To-Pay for Extension Services in an Emerging-Market Setting." *American Journal of Agricultural Economics* 83 (3): 764–68. https://doi.org/10.1111/0002-9092.00205.

Homann-Kee Tui, Sabine, Adewale Adekunle, Mark Lundy, Josephine Tucker, Eliud Birachi, Marc Schut, Laurens Klerkx, et al. 2013. "What Are Innovation Platforms?" *Innovation Platforms Practice Brief*. Nairobi, Kenya: ILRI- International Livestock Research Institute.

Horton, Douglas, Anastasia Alexaki, Samuel Bennett-Lartey, Kim Noële Brice, Dindo Campilan, Fred Carden, José de Souza Silva, et al. 2003. *Evaluating Capacity Development*. Hague; Ottawa, ON; Wageningen, the Netherlands: International Service for National Agricultural

Research.

Ingram, Julie. 2008. “Agronomist-Farmer Knowledge Encounters: An Analysis of Knowledge Exchange in the Context of Best Management Practices in England.” *Agriculture and Human Values* 25 (3): 405–18. https://doi.org/10.1007/s10460-008-9134-0.

Jain, Lokesh, Harish Kumar, and R. K. Singla. 2015. “Assessing Mobile Technology Usage for Knowledge Dissemination among Farmers in Punjab.” *Information Technology for Development* 21 (4): 668–76.

Jones, Gwyn E., and Chris Garforth. 1997. “The History, Development, and Future of Agricultural Extension.” In *Improving Agricultural Extension. A Reference Manual*, edited by Burton E. Swanson, Robert P. Bentz, and Andrew J. Sofranko. Rome, Italy: Food and Agriculture Organization of the United Nations.

Kago, Kennedy Macharia, Jean-Joseph Cadilhon, Mary Maina, and Amos Omore. 2015. “Influence of Innovation Platforms on Information Sharing and Nurturing of Smaller Innovation Platforms: A Case Study of the Tanzania Dairy Development Forum.” In *29th International Conference of Agricultural Economists*. Milan, Italy: IAAE.

Kahan, David. 2013. *Market-Oiented Farming: An Overview*. Rome, Italy: Food and Agriculture Organization of the United Nations (FAO).

Karlsson, Madeleine, Gaia Penteriani, Helen Croxson, Alexandra Stanek, Robin Miller, Darshana Pema, and Fadzai Chitiyo. 2017. “Accelerating Affordable Smartphone Ownership in Emerging Markets.” *GSMA*, no. July: 1–59.

Kim, Ki Joon, and Dong-Hee Shin. 2015. “An Acceptance Model for Smart Watches: Implications for the Adoption of Future Wearable Technology.” *Internet Research* 25 (4): 527–41. https://doi.org/10.1108/IntR-05-2014-0126.

Kirkpatrick, Donald L., and James D. Kirkpatrick. 2012. *Implementing the Four Levels: A Practical Guide for Effective Evaluation of Training Programs*. San Francisco: Berrett-Koehler Publishers.

Klerkx, Laurens, Noelle Aarts, and Cees Leeuwis. 2010. “Adaptive Management in Agricultural Innovation Systems: The Interactions between Innovation Networks and Their Environment.” *Agricultural Systems M4 - Citavi*.

Klerkx, Laurens, Barbara van Mierlo, and Cees Leeuwis. 2012. “Evolution of Systems Approaches to Agricultural Innovation: Concepts, Analysis and Interventions.” In *Farming Systems Research into the 21st Century: The New Dynamic*, edited by I. Darnhofer, D. Gibbon, B. Dedieu, and Dordrecht, 457–83. Berlin: Springer.

Kline, Paul. 1993. *The Handbook of Psychological Testing (2nd Ed.)*. *The Handbook of Psychological Testing (2nd Ed.)*. https://doi.org/10.1016/S0191-8869(96)90047-1.

Knowler, Duncan, and Ben Bradshaw. 2007. “Farmers’ Adoption of Conservation Agriculture: A Review and Synthesis of Recent Research.” *Food Policy* 32 (1): 25–48. https://doi.org/10.1016/j.foodpol.2006.01.003.

Ko, Wen-Hwa, and Feng-Ming Chung. 2014. “Teaching Quality, Learning Satisfaction, and Academic Performance among Hospitality Students in Taiwan.” *World Journal of Education* 4 (5). https://doi.org/10.5430/wje.v4n5p11.

Koshkaki, Emadeddin Rahmanian, and Sepideh Solhi. 2016. “The Facilitating Role of Negative Emotion in Decision Making Process: A Hierarchy of Effects Model Approach.” *The Journal of High Technology Management Research* 27 (2): 119–28. https://doi.org/10.1016/j.hitech.2016.10.010.

Kotvojs, Fiona, and Rosalind Hurworth. 2013. “Evaluating Capacity Development: What Do We Really Want to Know ?” *Evaluation Journal of Australasia* 13 (1): 4–14. https://doi.org/10.1177/1035719X1301300102.

Krone, Madlen, Peter Dannenberg, and Gilbert Nduru. 2016. “The Use of Modern Information and Communication Technologies in Smallholder Agriculture: Examples from Kenya and Tanzania.” *Information Development* 32 (5): 1503–12. https://doi.org/10.1177/0266666915611195.

Kumar, Nirmalya. 1996. “The Power of Trust in Manufacturer-Retailer Relationship.” *Harvard Business Review*.

Kwak, Kyuseop, Paul Wang, and Jordan J. Louviere. 2016. “A Novel Approach to Detect Attribute by Covariate Interactions in Discrete Choice Models.” *Journal of Choice Modelling* 21. Elsevier: 42–47.

Laeequddin, Mohammed, B S Sahay, Vinita Sahay, and K Abdul Waheed. 2010. “Measuring Trust

in Supply Chain Partners Relationships." *Measuring Business Excellence* 14 (3): 53–69.

Lafortezza, Daniela, and Etimos S C Consorzio. 2009. "Inventario de Las Cooperativas Productivas." Tegucigalpa, Bandera de HondurasHonduras: BCIE- Banco Centroamericano de Integración Económica.

Lancaster, Kelvin J. 1966. "A New Approach to Consumer Theory." *Journal of Political Economy* 74 (2): 132–57.

Landmann, Dirk. 2015. "The Influence of Trust in the Nicaraguan Learning Alliance on Capacity Development of Members and Other Influenced Groups." Göttingen. 2015.

Landmann, Dirk, and Jean-Joseph Cadilhon. 2016. "With Trust and a Little Help from Our Friends: How the Nicaragua Learning Alliance Scaled up Training in Agribusiness." In *Innovation Platforms for Agricultural Development.Evaluating the Mature Innovation Platforms Landscape*, edited by Iddo Dror, Jean-Joseph Cadilhon, Marc Schut, Michael Misiko, and Shreya Maheshwari, 16–41. New York: Routledge.

Leeuwis, Cees, and Anne van den Ban. 2004. *Communication for Rural Innovation*. 3rd ed. Blackwell Science Ltd, Oxford. https://doi.org/10.1002/9780470995235.

Leone, Luigi, Marco Perugini, and Anna Paola Ercolani. 1999. "A Comparison of Three Models of Attitude-Behavior Relationships in the Studying Behavior Domain." *European Journal of Social Psychology*. https://doi.org/10.1002/(SICI)1099-0992(199903/05)29:2/3<161::AID-EJSP919>3.0.CO;2-G.

Liu, Yong, Hongxiu Li, and Christer Carlsson. 2010. "Factors Driving the Adoption of M-Learning: An Empirical Study." *Computers and Education* 55 (3). Elsevier Ltd: 1211–19. https://doi.org/10.1016/j.compedu.2010.05.018.

Ludemann, Ruud, Marianne van Dorp, Tim Chancellor, and Annemarie Groot-Kormelinck. 2012. *Capacity Development in Agricultural Research for Development*. Wageningen/Greenwich.

Lundy, Mark, and María Verónica Gottret. 2005. "Learning Alliances: An Approach for Building Multi-Stakeholder Innovation Systems." Cali, Colombia: CIAT- International Center for Tropical Agriculture.

Lusthaus, C, M Adrien, and M Perstinger. 1999. "Capacity Development: Definitions, Issues and Implications for Planning, Monitoring and Evaluation." *Universalia Occasional Paper* 35

(35): 1–21. http://preval.org/documentos/2034.pdf.

Mangham, Lindsay J., Kara Hanson, and Barbara McPake. 2009. "How to Do (or Not to Do)...Designing a Discrete Choice Experiment for Application in a Low-Income Country." *Health Policy and Planning* 24 (2): 151–58. https://doi.org/10.1093/heapol/czn047.

Mariami, Zewdie Adane, Jean-Joseph Cadilhon, and Christine Werthmann. 2015. "Impact of Innovation Platforms on Marketing Relationships: The Case of Volta Basin Integrated Crop-Livestock Value Chains in Ghana." *African Journal of Agricultural and Resource Economics*.

Martínez-García, Carlos Galdino, Peter Dorward, and Tahir Rehman. 2013. "Factors Influencing Adoption of Improved Grassland Management by Small-Scale Dairy Farmers in Central Mexico and the Implications for Future Research on Smallholder Adoption in Developing Countries." *Livestock Science* 152 (2–3): 228–38. https://doi.org/10.1016/j.livsci.2012.10.007.

McFadden, Daniel. 1973. "Conditional Logit Analysis of Qualitative Choice Behavior." In *Frontiers in Econometrics (Economic Theory and Mathematical Economics)*, edited by P. Zarembka, 252. New York, USA: Academic Press.

Mittal, Surabhi, Sanjay Gandhi, and Gaurav Tripathi. 2010. "Socio-Economic Impact of Mobile Phones on Indian Agriculture." 246. New Delhi: Indian Council for Research on International Economic Relations.

Mittal, Surabhi, and Gaurav Tripathi. 2009. "Role of Mobile Phone Technology in Improving Small Farm Productivity." *Agricultural Economics Research Review* 22: 451–59.

Mizrahi, Yemile. 2004. "Capacity Enhancement Indicators." *World Bank Institute Working Papers*. Vol. 37232. Washington D.C.

Mundy, Paul, Benjamin Kwasi Addom, and Krishan Bheenick. 2017. "Beyond the Hype: Mobile Phones and the Web to Improve Agricultural Value Chains." *CTA Technical Briefs* 06.

Muyanga, Milu, and T.S Jayne. 2008. "Private Agricultural Extension System in Kenya: Practice and Policy Lessons." *The Journal of Agriculture Education and Extension* 14 (2): 111–24.

Mwaura, Francis, Fred Roland Muwanika, and Geofrey Okoboi. 2010. "Willingness to Pay for Extension Services in Uganda among Farmers Involved in Crop and Animal Husbandry." In *Joint 3rd AAAE and 48th AEASA Conference*. Cape Town, South Africa: African Association

of Agricultural Economists (AAAE).

Nederlof, Suzanne, Mariana Wongtschowski, and Femke van der Lee, eds. 2011. *Putting Heads Together- Agricultural Innovation Platforms in Practice*. Amsterdam, Netherlands: Bulletin 396, KIT Publishers.

Neely, Constance L. 2010. "Capacity Development for Environmental Management in the Agricultural Sector in Developing Countries." *OECD Environment Working Papers*. Vol. 26. https://doi.org/10.1787/5km4kntgq7xx-en Y3.

Norton, George W., Jeffery Alwang, and William A. Masters. 2006. *Economics of Agricultural Development; World Food Systems and Resource Use*. 2nd ed. London; New York: Routledge.

OECD. 2006. "The Challenge of Capacity Development- Working Towards Good Practice." *Future Virology*.

Oladele, O I. 2008. "Factors Determining Farmers ' Willingness To Pay for Extension Services in Oyo State , Nigeria." *Agricultura Tropica et Subtropica* 41 (4): 165–70.

Olenik, Christina, and Caroline Fawcett. 2013. "State of the Field Report: Examining the Evidence in Youth Workforce Development." USAID- United States Agency for International Development.

Patton, Michael Quinn. 2002. *Qualitative Research and Evaluation Methods*. Vol. 3rd. London, UK: SAGE Publications Ltd. https://doi.org/10.2307/330063.

Pedersen, Line Bjørnskov, Trine Kjær, Jakob Kragstrup, and Dorte Gyrd-Hansen. 2011. "Does the Inclusion of a Cost Attribute in Forced and Unforced Choices Matter? Results from a Web Survey Applying the Discrete Choice Experiment." *Journal of Choice Modelling* 4 (3): 88–109. https://doi.org/10.1016/S1755-5345(13)70044-7.

Perugini, Marco, and Richard P. Bagozzi. 2001. "The Role of Desires and Anticipated Emotions in Goal-Directed Behaviours: Broadening and Deepening the Theory of Planned Behaviour." *British Journal of Social Psychology* 40 (1): 79–98. https://doi.org/10.1348/014466601164704.

Peterson, Warren. 1997. "The Context of Extension in Agricultural and Rural Development." In *Improving Agricultural Extension. A Reference Manual*, edited by Burton E. Swanson, Robert

P. Bentz, and Andrew J. Sofranko. Rome, Italy: FAO.

Pham, Ngoc Die, Jean-Joseph Cadilhon, and Brigitte L. Maass. 2015. “Field Testing a Conceptual Framework for Innovation Platform Impact Assessment : The Case of MilkIT Dairy Platforms in Tanga Region , Tanzania.” *East African Agricultural and Forestry Journal* 81 (1). Taylor & Francis: 58–63. https://doi.org/10.1080/00128325.2015.1041257.

Phillips, Daniel, Hugh Waddington, and Howard White. 2014. “Better Targeting of Farmers as a Channel for Poverty Reduction: A Systematic Review of Farmer Field Schools Targeting.” *Development Studies Research* 1 (1): 113–36. https://doi.org/10.1080/21665095.2014.924841.

Ponniah, Anandajayasekeram, Ranjitha Puskur, Sindu Workneh, and Dirk Hoekstra. 2008. *Concepts and Practices in Agricultural Extension in Developing Countries: A Source Book*. *International Livestock Research Institute, Addis Ababa, Ethiopia, ISBN*. https://doi.org/10.1017/CBO9781107415324.004.

PRAN. 2015. *Annual Report 2014-1015*. Third. Gaya, India: PRAN.

———. 2016. “Interview with Members of the Board of Trustees of PRAN.”

Prasad, R M, Rasheed Sulaiman, and Nimisha Mittal. 2015. “Assessing Capacity Development Needs of Extension and Advisory Services (EAS): A Review.”

Preacher, Kristopher J., and Andrew F. Hayes. 2004. “SPSS and SAS Procedures for Estimating Indirect Effects in Simple Mediaton Models.” *Behavior Research Methods, Instruments, & Computers* 36 (4): 717–31. https://doi.org/10.3758/BF03206553.

Pretty, Jules N. 1995. “Participatory Learning for Sustainable Agriculture.” *World Development* 23 (8): 1247–63. https://doi.org/10.1016/0305-750X(95)00046-F.

Rao, N. H. 2007. “A Framework for Implementing Information and Communication Technologies in Agricultural Development in India.” *Technological Forecasting and Social Change* 74: 491–518. https://doi.org/10.1016/j.techfore.2006.02.002.

Rivera, William M. 2011. “Public Sector Agricultural Extension System Reform and the Challenges Ahead.” *Journal of Agricultural Education and Extension* 17 (2): 165–80.

Rivera, William M., and Gary E. Alex. 2008. “Human Resource Development for Modernizing the Agricultural Workforce.” *Human Resource Development Review* 7 (4): 374–86.

https://doi.org/10.1177/1534484308324633.

Robinson-Pant, Anna. 2016. *Learning Knowledge and Skills- for Agriculture to Improve Rural Livelihoods*. *Nurse Educator*. Vol. 13. Rome, Italy: UNESCO. https://doi.org/10.1097/00006223-198811000-00008.

Rodgers, Gerry, Amrita Datta, Janine Rodgers, Sunil K. Mishra, and Alakh N. Sharma. 2013. *The Challenge of Inclusive Development in Rural Bihar.* New Delhi, India: Institute for Human Development and MANAK Publications PVT. LTD.

Rogers, Everett M. 1995. "Diffusion of Innovations." *New York* 12.

Rönkkö, Mikko, and Joerg Evermann. 2013. "A Critical Examination of Common Beliefs About Partial Least Squares Path Modeling." *Organizational Research Methods* 16 (3): 425–48. https://doi.org/10.1177/1094428112474693.

Rosa, Cecilia de, Andrew Nadeau, Emilio Hernandez, Fred Kafeero, and Jacques Zahiga. 2016. "Delivery Strategies to Enhance the Sustainability of Training: Lessons from the Food and Agriculture Organization of the United Nations." *International Journal of Training and Development* 20 (2): 164–76. https://doi.org/10.1111/ijtd.12074.

Sándor, Zsolt, and Michel Wedel. 2005. "Heterogeneous Conjoint Choice Designs." *Journal of Marketing Research* 42 (2): 210–18.

Sanzo, M. José, M. Leticia Santos, Rodolfo Vázquez, and Luis I. Alvarez. 2003. "The Role of Market Orientation In Business Dyadic Relationships: Testing an Integrator Model." *Journal of Marketing Management* 19 (1): 73–107. https://doi.org/10.1362/026725703763771971.

Sarstedt, Marko, Jörg Henseler, and Christian M. Ringle. 2011. "Multigroup Analysis in Partial Least Squares (PLS) Path Modeling: Alternative Methods and Empirical Results." *Advances in International Marketing* 22 (June 2014): 195–218. https://doi.org/10.1108/S1474-7979(2011)0000022012.

SawtoothSoftware. 2017. "SawtoothSoftware." 2017. http://www.sawtoothsoftware.com/.

Scarpa, Riccardo, Mara Thiene, and Kenneth E. Train. 2008. "Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps." *American Journal of Agricultural Economics* 90 (4): 994–1010. https://doi.org/10.1111/j.1467-8276.2008.01155.x.

Sekabira, Haruna, and Matin Qaim. 2017. “Mobile Money, Agricultural Marketing, and off-Farm Income in Uganda.” *Agricultural Economics* 48: 597–611. https://doi.org/10.1111/agec.12360.

Sharma, Alakh N., and Gerry Rodgers. 2015. “Structural Change in Bihar ’ s Rural Economy Findings from a Longitudinal Study.” *Economic and Political Weekly* l (52): 1998–2000.

Sheeran, Paschal. 2002. “Intention—Behavior Relations: A Conceptual and Empirical Review.” *European Review of Social Psychology* 12: 1–36. https://doi.org/10.1080/14792772143000003.

Sonnier, Garrett, Andrew Ainslie, and Thomas Otter. 2007. “Heterogeneity Distributions of Willingness-to-Pay in Choice Models.” *Quantitative Marketing and Economics* 5 (3): 313–31. https://doi.org/10.1007/s11129-007-9024-6.

Statista. 2018. “Share of Mobile Phone Users That Use a Smartphone in India from 2014 to 2019.” 2018. https://www.statista.com/statistics/257048/smartphone-user-penetration-in-india/.

Subedi, Shanker, Jean-Joseph Cadilhon, Thanammal Ravichandranc, and Nils Teufel. 2014. “Impact Evaluation of Innovation Platforms to Increase Dairy Production: A Case from Uttarakhand, Northern India.” *8th International Conference of Asian Society of Agricultural Economists (ASAE) on Viability of Small Farmers in Asia 2014; Saver, Banladesh*. Nairobi, Kenya: ILRI- International Livestock Research Institute.

Swailes, Stephen, and Simon Roodhouse. 2004. “Vocational Qualifications and Higher Education: Some Policy Issues.” *Policy Futures in Education* 2 (1): 31–52.

Teno, Gabriel, and Jean-Joseph Cadilhon. 2016. “Innovation Platforms as a Tool for Improving Agricultural Production: The Case of Yatenga Province, Northern Burkina Faso.” *Field Actions Science Reports* 9 (September). http://factsreports.revues.org/4239.

Terblanche, S.E. 2017. “Professionalism in Rural Advisory Services.” Global Forum for Rural Advisory Services (GFRAS).

Thiene, Mara, and Riccardo Scarpa. 2009. “Deriving and Testing Efficient Estimates of WTP Distributions in Destination Choice Models.” *Environmental and Resource Economics* 44 (3): 379–95. https://doi.org/10.1007/s10640-009-9291-7.

Topală, Ioana. 2014. “Attitudes towards Academic Learning and Learning Satisfaction in Adult

Students." *Procedia - Social and Behavioral Sciences* 142: 227–34. https://doi.org/10.1016/j.sbspro.2014.07.583.

TRAI. 2017. *Overview of Telecom & Broadcasting Sectors- Annual Report 2016- 2017*. Telecom Regulatory Authority of India.

Train, Kenneth E. 2003. *Discrete Choice Methods with Simulation*. Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511753930.

Train, Kenneth E., and Melvyn Weeks. 2005. "Discrete Choice Models in Preference Space and Willing-to-Pay Space." In *Applications of Simulation Methods in Environmental and Resource Economics*, edited by Riccardo Scarpa and Anna Eds. Alberini, 1–16. Dordrecht. https://doi.org/10.1007/1-4020-3684-1.

Trienekens, Jacques H. 2011. "Agricultural Value Chains in Developing Countries A Framework for Analysis." *International Food and Agribusiness Management Review* 14 (2): 51–82.

Ubels, Jan, Naa-Aku Acquaye-Baddoo, and Alan Fowler, eds. 2010. *Capacity Development in Practice*. London; Washington, DC: Earthscan.

UN. 2015. "The Millennium Development Goals Report 2015." *United Nations*.

UNDP. 2008. *Capacity Assessment Methodology: User's Guide*. Edited by Jennifer Colville. New York, USA: UNDP- United Nations Development Programme.

———. 2010. "Monitoring Guidelines of Capacity Development in GEF Operations." *United Nations Development Programme*, 26.

Vallejo, Bertha, and Uta Wehn. 2016. "Capacity Development Evaluation: The Challenge of the Results Agenda and Measuring Return on Investment in the Global South." *World Development* 79. Elsevier Ltd: 1–13. https://doi.org/10.1016/j.worlddev.2015.10.044.

Venkatesh, Viswanath, and H. Bala. 2008. "Technology Acceptance Model 3 and a Research Agenda on Interventions." *Decision Sciences* 39 (2): 273–315. https://doi.org/10.1111/j.1540-5915.2008.00192.x.

Venkatesh, Viswanath, and Fred D. Davis. 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Studies." *Management Science* 46 (2): 186–205. https://doi.org/10.1287/mnsc.46.2.186.11926.

Venkatesh, Viswanath, and Tracy Ann Sykes. 2013. “Digital Divide Initiative Success in Developing Countries: A Longitudinal Field Study in a Village in India.” *Information Systems Research* 24 (2): 239–60. https://doi.org/10.1287/isre.1110.0409.

Verma, Pranay, and Neena Sinha. 2016. “Technology Acceptance Model Revisited for Mobile-Based Agricultural Extension Services in India.” *Management Research and Practice* 8 (4): 29–38.

Waddington, Hugh, Birte Snilstveit, Jorge Hombrados, Martina Vojtkova, Daniel Phillips, Philip Davies, and Howard White. 2014. “Farmer Field Schools for Improving Farming Practices and Farmer Outcomes : A Systematic Review.” *Campbell Systematic Reviews* 6: 335. https://doi.org/10.4073/csr.2014.6.

Watson, David. 2010. “Improving on Results.” In *Capacity Development in Practice*, edited by Jan Ubels, Naa-Aku Acquaye-Baddoo, and Alan Fowler, 239–249 T4–Combining the ‘Best of Two Worlds’ i. London; Washington, DC: Earthscan.

World Bank. 2002. *Voices of the Poor From Many Lands*. Edited by Deepa Narayan and Patti Petesch. *Oxford University Press and The World Bank*. Washington D.C. https://doi.org/10.1596/0-8213-5049-8.

———. 2005. “Bihar: Towards a Development Strategy.” 2005. hhttp://documents.worldbank.org/curated/en/624671468035374716/Bihar-Towards-a-development-strategy.

———. 2007. *World Development Report 2008- Agriculture for Development*. *Agriculture*. Washington D.C.: World Bank. https://doi.org/10.1596/978-0-8213-7233-3.

———. 2010. *Gender and Governance in Rural Services: Insights from India, Ghana and Ethiopia. Washington*. Edited by World Bank. Washington D.C., USA. https://doi.org/10.1596/978-0-8213-7658-4.

———. 2012. *Agricultural Innovation Systems*. Washington D.C.: World Bank. https://doi.org/10.1596/978-0-8213-8684-2.

———. 2013. *Implementing Agriculture for Development- Agriculture Action Plan*. Washington D.C.: World Bank.

———. 2016a. “Bihar- Indicators at a Glance.” 2016.

http://documents.worldbank.org/curated/en/908411467992055870/Bihar-Indicators-at-a-glance.

———. 2016b. *World Development Report 2016: Digital Dividends*. Edited by Bruce Ross-Larson. *World Development REport*. Vol. 65. Washington D.C.: World Bank. https://doi.org/10.1596/978-1-4648-0671-1.

———. 2017. "Nicaragua: Paving the Way to Faster Growth and Inclusion. Systematic Country Diagnostic."

Žabkar, Vesna, Maja Makovec Brenčič, and Tanja Dmitrović. 2010. "Modelling Perceived Quality, Visitor Satisfaction and Behavioural Intentions at the Destination Level." *Tourism Management* 31 (4): 537–46. https://doi.org/10.1016/j.tourman.2009.06.005.

Zeweld, Woldegebrial, Guido Van Huylenbroeck, Girmay Tesfay, and Stijn Speelman. 2017. "Smallholder Farmers' Behavioural Intentions towards Sustainable Agricultural Practices." *Journal of Environmental Management* 187. Elsevier Ltd: 71–81. https://doi.org/10.1016/j.jenvman.2016.11.014.

Zhang, Ping, and Na Li. 2005. "The Importance of Affective Quality." *Commun. ACM Communications of the ACM* 48 (9): 105–8.

General appendix

E-ID	Year	Month	Day	Number
	16			

Appendix 1: Farmers Questionnaire – Summer 2016

Objective of survey

I am a research associate from University of Göttingen. We are doing a study to understand extension service preferences of small-scale farmers and the factors influencing these preferences. You have been randomly selected among many other farmers to participate in our study. Your participation is voluntary, and your responses will be most appreciated.

Informed consent

Your responses will be treated COMPLETELY CONFIDENTIAL. Therefore, your responses will not be associated to your name in any of our work or in our further interviews. They will be added to those of 500 other respondents and analysed together. Do you have any questions or comments about this survey? If no, thank you and let us proceed.

Dirk Landmann; Tel: 9.102.276.949; Email: dlandma@gwdg.de

ENUMERATOR: Find the household member that is doing most of the work (regarding to working hours) on this farm. If you find the person doing most of the work or at least doing second most of the work, please start the interview. Otherwise, DO NOT interview the person on the farm. Please go to next household doing farming.

Before starting the interview, please make sure the respondent knows that answers are confidential, that she/ he understands the aim of the survey and that his/her help is much appreciated.

Place of Interview										
Date:										
Start time:										
S1. District:	1	2	3	4	5	6	7	8	9	10
S2. Block:	1	2	3	4	5	6	7	8	9	10
S3. Panchayat:	1	2	3	4	5	6	7	8	9	10
S4. Village:										
S5. Enumerator-ID:	1	2	3	4	5	6	7	8		
S6. GPS Coordinates:	S6a. Latitude									
	S6b. Longitude									
	S6c. Altitude									
Please choose one of the five options and then follow the instructions with which sections you should continue, after answering the general questions.										

ENUMERATOR: This question is very important for the next block about agriculture. Please make sure that the farmer gives the correct answer.

S7. Which farm activities does your household currently carry out?				
1= Only Crops	2= More crops than Livestock	3= Both equally divided	4= More livestock than crops	5= Only livestock
C-TYPE	C-LS-TYPE:			LS-TYPE:

Household
Introduction: The following question aims to find out how the household is structured and who of your household is active in agriculture. Please provide us first with the total number of household members. **Household members:** Have to be older than one year. That are the people who live together for more than one year, usually pool their income and eat at least one meal together every day when they are at home. This does not include people who have permanently migrated or are considered visitors. Afterwards please provide us with more detailed information about each household member.

S8. Who is living in your household?					
A) Number of Householder member	B) Position inside the household (related to the household head) *[1]	C) Age	D) Gender (1= Male; 2= Female)	E) Main working occupation (1= Agriculture of Household; 2= Wage labour; 3= Migrated wage labour; 4= Working in the household; 5= Farmworker outside the household; 6= Not Applicable; 7= Other)	F) Who are you? (Please mark the person you are)
…	…	…	…	…	…

*[1] 1= Household Head; 2= Husband/ wife/ spouse; 3= Son/ daughter; 4= Brother/sister; 5= Father/ mother; 6= Father/ mother-in-law; 7= Daughter/son -in-law; 8= Brother/Sister-in-law; 9= grandson/ daughter; 10= Niece/Nephew; 11= Permanent servant; 12= Farm worker; 13= Other relative

ENUMERATOR: Check Question S7: to see which Question applies to the current respondent. If the question does not apply use" 0= not applicable"

S9a. For those who are working in agriculture, please provide us with the following information about **crop production**.			
Those working in agriculture (Age)	Working hours per week and person in crop production.	Who is the main decision maker of agricultural crop production?	Who is the main decision maker about buying agricultural inputs and selling agricultural produce for crop production?
…	…	…	…

S9b. For those who are working in agriculture, please provide us with the following information about **livestock production**.			
Those working in agriculture (Put their Age here)	Working hours per week and person in livestock production.	Who is the main decision maker of agricultural livestock production?	Who is the main decision maker about buying agricultural inputs and selling agricultural produce for livestock production?
…	…	…	…

ENUMERATOR: Please continue the interview with the person doing most of the agricultural work or at least with the second place.
The following section comprises questions about you and the household you live in. Please provide us with the following information or choose an option.

A: Respondent	
A1. Name	
A2. Mobile-Phone-Number	

A3. Religion:	1= Hindu	2= Muslim	3= Christian	4= No religion	5= Other: _____

If you belong to Hindi, please choose one category and a caste you belong to. If you belong to another religion, please continue with Question A4.

A3a. What is your category (a) and caste (b)?						
		Caste				
Category	1 = Gen. category	a) Brahmin	b) Bhumihar	c) Rajput	d) Kayastha	e) Other
	2 = Other backward class	a) Yadav	b) Koiri	c) Kurmee	d) Lohar	e) Baniya
		f) Kahar	g) Badhai	h) Garediya	i) Naai	j) Other
	3 = Scheduled caste	a) Paswan	b) Bhuiya	c) Pasi	d) Dhuniya	
		e) Chamar	f) Musahar	g) Dhobi	h) Other:	
	4= Others:					
	5= None					

A4. Marital Status:	1= Married	2= single	3= divorced	4= widowed

A5. What is your highest Education completed? (Choose one option)	1= No degree	2= Primary School	3= Secondary School	4= Graduate	5= Post-Graduate	6= Other Specify:

A6. Literacy status (Please answer with yes and no)?		
A6a. Can you read?	1= Yes	2= No
A6b. Can you write?	1= Yes	2= No
A6c. Can you calculate?	1= Yes	2= No

A7. Does your household have access to (More than one option possible)?	A) Electricity	B) Internet	C) Radio	D) Newspaper	E) Television

A8. Do you own a **smartphone**?	1= Yes	2= No
A8a. **If no**, do you have access to use a smartphone?	1= Yes	2= No

Now I would like us to discuss matters related to the farming activities such as crop and livestock production. Thus, the next section deals with you as a farmer. Please answer the questions with regard to your business and farming activities.

B: Farm
How much land do you own? Please specify a.) how much land you own in total, b) how much of this total land is used for own purposes, c) how much of the total land you rent out and d) how much is fallow land. Please also specify the unit you are using in order to answer the three questions.

B1. Own Land:	a) TOTAL	b) Used for own purposes	c) Rented out:	d) Fallow land (unused)	e) Unit *(1= Bigha, 2= Katha, 3= Decimal, 4= Acres, 5= Hectare)*

How much land do you cultivate? Please specify a.) how much land you cultivate in total, b) how much of this total land is your own, c) how much of the total land you rented. Please also specify the unit you are using in order to answer the three questions (Use the one you mentioned above).

B2. Cultivated Land:	a) TOTAL	b) Own land	c) Rented in	d) Unit *(1= Bigha, 2= Kattha,3= Decimal, 4= Acres, 5= Hectare)*

B3. How many plots* do you cultivate?	
Plots: a piece of land that is not spatially segmented and where one crop have more or less the same age and managed in the same way	

B4. For how many years have you been farming (as an independent household)?	

B5. What produce is the outcome of your crop production? What crops did you produce in the last year (From 01.03.2015 until 29.02.2016)?
Please fill out the list. Please only fill in the information for the crops you are cultivating and answer all questions until M).

A)	B)	C)	D)	E)	F)	G)	H)	I)	J)	K)	L)	M)
Crop	Season: W= Winter; S= Spring; R= Rainy*[1]	Area		Yield (Quantity)					Expenditure in INR in the last three seasons (one Year)	Revenues in INR in the last three seasons (one Year)	Profits in INR in the last three seasons (one Year)	Buyer: *1= Direct (Consumer), 2=Local market, 3=Middleman; 4= Cooperative 5= Export Company; 6=Other*
		Total	Unit *(1= Bigha, 2= Kattha, 3= Decimal, 4= Acres, 5= Hectare)*	Total	Home consume	Sold	Seed	Unit				
Paddy												
Wheat												
Vegetables												
Millets												
Oilseeds												
Pulses												
Lentils												
Sugarcane												
Maize												
Gram												
Other												

*[1]: *W= Winter (14.Dec. - 30. Feb.); S= Spring (1. March- 15. Jun); R= Rainy (16. Jun- 15. Dec)*

Next, we will discuss livestock production and marketing activities.
Which animals did you have on your farm in the last season (between 01.03.2015 and 29.02.2016?

Please fill out the list, starting with A) choosing a type of animal you possess, and answer all questions until N) for each type of livestock you have for production. Please one option or put the number according to your farm.

B6. What kind of livestock do you have and what are the (a) production characteristics of your livestock production?

A)	B)	C)	D)	E)	F)	G)	H)	I)	J)	K)	L)
Type of livestock	TOTAL number of animals	Number of animals active in the production right now	Produced good *(1= milk, 2= eggs; 3= meat; 4= living animals; 5= Work force; 6= Other-Specify)*	Quantity				Expenditure in INR in the last three seasons (Year)	Revenues in INR in the last three seasons (Year)	Profits in INR in the last three seasons (Year)	Buyer: *1= Direct (Consumer), 2=Local market, 3=Middleman; 4= Supermarket; 5= Cooperative 6= Export Company; 7=Other*
				Unit *(1= kg; 2= Quintal; 3= pieces; 4= Litre; 5= other)*	Total pro-duction per day	Home consume	Sold				
Cows											
Buffalo											
Goats											
Pigs											
Poultry											
Laying hens											
Other:											
TOTAL											

Let's now talk about external workers use of agricultural production (Crop and Livestock) on your farm.

Please indicate for each season how many external workers are working on your farm in agricultural production (Crop and Livestock), starting with (B) and fill out the table until H). If something is not applicable use 999 and if something is not known use 888.
ENUMERATOR (EXAMPLE): During winter 3 external workers were working on your farm. Two of them, C) 2 male, D) 1 female; E) per person they work 4 hours each day and F) receive 200 INR for salary. G) in total each of them worked 40 days the winter season; H) Activities they did were 1= Seeding and 3= harvesting.)

B7. External Workers- How many external workers are working on your farm? How many workers do you have, hired?

A)	B)	C)	D)	E)	F)
Season	Number of workers	Male	Female	Working days per worker and per season	Working area: *(1= Crops; 2= Livestock)*
I. Winter (14.12.2015- 30.02.2016)					
II. Spring (01.03.2015- 15.06.2015)					
III. Rainy (16.06.2015- 15.12.2015)					

999= Not applicable; 888= Not known

C: Society structure; network; Organisation

The following chapter is about how connected you are within the village or with other organisations, institutions, companies etc. Please answer each question, reminding yourself how you act and work with others.

C1. Are you a member of a network, society or organisation?

1= Yes	2= No

C1a. What are the reasons why you are not participating in an organisation/ network?

1= No benefits	2= No opportunity to participate	3= Bad experience in the past	4= Other Specify:

C2. With whom are you working together with related to your agricultural production/ business? (Private companies [e.g. Buyer, traders, agents) networks, cooperations]) Which of the following organisations do you work together with related to your agricultural production/ business?

If one of the options in A) applies to you, please complete the table regarding your choice in A). One sector can represent more than one institution or company (e.g. Private sector here can describe several different private companies).

A) Form of organisation you are working with	B) Type of support (you can choose several options) *[1]	C) What is the most important factor, why you are working together (Choose one option)? *1= Best price; 2= Long relationship; 3= Closest Distance; 4= Only option; 5= recommended by others; 6= Best product/ service; 7= Best facilities; 8= Others*	D) Working together since/ Member since	E) Member-ship fee (INR per month)	Numbers of members			**I) Ranking of most important partners (1: Most important)**
					F) TOTAL	G) Male	H) Female	
1= PRAN								
2= FnF								
3= Jeevika								
4= KVK								
5= Other Government								
6= Other NGO								
7= Private sector								
8= Public								
9= Other Association								
10= Other Organisation								
11= Other Cooperative								
12= Other specify:								

*[1] Type of support	1= Seeds	2= Fertilizer	3= Pesticides, Herbicides	4= Medicine for livestock	5= Input support for livestock	6= Technical support (machinery)
	7= Trainings	8= Demonstrations	9= Extension service	10= Network activity- Information exchange	11= Trader	12= Processor
	13= Retailer	14= Service Provider	15= Provision of credits	16= Other	17= None	
Please choose Yes or No. If yes: specify reasons with choosing the option that applies most to you.						

C3. Have you ever left a Community, network or society?	1= Yes	2= No		
C3a. **If Yes**, what was the reason for leaving:	1= stopped their activity	2= No benefits	3= Better option	4= Other Specify:

D: Information
Please answer the question by choosing 3 options for each category: Production and Business. Please rank your choices from 1 (most important) to 3 (least important)

D1. What is the most important **channel of communication** you usually use for your Production /Business? Rank (1-3)		
	A) Production	B) Business
1= Telephone		
2= Mobil phone		
3= Smartphone		
4= Computer		
5= Radio		
6= TV		
7= newspaper		
8= Direct individual contact		
9= Group meetings		
10= Other specify:		
D1a. Which channel of communication will be the most important in the next five years for agricultural production/ business?	Code: ____	Code: ____

Please answer the question by choosing 3 options for each category: Production and Business. Please rank your choices from 1 (most important) to 3 (least important)

D2. What is the most important **source of information about the** Business/Production for you? Rank (1-3)		
	A) Production	B) Business
1= Extension agents		
2= newspaper		
3= TV		
4= Neighbours, Farmer-colleagues		
5= Group member (or my cooperative)		
6= Regional organisations		
7= Governmental organisations		
8= Private companies		
9= NGOs		
10= Other organisations		
11= Other (Specify)		
D2a. Which source of information will be the most important in the next five years about agricultural production/ business?	Code: ____	Code: ____

E: experience with Capacity development activities

This section deals with your experience in capacity development activities/ training. Please choose yes, if you ever participated in a capacity development activity/ training, or if you are right now participating. If you answer No, please continue with 1a. and then the next section E1. If you already participated at training or you are doing it right now continue with question E2.

E1. Have you ever had the possibility to participate at training?				1= Yes	2= No	
E1a.If you are not participating at the training, which reason applies most to you?	1= no benefits	2= no options	3= Bad experience	4= Costs are too high	5= No time	6= Other

E2. What kind of training/ extension services did you already participate?
Please use for each training one row. One training can be one meeting or can go on for several weeks or month. One training is about one topic and is set by a certain schedule. Please choose in each box only one option or put a number.

A)	B)	C)	D)	E)	F)	G)	H)	I)	J)	K)
Type of training *(1= Mass media (Smartphones, Radio, Television); 2= Classroom; 3= Classroom + demonstrations)*	When did the training start? Month	When did the training start? Year	Who provided the training? *(1= PRAN; 2= FnF; 3= NGO; 4= Jeevica; 5= KVK; 4= Government; 5= Private sector 6= Other Specify)*	Duration of the training in days?	Duration of each meeting? (hours)	What was it about? *(1= Crop production; 2= Livestock; 3= markets)*	Distance from place of training to your house (in Traveling hours)?	What was your main motivation to participate in the training? *(1= gaining knowledge; 2= free provision; 3= my friends/ neighbour farmers are going; 4= Getting benefits/inputs at the training; 5= Other Specify)*	How satisfied are you with this training? Scale: 1 (not at all) to 5 (Extremely)	How did the training fit your needs? Scale: 1 (not at all) to 5 (Extremely much)
…	…	…	…	…	…	…	…	…	…	…

Please read all the statements to measure performance by giving points with one number between 1 (strongly disagree) and 5 (strongly agree).

E3. Please choose for each statement how much you agree or disagree with this statement.

SECTION E3: Focus Indicators for Performance "Capacity Development"	
1. We had enough capital for doing new investments in the last year.	
2. It was easier to get inputs & services needed for our agricultural production in the last year.	
3. Total quantity of produced goods has increased in the last year.	
4 We have introduced new crops in the last year.	
5. In the last year, we have adopted new practices in business and/or production.	
6. Annual income from agriculture has been increasing in the last year.	
7. Our knowledge about our agricultural production and business has improved in the last year.	

Please provide us with the reason why you would like to receive a training.

E4. Are you interested in the participation of training?	1= Yes	2= No

E4a. Which statement fits most to your opinion? Please give points to each statement. In total, you can give 20 points.

1	I will be able to have higher yields	
2	I will be able to get a better price	
3	I will produce the same yield in less time	
4	I will produce the same yield with less spending	
5	My colleagues are recommending me to participate at the training.	
SUM		20

F: Preferences for capacity development forms

Now I would like us to discuss matters related to the farming activities such as crop and livestock production. Thus, the next section deals with you as a farmer. Please answer the questions regarding your business and farming activities. **Please choose one of the five options and then follow the instructions with which sections you should continue, after answering the general questions.**

ENUMERATOR: This question is very important and the base for the following Block: Preferences for capacity development activities

F1. Which farm activities do you consider the most important for the future of your Household?

1= Only Crops	2= More crops than Livestock	3= Both equally divided	4= More livestock than crops	5= Only livestock
C-Future-TYPE	C-LS-Future-TYPE:			LS-Future-TYPE:

ENUMERATOR: Check Section F: Farmer Question 1 to see which Question applies to the current respondent. If the question does not apply use "999= not applicable")

The following section deals with your preferences for capacity development/ training.

ENUMERATOR: Check Section B: Farmer Question 1 To see with which Question you have to continue.

Please fill out the table if you are a C-Future-TYPE (Section F: Farmer Question 1).

Please mark the topics in each section which you consider to be **NOT** important to develop your capacities on crop production in agriculture. Afterwards, distribute points between 0 and 20 to those who are NOT marked/ you consider as important, to express the relevance of each topic to you (the sum has to be 20 in total).

F2. Crop Topics

		Topics	1. Please mark topics **NOT important** to you with an X	2. Focusing on the topics that then remain (those **not** marked with X: please distribute points between 0 and 20 to express the relevance of each topic to you. (The sum has to be 20)
Crop Production	A) Production information about	1. Selection of seed		
		2. New varieties		
		3. Use of pesticide		
		4. Production techniques/ equipment/ machinery		
		5. Production management		
		6. Use of fertilizer		
		7. Extension access		
		8. Irrigation		
	B) Market information about markets	1.Acess of inputs		
		2. Credit possibilities		
		3.Labour access		
		4. Market opportunities (where to sell)		
		5. Market prices		
		6. Market requirements or standards		
E) Human capacity/ soft skills		1. Leadership Skills		
		2. Media/ Communication skills		
		3. Self-competence		
		4. Social competence		
				20

Please fill out the table if you are a LS-Future-TYPE (Section F: Farmer Question 1).

Please mark the topics in each section which you consider to be **NOT** important to develop your capacities on livestock production in agriculture. Afterwards, distribute points between 0 and 20 to those who are NOT marked /you consider as important, to express the relevance of each topic to you (the sum has to be 20 in total).

F3. Livestock topics

		Topics	1. Please mark topics **NOT important** to you with an X	2. Focusing on the topics that then remain (those **not** marked with X: please distribute points between 0 and 20 to express the relevance of each topic to you. (The sum has to be 20)
Livestock production	C) Production information	1. Feeding		
		2. Reproduction, Breeding		
		3. Production techniques/ equipment		
		4.Livestock management		
		6. Animal Health, Diseases detection		
		7. Extension access		
	D) Market information	1.Acess of inputs		
		2. Market opportunities (where to sell)		
		3. Credit possibilities		
		4.Labour access		
		5. Prices		
		6. Market requirements or standards		
E) Human capacity/ soft skills		1= Leadership Skills		
		2. Media/ Communication skills		
		3. Self-competence		
		4. Social competence		
				20

Please fill out the table if you are a C-LS-Future-TYPE (Section F: Farmer Question 1).
Please mark the topics in each section which you consider to be **NOT** important to develop your capacities on livestock production in agriculture. Afterwards, distribute points between 0 and 20 to those who you did NOT mark /you consider as important, to express the relevance of each topic to you (the sum has to be 20 in total).

F4. Crops and Livestock topics together				
		Topics about:	1. Please mark topics **NOT important** to you with an X	2. Focusing on the topics that remain (those **not** marked). Please distribute points between 0 and 20 to express the relevance of each topic to you. (The sum has to be 20)
Crop Production	A) Production information	1. Selection of seed		
		2. New varieties		
		3. Use of pesticide		
		4. Production techniques/ equipment/ machinery		
		5. Production management		
		6. Use of fertilizer		
		7. Extension access		
		8. Irrigation		
	B) Market information	1.Acessment of inputs		
		2. Credit possibilities		
		3.Labour access		
		4. Market opportunities (where to sell)		
		5. Prices		
		6. Market requirements/ standards		
Livestock production	C) Production information	1. Feeding		
		2. Reproduction, Breeding		
		3. Production techniques/ equipment		
		4.Livestock management		
		5. Animal Health, Diseases detection		
		6. Extension access		
	D) Market information	1.Assessment of inputs		
		2. Market opportunities (where to sell)		
		3. Credit possibilities		
		4.Labour access		
		5. Prices		
		6. Market requirements or standards		
E) Human capacity/ soft skills		1. Leadership Skills		
		2. Media/ Communication skills		
		3. Self-competence		
		4. Social competence		
				20

G: Discrete Choice Experiment

Please answer the questions reminding yourself what you would consider as most suitable for you.

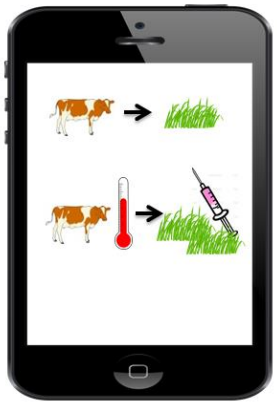
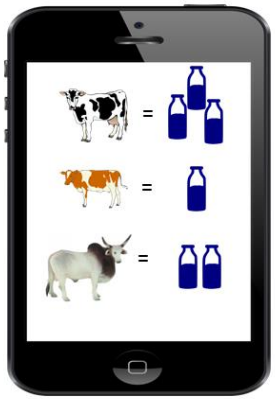
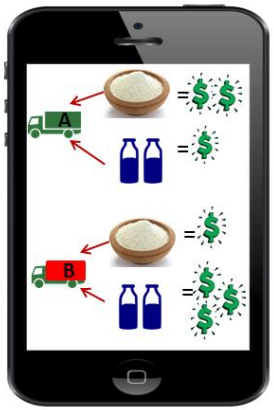
ENUMERATOR: Check Section B: Farmer- Question 1 to see which Question you have to continue. C-Type: EVERY choice they have is related to crops! LS-Type: EVERY choice they have is related to livestock! C-LS-Type: They will have two sections. Section DCE-C is ONLY related to Crops, Section DCE-LS is ONLY related to livestock. Please make sure that the respondents consider this while taking the choice.

In the following, we present different training options to you. Imagine that you would have to choose between different trainings about CROP/ LIVESTOCK production. Please always select the one which you would prefer the most under realistic conditions. Afterwards, you will always be asked if you would take this choice in real life as well.
The three different schemes of training are presented in the table. Please read it carefully and make sure you understand each of them.

Attribute	Method of training	Trainer	Additional offer	Duration of one training	Training costs	Location
Level	Mass Media	Farmers' colleague- Known by participants	Credits (Financial support)	Half a day	50 INR	Local/ village- no travel costs compensation
	Class-room-training	Expert trained on the job	Inputs (Trials of Seeds/ Fertilizer)	1 full day	100 INR	Regional- travel costs compensation
	Classroom training with field demonstration	Expert trained by university	Network activities (regular information exchange with colleagues)	Two full days	150 INR	Remote- travel costs compensation
			No offer			

H: ICT- Theory of Planned Behaviour

ENUMERATOR: Please explain the following example to the farmer. Make sure that the farmer understood the possible ideas through asking a few questions.
Now we present you a possible way how smartphones could be used in the future to provide you with information and develop your skills. What we show to you is not available yet. It might be available in the near future. We want to understand your point of view concerning this way of receiving agricultural information and knowledge. Please do always have the following examples in your mind while answering the question of the next block.
Here are the examples:

Information about the use of seeds and their stress tolerance	**Information about the time when to use fertilizer**	**Information about Diseases of animals and ways to treat those**	**Information about characteristics of different cows**	**Information about current market prices of your produce**	**Information about estimated future prices**
					
You can receive information about the stress tolerance of different varieties and how to deal best with drought seasons.	Here you can receive information about the best point of time when to use fertilizer during the growth of a crop.	You can receive information about symptoms of animal diseases and ways to treat those (example: body temperature)	You can receive information about different breeds. (example what they need to eat, and they are able to produce)	You can also receive information where you can sell your different products and what current price you will receive.	You can get information about estimated future prices for different goods based on the last season & experts.

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree."

H-I: Attitude		
1	Using a smartphone to generate agricultural knowledge will be good.	
2	Using a smartphone to generate agricultural knowledge will increase productivity.	
3	Using a smartphone to generate agricultural knowledge will be helpful.	
4	The use of the smartphone as a learning tool excites me.	
5	Using a smartphone for generation of agricultural knowledge would be a pleasant experience.	
6	Using a smartphone to generate agricultural knowledge will make my work more attractive.	
7	I would like the agricultural work more if I would use a smartphone.	

H-II: Norms		
1	Stakeholders I am working with think I should integrate smartphones to generate agricultural knowledge.	
2	Most people who are important to me would be in favour of using a smartphone to generate agricultural knowledge.	
3	Other farmers in my surrounding think I should take advantage of smartphones to generate agricultural knowledge.	
4	People whose opinions are valued to me expect that people like me should use smartphones to generate agricultural knowledge.	
5	I feel under pressure by most people who are important to me to use a smartphone to generate agricultural knowledge.	
6	I think other farmers in my village would be willing to adapt a smartphone to generate agricultural knowledge.	
7	Generally, it is expected of me to use a smartphone to generate agricultural knowledge.	

H-III: Beliefs- Self-efficacy		
1	I could generate agricultural knowledge using a smartphone if I try hard enough.	
2	I am confident about using a smartphone to generate agricultural knowledge.	
3	Using a smartphone to generate agricultural knowledge would not challenge me.	
4	I could generate agricultural knowledge using a smartphone if there was no one around to tell me what to do.	
5	I would be able to generate agricultural knowledge using a smartphone if I had seen someone else using it before trying it myself.	
6	I could generate agricultural knowledge using a smartphone if someone would help me to get started	
7	I would be comfortable to use a smartphone to generate agricultural knowledge.	

H-IV: Beliefs- Self-control		
1	Political decisions have a decisive influence on the usage of a smartphone to generate agricultural knowledge.	
2	Whether I use a smartphone to generate agricultural knowledge or not is not entirely up to me.	
3	Farm performance is due to luck.	
4	I think that I have the discipline to learn how to use a smartphone to generate agricultural knowledge.	
5	My own decisions and actions are decisive whether I will use a smartphone.	
6	The interests of other Household-members have a decisive influence on my usage of a smartphone to generate agricultural knowledge.	
7	If I use a smartphone for generating agricultural knowledge or not depends on the funding provided.	

H-V: Positive anticipated emotions								
If I would succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel …								
			Not at all	Slightly	Moderately	Very	Extremely	
1	Excited	not at all	1	2	3	4	5	Extremely
2	Delighted	not at all	1	2	3	4	5	Extremely
3	Happy	not at all	1	2	3	4	5	Extremely
4	Glad	not at all	1	2	3	4	5	Extremely
5	Satisfied	not at all	1	2	3	4	5	Extremely
6	Proud	not at all	1	2	3	4	5	Extremely
7	Self-assured	not at all	1	2	3	4	5	Extremely

H-VI: Negative anticipated emotions								
If I would NOT succeed to increase agricultural knowledge by the aid of using a smartphone, I will feel …								
			Not at all	Slightly	Moderately	Very	Extremely	
1	Angry	not at all	1	2	3	4	5	Extremely
2	Frustrated	not at all	1	2	3	4	5	Extremely
3	Guilty	not at all	1	2	3	4	5	Extremely
4	Ashamed	not at all	1	2	3	4	5	Extremely
5	Sad	not at all	1	2	3	4	5	Extremely
6	Disappointed	not at all	1	2	3	4	5	Extremely
7	Worried	not at all	1	2	3	4	5	Extremely

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree."

VII: Trainers readiness		
1	I think trainers and experts would be in favour of utilizing a smartphone to generate agricultural knowledge.	
2	I think trainers and experts would believe that a smartphone could be a useful educational tool in their training.	
3	I think trainers and experts would possess adequate technical skills to use a smartphone in their training.	

VIII: Farmers readiness		
1	I think other farmers would be in favour of utilizing smartphones in their training.	
2	I think other farmers would believe that a smartphone could be a useful educational tool in their coursework.	
3	I think other farmers would possess adequate technical skills to use a smartphone in the training.	

IX: Perceived usefulness		
1	I think that using a smartphone would enable me to generate agricultural knowledge more quickly.	
2	I think that using a smartphone would make it more convenient for me to generate agricultural knowledge.	
3	I think a smartphone to generate agricultural knowledge is useful.	
4	Overall, I think that using a smartphone to generate agricultural knowledge is advantageous.	
5	With using a smartphone, I can access information on agricultural practices whenever I need it.	
6	Being familiar with smartphones also enables me to work with other technological innovations.	
7	Using a smartphone frequently increases farmers' skills in reading and writing.	
8	Agricultural knowledge I could obtain from smartphones is knowledge I need.	

X: Perceived ease of use		
1	I think that using a smartphone to generate agricultural knowledge would be easy.	
2	I think that using a smartphone to generate agricultural knowledge does not require a lot of mental effort.	
3	Using a smartphone to generate agricultural knowledge will save time.	
4	Agricultural knowledge presented by smartphone applications is much easier to understand than normal training.	
5	Smartphones need to be charged very often.	
6	Smartphones might easily get damaged when working in the fields with them	
7	I would be completely overstrained if the smartphone does not work as it should	

XI: Perceived costs		
1	Learning how to use a smartphone will cost me a lot of time.	
2	Getting a smartphone will be challenging for me.	
3	I think I am able to afford a smartphone in the following two years.	
4	The charges for a smartphone are very high	
5	The purchase prices of smartphones are expensive	
6	Smartphone-accessories are very cheap	

XII: Image		
1	In our sector, a smartphone to generate agricultural knowledge will be a relevant feature.	
2	Farmers that have a smartphone to generate agricultural knowledge enjoy a better reputation.	
3	Smartphone to generate agricultural knowledge will gain greater significance in society.	
4	Smartphones have a good image	
5	Smartphones are too complicated to generate agricultural knowledge.	
6	Smartphones are more reliable than other sources to generate agricultural knowledge.	
7	Smartphones only fit young people	

H-XIII: Desire		
1	My desire for using a smartphone in order to increase agricultural knowledge can be described as very strong	
2	I want to use a smartphone to generate agricultural knowledge.	
3	I am willing to put efforts to get a smartphone.	

H-XIV: Intention		
1	I am planning to use a smartphone to generate agricultural knowledge.	
2	I will expand efforts on using a smartphone to generate agricultural knowledge.	

A-II: Respondent/ Household			
1. Please specify your sources of income of the last 12 months and how much are you generate/ receive through this source. Please name the most important one first.			
Source		In INR	(in per cent)
1	Agriculture		
2	Agricultural wage labour		
3	Wage Labour		
4	Support by family members		
5	support by other institutions		
6	Other business		
7	Other		

2. Would you like to give us any comments regarding our study?

_____
_____
_____
_____

Ending Time:	

Thank you for your attention

E-ID	Year	Month	Day	Number
	16			

Appendix 2: Farmers Questionnaire – December 2016

Objective of the survey
I am a research associate from Göttingen University. We are doing a study to understand which factors influence the participation and evaluation satisfaction of PRANs agricultural training. You have been randomly selected among many other farmers to participate in our study. Your participation is voluntary, and your responses will be most appreciated.
Informed consent
Your responses will be treated ***COMPLETELY CONFIDENTIAL.*** *Therefore, your responses will not be associated with your name in any of our work or in our further interviews. They will be added to those of 250 other respondents and analysed together. Do you have any questions or comments about this survey? If no, thank you and let us proceed.*
Dirk Landmann; ***Tel:*** *9.102.276.949****;*** ***Email:*** *dlandma@gwdg.de*

A1: Respondent	
A1. Name	
A2. Mobile-Phone-Number	

A3. Did you attend the interview last summer?	1= Yes	2= No
A3a: If yes, what was your respondent number (RESP_NUM)?		

B. Place of Interview										
B2. Enumerator-ID:	1	2	3	4	5	6	7	8		

Please choose one of the five options and then follow the instructions with which sections you should continue, after answering the general questions.

ENUMERATOR*: This question is very important for the next block about agriculture. Please make sure that the farmer understands the question correctly.*

B3. Which farm activities does your household currently carry out?				
1 = Only Crops	2 = More crops than Livestock	3 = Both equally divided	4 = More livestock than crops	5 = Only livestock

C. Household	
Introduction: The following question aims to find out how the structure of your household is and who of your household members are working in agriculture. Please provide us with the total number of household members first. **Household members:** Have to be older than one year. These are the people who live together for more than one year, usually pool their income and eat at least one meal together every day when they are at home. This does not include people who have permanently migrated or are considered visitors. Afterwards please provide us with more detailed information about each household member.	
C1. How many members does your household have?	

A) Number of household members working in agriculture.	B) Position inside the household (related to the household head) *[1]	C) Age	D) Gender *(1= Female; 2= Male)*	E) Who are you? (Please mark the person you are)

*[1] *1= Household Head; 2= Husband/ wife/ spouse; 3= Son/ daughter; 4= Brother/sister; 5= Father/ mother; 6= Father/ mother-in-law; 7= Daughter/son -in-law; 8= Brother/Sister-in-law; 9= grandson/ daughter; 10= Niece/Nephew; 11= Permanent servant; 12= Farm worker; 13= Other relative*

C2a. For those who are working in agriculture, please provide us with the following information about **crop production**.			
A) Those working in agriculture (put their age here)	B) Who is doing most of the agricultural work? (Scale of sum with 10 points)	C) Who is the main decision maker of agricultural crop production?	D) Who is the main decision maker about buying agricultural inputs and selling agricultural produce for crop production?
…	…	…	…
SUM	10		

C2b. For those who are working in agriculture, please provide us with the following information about **livestock production**.			
A) Those working in agriculture (Put their age here)	B) Who is doing most of the agricultural work? (Scale of sum with 10 points)	C) Who is the main decision maker of agricultural livestock production?	D) Who is the main decision maker about buying agricultural inputs and selling agricultural produce for livestock production?
…	…	…	…
SUM	10		

The following section comprises questions about you and the household you live in. Please provide us with the following information or choose an option.

A2 Respondent

A4. What religious group do you belong too?				
1 = Hindu	2 = Muslim	3 = Christian	4 = No religion	5 = Other: _____

If you belong to Hindi, please answer the following question and choose one category and a caste you belong too. If you belong to another religion, please continue with Question A4.

Caste						
Category	1 = General category	f) Brahmin	g) Bhumihar	h) Rajput	i) Kayastha	j) other
	2 = Other backward cast	a) Yadav	b) Koiri	c) Kurmee	d) Lohar	e) Baniya
		f) Kahar	g) Badhai	h) Garediya	i) Naai	j) Other _____
	4 = Others	i) Paswan	j) Bhuiya	k) Pasi	l) Dhuniya	m) Chamar
		n) Musahar	o) Dhobi	p) Other		

A5. Marital Status:	1= Married	2= Single	3= Divorced	4= Widowed	

A6. What is your highest education completed? (Choose one option)	1= No degree	2= Primary School	3= Secondary School	4= Graduate	5= Post-Graduate	6= Other Specify:

A7. Literacy status (please answer with yes or no)?					
A7a. Can you read?	1= Yes	2= No	A7b. Can you write?	1= Yes	2= No
A7c. Can you calculate?	1= Yes	2= No			

A8. Do you have access to…? (more than one option possible)	A) Electricity	B) Internet	C) Radio	D) Newspaper	E) Television

A9. Which kind of water access does your household have?				
A) Tapped water	B) Pumped water	C) Portable water	D) Wells	E) Other:

A10. Do you own a smartphone?		1= Yes	2= No
A10a: If no, do you have access to one?	1= Yes	2= No	

A5. What do you expect from today's agricultural training?							
1= Gaining knowledge	2= New skills	3= Free provision	4= My friends/ neighbour farmers are going	5= Getting benefits/ inputs at the training	6= Infor-mation exchange	7= Other: …	8= None

D. Farm
How much land do you cultivate? Please specify a.) how much land you cultivate in total, b) how much of this total land is your own, c) how much of the total land you rented. Please also specify the unit you are using in order to answer the three questions (use the one you mentioned above).

D1. Cultivated land:	a) TOTAL	b) Own land	c) Rented in	d) Unit *(1= Bigha, 2= Kattha,3= Decimal, 4= Acres, 5= Hectare)*

D2. How many plots* do you cultivate?	
** Plots: A piece of land that is not spatially segmented and where one crop has more or less the same age and is managed in the same way.*	
D3. For how many years have you been farming (as an independent household)?	

D4. What produce is the outcome of your crop production? What crops did you produce in the last year (From 01.03.2015 to 15.12.2016)?

Please fill out the list. Please only fill in the information for the crops you are cultivating and answer all questions until M).

A)	B)	C)	D)	E)	F)	G)	H)	I)	J)	K)	L)	M)
Crop	Season: *1= Winter; 2= Spring; 3= Rainy*[1]; 4= Winter and Spring; 5= Winter and rainy; 6= Spring and rainy; 7= Winter, spring and rainy*	Area		Yield (Quantity)					Expenditure in INR in the last three seasons (one Year)	Revenues in INR in the last three seasons (one Year)	Profits in INR in the last three seasons (one Year)	Buyer: *1= Direct (Consumer), 2=Local market, 3=Middleman; 4= Cooperative 5= Export Company; 6=NGO; 7= Other; 8= Not applicable*
		Total	Unit (1= Bigha, 2= Kattha, 3= Decimal, 4= Acres, 5= Hectare)	Total	Home consump-tion	Sold	Seed	Unit: *1= kg; 2= Quintal; 3= Pieces; 4= Litre*				
Paddy												
Wheat (Total)												
SWI[2]												
Vegetables (If **not** listed)												
Millets												
Oilseeds												
Pulses												
Lentils												
Sugarcane												
Maize												
Gram												
Other:												
Potato												
Cauliflower												
Ladyfinger												
Cabbage												
Tomato												

*[1]: W= Winter (14. Dec. - 30. Feb.); S= Spring (1. March- 15. Jun); R= Rainy (16. Jun- 15. Dec); [2]SWI= System of Wheat Intensification

D5. What type of livestock (A) do you have and what is your TOTAL number of animals (B)?

Next, we will discuss livestock production. Which animals did you have on your farm in the last season between 01.03.2015 and 15.12.2016?

A)	B)
Type of livestock	TOTAL number of animals
1.Cows	
2. Buffalo	
3. Goats	
4. Pigs	
5. Poultry	
6. Laying hens	
7. Other:	
8. No animals	

Let us talk about the employment of external workers for agricultural production (crop and livestock) on your farm.

D6. Did you hire external workers for doing agricultural related work in the last year?				
A)	B)	C)	D)	E)
Season	Number of workers	Working days per worker and per season	Working in crop production? Please mark.	Working in livestock production? Please mark.
I. Winter (14.12.2015-30.02.2016)				
II. Spring (01.03.2015-15.06.2015)				
III. Rainy (16.06.2016-15.12.2016)				

999= Not applicable; 888= Not known

E: Network

The following chapter is about how connected you are within the village or with other organisations, institutions, companies. Please answer each question, reminding yourself how you act and work with others.

E1. Are you a member of a network, society or organisation? Are you working together with other sectors or receiving goods through them?	
1= Yes	2= No

E1a. What are the reasons why you are **not** participating in an organisation/ network?			
1= No benefits	2= No opportunity to participate	3= Bad experience in the past	4= Other Specify:

E2. With whom are you working together with related to your agricultural production/ business? (Private companies [e.g. Buyer, traders, agents) networks, cooperations]) Which of the following organisations do you work together with related to your agricultural production/ business?

If one of the options in A) applies to you, please complete the table regarding your choice in A). One sector can represent more than one institution or company (e.g. Private sector here can describe several different private companies).

A) Form of organisation you are working with	B) Type of support (you can choose several options) *[1]	C) What is the most important factor, why you are working together (Choose one option)? *1= Best price; 2= Long relationship; 3= Closest Distance; 4= Only option; 5= recommended by others; 6= Best product/ service; 7= Best facilities; 8= Others*	D) How long you are working together? / Member since (in years)?	E) Ranking of most important partners (1: Most important)
1= PRAN				
2= FnF				
3= Jeevika				
4= KVK				
5= Other Government				
6= Other NGOs				
7= Private sector in general				
8= Public				
9= Other Association				
10= Other Organisation				
11= Other Societies/ Cooperatives				
12= Other specify:				
13= No				

*[1] Type of support	1= Seeds 7= Trainings 13= Retailer	2= Fertilizer 8= Demonstrations 14= Service Provider	3= Pesticides, Herbicides 9= Extension service 15= Provision of credits	4= Medicine for livestock 10= Network activity- Information exchange 16= Other	5= Input support for livestock 11= Trader 17= None	6= Technical support (machines) 12= Processor

F. Information
Please answer the question by choosing 3 options. Please rank your choices from 1 (most important) to 3 (least important)

F1. What is the most important **source of information** for you? Please, rank from 1 (most important) to 3 (less important).	
1= Extension agents	
2= Newspaper	
3= TV	
4= Neighbours, Farmer-colleagues	
5= Group member (members of my group, cooperative,)	
6= Regional organisations	
7= Governmental organisations	
8= Private companies	
9= NGOs	
10= Other organisations	
11= Internet	
12= Agricultural training	
13= Other:	
F1a. Which source of information will be the most important in the next five years about agriculture?	Code:_____

G: Experience with other training
This section deals with your experience in training. Please use for each training one row. One training can be one day- meeting or can go on for several weeks or months. One training is about one topic and is set by a certain schedule. Please choose in each box only one option or put a number inside.

A)	B)	C)	D)	E)	F)	G)	H)
Type of training *(1= Mass media (Smartphones, Radio, Television); 2= Classroom; 3= Classroom + demonstrations)*	Who provided the training? (*1= PRAN; 2= FnF; 3= NGO;4= Jeevika; 5= KVK; 4= Government; 5= Private sector6= Other Specify)*	Duration of the training in days?	Duration of each meeting (Hours)?	What was it about? *(1= Crop production in rainy season; 2= Crop production in summer; 3= Crop production in winter; 4= Livestock; 5= markets)*	What was your main motivation to participate in the training? *(1= Gaining knowledge; 2= New skills; 3= Free provision; 4= my friends/ neighbour farmers are going; 5= Getting benefits/inputs at the training; 6= information exchange; 7= Other Specify; 8= None)*	How satisfied are you with this training? Scale: 1 (not at all) to 5 (extremely)	How did the training fit your needs? Scale: 1 (not at all) to 5 (extremely)

H. Theory of Planned Behaviour

Now we would like to ask you some statements about your opinion towards agricultural training.

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree".

H1. Attitude		
1	I see agricultural training as something positive to be educated in cultivation on winter crops.	
2	Participation in agricultural training is very important to me to acquire new methods.	
3	I find agricultural training useful to exchange information about local improvements with other farmers.	
4	I want to continue producing in a traditional manner rather than trying new ways of production.	
5	I believe that participation in agricultural training will increase my productivity.	
6	By participating in agricultural training, I want to improve our household's standard of living.	
7	Participation in agricultural trainings helps me to be better organized.	
8	Participation in agricultural training courses is instructive.	
9	I can apply the training content in practice.	
10	The agricultural training is about a relevant topic.	

H2. Subjective Norm		
1	I believe that my relatives expect me to succeed in farm work and to improve our income through agricultural training.	
2	My family supports participation in agricultural training.	
3	People who influence me think I should participate in agricultural training.	
4	People in my environment who attend agricultural training are highly respected.	
5	Others think I could gain knowledge through agricultural training.	
6	It is important for me to be respected and appreciated by my environment.	
7	I participate in agricultural training without any advice from friends and family.	
8	I participate in agricultural training even if others do **not** recommend it.	

H3. Perceived Control		
1	I think I can improve our income through agricultural training.	
2	I find it easy to acquire new agricultural techniques during the training.	
3	I think that using agricultural training to generate agricultural knowledge does **not** require a lot of mental effort.	
4	I have the desire to develop myself constantly through agricultural training.	
5	I think there should be access to agricultural training in the future.	
6	I think that the overall effect generated by agricultural training will be positive.	
7	Most farmers in my environment have the possibility to participate in agricultural training.	

H4: Intention		
1	I intend to participate in agricultural training within the next 6 months.	
2	I am planning to apply the knowledge gained today within the next 4 weeks.	

H5. Respondent/ Household/Source of Income			
Please specify your sources of income of the last 12 months and how much are you generate/ receive through this source. *Please name the most important one first.*			
Source		In INR	In per cent
1	Agriculture		
2	Agricultural wage labour		
3	Wage Labour		
4	Support by family members		
5	Support by other institutions		
6	Other business		
7	Other		

Now the agricultural training you participate in will start. We wish you an interesting training.

Second part of the study

Now the second part of the survey starts, which is again about your intention to participate in an agricultural training but also about your satisfaction and learning success.

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree".

H1.1. Attitude after		
1	I believe that participation in agricultural training will increase my productivity.	
2	The agricultural training was positive to be educated in cultivation on winter crops.	
3	Participation in agricultural training is very important to me to acquire new methods.	
4	I find agricultural training useful to exchange information about local improvements with other farmers.	
5	I think that the overall effect generated by agricultural training will be positive.	
6	Participation in agricultural trainings helps me to be better organized.	
7	Participation in agricultural training courses is instructive.	
8	I can apply the training content in practice.	

H3.1. Perceived Control after		
1a	I think I can improve our income through agricultural training.	
2a	I find it easy to acquire new agricultural techniques during the training.	
3a	I think that using agricultural training to generate agricultural knowledge does **not** require a lot of mental effort.	
4a	I have the desire to develop myself constantly through agricultural training.	
5b	I think there should be access to agricultural training in the future.	
6b	I would like to have a different training than the one we had today.	
7b	I think that the overall effect generated by agricultural training will be positive.	

H4.1 Intention after		
1	I intend to participate in agricultural training within the next 6 months.	
2	I can apply the knowledge gained today in the next 5 weeks.	

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree".

I1. Satisfaction	
I1.1 Reasons for joining	I gained knowledge during the training.
	My friends /family attended the training.
	I exchanged knowledge with other farmers.
	I improved my agricultural skills.
	I had no costs through the training.
	I had benefits through the agricultural training.
I1.2 Expectation	My expectations were fulfilled to my satisfaction.
I1.3 Duration	The training lasted much too long.
	The training was well timed.
	The training was too short.
I1.4 Training content	The training contained irrelevant information.
	The training was too theoretical.
	The training was perfectly balanced between practical and theoretical information.
1.5 Practical importance	I will be able to apply most of the training content in practice.
	I could hardly apply today's training content in practice.
	The training content was irrelevant for me.
1.6 Trainers' competence	The instructor was able to convey the contents of the training very well.
	The trainer could handle the participants very well.
	The instructor was **not** good.

The next question is about other possible topics for agricultural training. Please rate those statements, which topic is important to you and you would participate in a training.

Please judge the following statements by choosing a point on a scale between "1= not at all and 5= extremely".

I2. Which topics are very important to you?	
I2. Which of the following subjects would you consider in another training session?	
1	I would like to educate myself further in the cultivation of winter crops.
2	I would like to educate myself further in farm mechanization.
3	I would like to have more information access to fertiliser, seedlings, planting material and pesticides.
4	I would like to learn, how I can improve post-harvest storage and treatment.
5	I would like to learn more about business planning.
6	I would like to learn, how to manage a change.
7	I would like to have market information on sales and prices.

J. Learning Success

J1. In this part of the study, we would like to check, which learning contents you have kept? Please choose one of the four possible answers.

ENUMERATOR: The survey is divided into two parts. One part an expert by PRAN is teaching the farmers and in the second part, an academic is teaching. It is very important to choose the right kind of trainer. Please double check your answer.

J. Which kind of trainer has taught you? Please specify.	
1= Expert by PRAN	
2= Academic	

If you have chosen the Expert by PRAN, please go on with the direct following learning success J1. If you have chosen the academic as an expert, please skip the following learning success J1 and start with J2 Learning success for academic.

J1.1 For Shree vidhi process to sow wheat seeds, one needs seeds per katha.				
1= 3 kilogram	2= 5 kilogram	3= 0,5 kilogram	4= 7 kilogram	5= I don't know

J1.2 The requirements for wheat seed sowing are?				
1= Carbondagym copper oxychloride phytolum	2= Hot water, cow urine, jagerry, vermiwash, pot	3= PSB, trycoma, vibhistin	4= none	5= I don't know

J1.3 Materials used in seed treatment?				
1= Vibhistin, diethane M45	2= Captain, phytolum	3= seed trycoderma	4= none	5= I don't know

J1.4 While sowing seeds via shree vidi, the number of seeds at one place will be?				
1= 5	2= 8	3= 6	4= 2	5= I don't know

J1.5 For sowing wheat seeds via shree vidhi, one line is how far from the next line?				
1= 10 inch	2= 12 inch	3= 8 inch	4= 14 inch	5= I don't know

J1.6 The wheat that is planted through shree vidhi, when do you first water it?				
1= 20 days	2= 15 days	3= 25 days	4= 30 days	5= I don't know

J1.7 When is the first time you plough the field?				
1= 20 days	2= 25 days	3= 35 days	4= 30 days	5= I don't know

J1.8 Before harvesting, what are the fertilizers one should use?				
1= DAP, Urea, potash	2= Shreepranamitra, shreejivamitra, Shreedhanjivamitra	3= Single super phosphate, NPK	4= None	5= I don't know

J1.9 After using the first weeder, what are the fertilisers you need to use?				
1= urea, DAP	2= Potash sulpher	3= Shreepranamitra, shreejivamitra	4= None	5= I don't know

J1.10 How many particles are there in 1 kilogram of wheat seeds?				
1= 20000	2= 40000	3= 60000	4= 80000	5= I don't know

J2 Learning Success for Academic
In this part of the study, we would like to check, which learning contents you have kept? Please choose one of the four possible answers.

2.1 If you sow seeds on time, what quantity of seeds would you need per katha?				
1=2 kilograms	2=750 grams	3=1.8 kilogram	4=1 kilogram	5= I don't know

2.2What are the things required for seed treatment?				
1=Bavistin **and** Trychoderma	2=Capton, Phytolom	3=Trychoderma **or** bavistin	4=None of these	5= I don't know

2.3 Which of the following is recommended when you sow the wheat seeds late?				
1=HD 2967	2= HI 1563	3= K9351	4=None of these	5= I don't know

2.4 Which time is the best to sow seeds for wheat?				
1= The whole month of October	2= 15 Nov to 10 Dec	3= The whole month of December	4=15 Oct to 15 Nov	5= I don't know

2.5 If you sow on time, what should be the distance between the two lines of seeds?				
1=10 inch	2=12 inch	3=8 inch	4=14 inch	5= I don't know

2.6 If you have the possibility of one irrigation for the wheat crops, when should you do it?				
1= 20-25 days later	2= 40-45 days later	3= 60-65 days later	4= 80-85 days later	5= I don't know

2.7 How many days after sowing wheat seeds do you use Krptwarnashi?				
1= 40-45 days later	2= 30-35 days later	3= 50-55 days later	4= 20-25 days later	5= I don't know

2.8 Name the Micronutrient to be sprayed to meet the deficiency of zinc:				
1= Muriate of Potash (KCl)	2= Harakashish (FeSO4- Iron Sulfate)	3= Zinc-Sulfate (ZnSO4)	4=1 None of them	5= I don't know

2.9 Between zero till seed cum fertiliser drill to sow seeds, how many times should you till the field?				
1= Twice	2= Thrice	3= Four times	4= No ploughing required	5= I don't know

2.10 How many seed grains do you have in one kilogram of wheat?				
1= 20000	2= 40000	3= 60000	4=80000	5= I don't know

Thank you for your answers. Now we would like to know if you would recommend and participate again in the training.

K1: Would you recommend the agricultural training today?	1= Yes	2= No				
K1a: If you would <u>not</u> recommend the training, which reason applies to you most?	1= No benefits	2= No options	3= Bad experience	4= Costs are too high	5= No time	6= Other
K1b: If yes, why do you recommend today's agricultural training?	1= Useful topic	2= Good trainer	3= No costs	4= Instructive	5= Good expla-nation	6= Other

K2. Would you attend today's agricultural training again?	1= Yes	2= No				
K2a. If you would <u>not</u> attend today's training again, which reason applies to you most?	1= No benefits	2= No options	3= Bad experience	4= Costs are too high	5= No time	6= Other

Please judge the following statements by choosing a point on a scale between "1= strongly disagree" and "5= strongly agree".

L. PRAN		
1	PRAN is a respected partner organisation for me.	
2	PRAN has a positive impact on agricultural development of my farm.	

The next question depends on your trainer. If the expert of PRAN trained you, please go on with M1. If the academic was your trainer please go on with M2.

N1. Would you like to give us any comments regarding our study? _____ _____ _____

Ending Time:	

Thank you for your attention