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Designing capacity development activities of small-scale farmers in developing countries based on discrete choice experiments

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Abstract:

A generally accepted approach to support and increase small-scale farmers' living standards in developing countries is to improve their management capacities by means of agricultural training. In this respect, capacity development is the most efficient and used method to train farmers. However, there is a lack of quantitative information about farmers' preferences of those activities, which are crucial to refine capacity development activities in the future. This study employs a discrete choice experiment analysing the willingness to pay to determine the preferences of small-scale farmers for agricultural training with respect to the training method, trainer, duration, location and additional offers. The main finding is that most important for farmers are training methods including demonstration. Furthermore, farmers would like to receive additional offers during the training and would like to be trained by an trainer with an academic background. Farmers are also willing to pay for these types of training. The outcomes could provide relevant politicians and other stakeholders the opportunity to improve their training programmes and, in the end, make capacity development more efficient.

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

1. Introduction

Capacity development generally describes measures, by which personal skills or important knowledge are developed with the objective of behavioural changes (UNDP 2010, 7; Mizrahi 2004, 15; Fukuda-Parr, Carlos, and Malik 2002, 9). It can be seen as one of the most common methods in developing countries to help people alleviating poverty (Baser et al. 2008, 46). In an agricultural context, farmers' capacities are mostly developed by training activities (Horton et al. 2003, 2, 6). In this respect, capacity development describes both the process and the outcome of these activities, whereby the outcome is defined as new ways of working and new production methods (Lusthaus et al. 1999, p.15 pp.; Hall 2005, p.612). However, the process of capacity development is poorly understood compared to its implementation and impact evaluation (Baser et al. 2008, p.50; Mackay 1999; Watson 2006).

Existing literature about capacity development focuses on what farmers should improve to increase their performance (Waddington et al. 2014), whereas only a few studies ask farmers about their needs. Even more rarely, farmers are asked about the preferred form of training activities within a capacity development context (Mackay 1999; Watson 2006). Furthermore, there is almost no agreement on identification and measurement of the "right" capacity development concept (Watson 2006, 3). In fact, the choice of capacity development activities is mostly taken in a more intuitive way by institutions and organisations (Mackay 1999; Watson 2006). Correspondingly, many papers emphasize that farmers' preferences should be more considered in the process of capacity development as their capacity is being built (e.g. Charatsari et al. 2011; Lusthaus et al. 1999, p.17). This more community-driven approach is also supported by data of the World Bank (Gillespie 2004). To understand the needs of those whose capacities are being built and to improve the capacity development process, an adequate baseline data before starting the training activities is needed according to the World Bank (Watson 2006, p.4 p.). This would be a crucial foundation to develop and enhance need-based capacity development programmes activities in the future. To the best knowledge of the authors, there has been no study yet analysing participants' preferences for capacity development activities.

Against the background of this research gap, the main objective of this paper is to examine the preferences of small-scale farmers' for capacity development. In this context, an empirical investigation based on historical data would be of limited explanatory power, as it is challenging and nearly impossible to clearly distinguish the influencing factors of a successful capacity development program in retrospective. Experiments can provide a solution to this dilemma as they collect data under controlled conditions. In particular, discrete choice experiments (DCEs) allow for the

determination of preferences for action alternatives without explicitly asking for them (e.g., Train, 2009). By relating the respondents' choice behaviour to the attributes of the action alternatives, as well as the respondents' individual characteristics, complex structures of the decision-making process can be revealed (e.g., Louviere et al., 2010). DCEs have already been successfully applied for analysing farmers' preferences, including different technology preferences (e.g., Paulrud and Laitila, 2010), agri-environmental schemes (e.g., Espinosa-Goded et al., 2010) or community forestry design (Gelo & Koch 2012). Charatsari et al. (2011) analysed the willingness to pay (WTP) and willingness to spend time of Greek farmers for agricultural education using the Continent Valuation Method (CVM). Following this, the most important factors for farmers regarding agricultural education are benefits of the participation, content and methodology (Charatsari et al. 2011). However this study was done with well educated farmers in Greece. Furthermore, by means of the CVM approach, it is also not possible to estimate the marginal WTP of attributes and their levels (Hanley et al. 1998).

The data for the present analysis was obtained through a DCE that was carried out with 664 small-scale farmers living in rural in Bihar-India. Participating farmers had to make a choice for their preferred capacity development training activity. The training alternatives were specified by non-monetary attributes that vary across the different choice sets, 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 price to be paid for the training was included as a monetary attribute, to allow for calculating the willingness-to-pay (WTP) or 'implicit price' for a change in each of the non-monetary attributes. Since calculating WTP values as the basis of a model in preference space results in less reasonable WTP distributions (Train and Weeks, 2005), we apply a mixed logit model in WTP space to estimate WTP values. To the best knowledge of the authors, this is the first study that estimates marginal WTP measures for agricultural capacity development activities and, additionally, the first doing this in a developing context with small-scale farmers. The design of the study and the method applied makes it possible to calculate the WTP for different levels in a currency based value.

The remainder of the paper is structured as follows: In section two, the conceptual framework of capacity development is briefly explained and the most important characteristics of capacity development are derived from the literature. Section three describes the experimental design and the analysis method, by which the collected data is analysed. In section four, the respective results are presented and, in section five, they are subsequently discussed. The paper ends with a brief summary and some implications for experts conducting capacity development activities in the field as well as politicians.

2. Capacity Development

This section first is about capacity development its definition, process, evaluation and current approaches in practise. The second section is about capacity development characteristics which are further used in the methodology. The terms capacity development and training refer to the same definition. The term training is also used as it is more common in practise and easier to understand for our respondents.

2.1 Conceptual framework

The Food and Agricultural Organisation of the United Nations (FAO) defines capacity development as a "process whereby individuals […] unleash, strengthen, create, adapt and maintain capacity over time" (FAO 2010, 10). After analysing a variety of sources, Bolger (2000) concluded that "capacity development refers to approaches, strategies and methodologies used to improve performance at the individual […] level" (Bolger 2000, 2). In this paper, the definition quoted by the FAO is further used because it includes different actors, explanation about the process and is also applicable in the field.

Capacity development is normally organized in certain steps. The first step is to set the stage for a participatory approach, understand the context and the lack of knowledge. Subsequent, the missing capacity and strategies to overcome these gaps have to be defined. Following, the analysis during the capacity development activities have to be carried out and monitored. Finally, evaluation of the activities has to take place (Hosono et al. 2011, p.182; UNDP 2008, p.5; FTI 2008; Mackay 1999, p.1 f.). Methods for the collection of the required data regarding the status of both actual and desired capacity are one-to-one interviews, semi-structured interviews, focus group discussions, standardized questionnaires, workshops, case studies, client satisfaction surveys and scorecards and self-assessment instruments (UNDP 2008, p.14). Many capacity development approaches are performance driven, meaning the performance is not at the same level the decision makers such as government, institutions or other stakeholders suppose them to be (Baser et al. 2008, p.51; Mackay 1999, p.1 f.; Watson 2006, p.vi). Setting the desired capacity is necessary but has to be seen under realistic circumstances. Otherwise, it will have a negative influence through disappointment (UNDP 2008, p.16). When individuals, characterized by low income, set the desired capacity of the activities themselves this is called- community-driven approach. Regarding the community-driven approach, data of about 60,000 poor people in 60 countries analysed by the World Bank show that organisations where the respondents feel represented and platforms for negotiating with other stakeholders would cause the greatest difference in their lives. Second most important factor for changing their lives would be community-driven programs to formulate their own destinies. Furthermore, objectives of the poor were developing capacities, facilitating community and

individual empowerment as well as building social and human capital (Gillespie 2004, 1). An analysis of the United Nations literature also come to the conclusion that capacity development should follow an approach responding to partners needs and helping them to reach their own goals and their own objectives of development (Lusthaus et al. 1999).

Demand and supply is a term used in value chains as trade with goods or services is occurring. Even at the capacity development sector demand and supply theories do exist. Institutions and organisations offering capacity development activities move towards activities characterized by inflexibility, standardization, bureaucratization, routine and stagnation (Baser et al. 2008, p.68 p.). This inefficiency of trainings also occurs in developing countries trying to reach small-scale farmers (Gillespie 2004). Experiences show that the most successful capacity development activities are those with the interaction between demanders and suppliers- so called networking approach. Currently, demanders are rather passive with huge needs but without much enthusiasm or power to put suppliers of capacity development under pressure. One approach to overcome these difficulties is to generate demand-inducing supply. This approach finds the niches in the capacity development sector and starts a successful interaction of the demand and supply side with the result of increasing capacity (Baser et al. 2008, 68–71). Especially the network approaches can be demand driven by community groups because of new technologies and communication possibilities (Fukuda-Parr, Carlos, and Malik 2002, 18). In this case, community groups have the control of resources and decisions. Partners of the communities could be stakeholders like NGOs, the private sector, governmental organizations or others. Poor communities normally have greater knowledge about reducing poverty as expected and also get most of the benefits if the resources of poverty reduction are used adequately (Gillespie 2004).

2.2 Characteristics

The following section provides an overview of different criteria and dimensions also defined as attributes and levels to analyse capacity development activities. Following UNDP (United Nations Development Programme) capacity development depends on 11 criteria. These criteria's are: required ownership, collaborative agreements, continuous process, relevant and valid information, incentives and resources, part of an early project design, building on existing mechanism and structures, need for a baseline, need for a benchmark, specific definition and another factor is that capacity development needs to be attributable (UNDP 2010, 9–10). The criteria defined by the UNDP are very broad. The studies quoted to justify the criteria and levels used in the following section are related to the criteria of the UNDP.

Training methods can be characterised by coaching, mentoring, short courses, formal education, face to face interaction and distance/e-learning (Ludemann et al. 2012, p.19 ff.). Rivera and Alex (2008)

call this section source of knowledge and information. They split the sources into the schools, extension service, In-Service training and, mass media and distance learning. In this paper, this attribute is called *method of training* and defined by the levels, mass media, classroom training and classroom training with demonstration (See also table 1). Ludemann et al. (2012, p.19 ff.) define the beneficiaries into the categories scientists, producers, research managers, education staff, trainers, extension agents, and staff from support services. These categories defining the *trainer* from the farmers' perspectives based on Ludemann et al. (2012) are clustered here into an expert trained by the university, an expert trained on the job and farmer's colleague. Farmers often are supported by different goods and services. Besides the training and education activity itself, other offers are credits (financial support), production inputs (trials of seeds and fertilizer), network activities (e.g. Self-Help-Groups) (Bingen et al. 2003; Gray et al. 2009; Peterson 1997). In this study, this characteristic/ attribute is called *additional offer* besides the training itself and defined by the levels credits, production inputs, network activities and no offer at all.

Table 1: Training attributes and attributes levels

Attribute	**Level**
Method of training	Mass Media
	Classroom training
	Classroom training with field demonstration*
Trainer	Farmers colleague*
	Expert trained on the job
	Expert trained by university
Additional offer	Credits (Financial support)
	Inputs (Trials of Seeds/ Fertilizer)
	Regular network activities with colleagues
	No offer*
Duration of one training	Half a day*
	One day
	Two days
Location	Village*
	Regional- travel costs compensation
	Remote- travel costs compensation
Training costs	50 INR
	100 INR
	150 INR

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

Training duration is split by Olenik and Fawcett (2013, 13) into long-term courses, short-term, courses and flexible schedules. The definitions of the terms used are not explicit. Because of this reason we analysed the duration of current training offered to farmers. Based on the terms used by other studies and the information given by other stakeholders, *training duration* is defined by the levels half a day, one day and two days. Training can be given at different places. Robinson-Pant

(2016) defining this by schools, or other places as a community centre. The Scientist of the UNESCO is defining the places by the frequency of visits. In this research we focus on the distance explained in a way that the farmers understand our levels. Because of this *location* of training is divided into village level, regional level with travel cost compensation and remote location also with travel costs compensation. In developed countries, there is a trend towards privatization of extension service given by companies but also by parastatals or agencies enclosed to the government. This trend is more visible at commercial farms than small-scale farmers. However, generating an income through agricultural training offers the stakeholder more possibilities for the supply of training and answering to the special demand of the farmers (Ponniah et al. 2008).

Research done by Essers et al. (2010) and Pederson et al. (2011) proved that the introduction of cost attributes does not lead to changes in preferences of the respondents. We assume that the price attribute is linear to prevent hypothetical bias (Fifer et al. 2014). Based on focus group discussions with farmers and expert discussions with stakeholders working in this region, we realized that the farmers are price sensitive and that the average WTP for agricultural training is 100 Indian rupees (INR) (See also section 3.1 research area and sample). Based on this qualitative data and literature we defined the *cost of the training* by three levels: one below the assumed WTP- 50 INR-, the assumed WTP- 100 INR- and one level above the assumed WTP- 150 INR.

3. Methodology

This section first describes the research area and the sample collected, followed by the experimental design and the modelling approach.

3.1 Research area and sample

This paper is based on Pre-Field visit in December 2015 and a data collected from April to July 2016. The Pre-Field approved the relevance and importance of the attributes and levels in the research area firstly defined by literature (See also section 2.2 Characteristics). During the Pre-Field visit we interviewed 16 key informants and hold five focus group discussions with 71 participating farmers in total. The Focus-Group-Discussions held in the villages itself. Firstly the groups were asked about their understanding and definition of certain terms as “training” or “capacity development”. Secondly, they were asked open questions about the characteristics of training which matter to them and why. Thirdly characteristics which are important according to literature and not mentioned by the farmers were evaluated by the farmers regarding their importance.

During the data collection in 2016 we interviewed 664 Indian farmers living in 27 villages in Bihar State were interviewed. Bihar State is an Indian region located in the north-east of the country. In Bihar, 89% of the population is living in rural areas (Census Organization of India 2015; World Bank

2016). 77% of the Bihari people are working in the agricultural sector. In Bihar agriculture is characterised by a low crop productivity respecting the potential yield, lack of water management, low investment rates and weak infrastructure regarding transport and marketing (World Bank 2005).

The Biharian farmers interviewed are living in the districts of Nalanda, Gaya and Vaishali. The partner organisations we worked with are FarmsNFarmers and PRAN (Preservation and Proliferation of Rural Resources and Nature). In our sample, 196 respondents living in 15 different villages work together with PRAN and 98 together FarmsNFarmers. FnF is active in the region of Vaishali, whereas PRAN is working in Nalanda and Gaya. Both organisations are focused on the agricultural sector. Until a couple of years ago, PRAN was only working with female farmers. Nowadays also male farmers attend the agricultural training. FnF is more involved in business activities as PRAN. They try to link the extension service between farmers and business partners via modern communication technology, such as mobile phones and smartphones. The reference levels of the training attributes (see also table 1) is set respecting the setting of training carried out by PRAN as this is the most known training by the respondents. The reference level is also the most common method nowadays to train farmers.

The interviews were carried out, face to face by eight trained Indian students with tablets using Sawtooth Software (SawtoothSoftware 2017). In each household, one person was identified as a small-scale farmer and interviewed. The entire households surveyed are living from agriculture as the main source of income. Every interviewee has knowledge about the agricultural production of the household.

3.2 Experimental design

The training are characterized by six attributes. Five attributes are defined each by three different levels and one attribute is defined by four different levels. Farmers had two choose seven times, one training out of two. In total 875 ($7 \times 5^3 \times 1^4$) alternative choice-cards are possible. The task was generated by balanced overlap to precise the interaction effects and to observe the must-have effect of respondents for certain levels. We generated 85 different questionnaire versions. Attributes and levels were presented randomized to the respondent. Results of testing the design beforehand showed the biggest standard-error with 0.033, which is below the threshold of 0.05. Each Level belonging to three-Level based attribute was asked 396 or 397 times. Each level belonging to the four-level based attribute was asked 297 or 298 times. The efficiency of each level is between 0.93 and 1.04. After the choice, the respondents had to answer the question if they “would really choose the option selected above, respecting their current situation?” which is also called dual response (see also annex Figure 1: Example of a choice card). The design of the survey and the dual response system was employed because of receptiveness of the interviewees. Brazell et al. (2006) conclude

that dual response showed more efficient estimates than DCEs with an opt-out option. Kallas and Gil (2012) analysed various sources and compared the two approaches with an own analysis of a data set. The authors conclude that with the forced options the share of certain options is bigger and with this, the marginal coefficients are also greater. This is visible in the implicit prices which are greater in the forced discrete choice version. The design of the DCE was also done with the program Sawtooth software (SawtoothSoftware 2017).

3.3 Modelling approach

Lancaster's theory of consumers and Mc Fadden's random utility theory are the base of choice experiments (Abebe et al. 2013). Following Lancaster, consumer chose the option with the highest level of utility (Lancaster 1966). The utility of consumer represented through equation (1).

$$\boldsymbol{U_{in} = V_{in} + \varepsilon_{in}} \tag{1}$$

$\boldsymbol{V}$ represents the deterministic part where the observable factors by the analyst are included. $\boldsymbol{\varepsilon}$ is the random component, which represents the non-observable components (Abebe et al. 2013).

There are two possible ways to analyze the data: mixed logit models or latent class model. Each model makes it possible to capture unobserved heterogeneity and both offer possibilities for unobserved sources of utility to obtain other potential sources of variability. Nevertheless, the mixed logit model is slightly different. The model is fully parametric and flexible. This is why, the mixed logit provides a big range of unobserved heterogeneity (Hensher & Greene 2003, p.697). The latent class model is a semiparametric specification which solves the problem of individual heterogeneity (Hensher & Greene 2003, p.697). However, mixed logit models can be described as the state of the art method for discrete choice analysis (Hall et al. 2006; Lancsar et al. 2007; Regier et al. 2009; Hole 2008; King et al. 2007; Paterson et al. 2008; Negrin et al. 2008; Özdemir et al. 2009)

WTP space offers information about the monetary amount people are willing to pay for certain goods or services. As a result, a direct comparison in ranking and relative comparison are possible (Hole & Kolstad 2012, p.446). The mixed logit in a WTP space is another improvement of the preference space. The mixed logit with a WTP space means a re-formulation of the model that the coefficient represents the WTP measures in the currency used. This method was already applied in economic disciplines (Train & Weeks 2005; Sonnier et al. 2007; Scarpa et al. 2008; Balcombe et al. 2009; Thiene & Scarpa 2009). The utility function is shown in equation **(2)**. n describes the person, j describes the job chosen, and t the choice situation. w_{njt} represents the wage function whereas x_{njt} represents other attributes of the job with a non-monetary value. a_n represents specific individual coefficient for wage and β_n' for the other attributes. ε_{njt} is a random term of the function.

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

Hole and Kolstad (2012) assumes that ε_{njt} is an extreme value and that the extreme value is distributed with the variance of $\mu_n^2(\frac{\pi^2}{6})$. Dividing the equation **(2)** by $\mu_n \mu_n$ does not affect behaviour and results in a new error term. The new error term is independent and identically distributed with the variance of $\frac{\pi^2}{6}$.

$$U_{njt} = \lambda_n w_{njt} + c_n' x_{njt} + \varepsilon_{njt}$$
$$\text{Explanations: } \lambda_n = \frac{\alpha_n}{\mu_n} \text{ and } c_n = \frac{\beta_n}{\mu_n} \quad (3)$$

Equation (3) represents a utility function in a preference space. The WTP for the attributes can be written as $\gamma_n = c_n/\lambda_n$. Because of that, the equation (3) can be converted into equation **(4)**.

$$\boldsymbol{U_{njt} = \lambda_n [w_{njt} + \gamma_n' x_{njt}] + \varepsilon_{njt}} \quad (4)$$

The equation **(4)** is what Train and Weeks (2005) call the mixed logit model in a WTP space. This is also the function used to calculate our models.

4. Results

4.1 Descriptive statistics

The sample (N=664) consists of 450 (68%) male and 214 (32%) female farmers with an average age of 43 years (see also: Table 2: Demographic data (Respondent, household and farm; N= 664)). The farmers cultivate 1.8 acres (0.7 ha) on average. In total 355 respondents (53%) work together with a partner organization. In this context, partner organisation is defined as any organization working in the agricultural sector and supporting the farmers. Out of these farmers working with partner organizations, 196 (30%) are PRAN-members, 98 (15%) are members of FarmsNFarmers and 61 are members of other organisations mostly Jeevika or KVK. 449 farmers (68%) did not receive training in the last year. 100 farmers participated only in one training in the last year, 66 farmers in two training, 32 farmers in three training, 14 farmers in four training and three farmers participate in more than five training.

Out of all decision, the farmers did during the DCE, 96% of the choices would also have been taken under real circumstances. This is the reason why all observations are taken into account even though the respondents were forced to choose.

Table 2: Demographic data (Respondent, household and farm; N= 664)

Variable	Freq.	Percent	mean	sd	Min	Max
Age in years			43.0572	12.6134	13	90
Share of female farmers	214	32.0				
Female-headed households	49	13.0				
Male-headed households	329	87.0				
Able to read (Literacy-rate)	490	74.0	0.7380	0.4401		
Level of education						
No degree	224	33.7				
Primary School	187	28.2				
Secondary School	179	27.0				
Graduate and Post-Graduate	74	11.1				
Hindu (Religion)	658	99.1				
General category	79	12.0				
Other backward class	476	72.3				
Scheduled caste	69	10.5				
Another caste	34	5.2				
Owner of a mobile phone	492	74.0	0.7410	0.4384		
Owner of a smartphone	99	15.0	0.1491	0.3565		
Number of household members			6.0587	2.4930	1	15
Access to electricity	613	92.0	0.9232	0.2665		
Access to internet	30	5.0	0.0452	0.2079		
Access to television	217	33.0	0.3268	0.4694		
Variable (Farm)	**Freq.**	**Percent**	**mean**	**sd**	**Min**	**Max**
Most important sector of farming						
More crops than livestock	600	90.4				
Crop and Livestock equally	49	7.4				
More livestock than crops	15	2.3				
Working with PRAN	196	30.0	0.2952	0.4565		
Working with FarmsNFarmers	98	15.0	0.1476	0.3550		
Working together with an organisation	355	53.0	0.5346	0.4992		
Own land Total (acre)			1.7605	3.3784		
Cultivated land Total (acre)			1.8367	3.3873	0	41.4
Participation in agricultural training (nr. in the last 12 month)						
0	449	67.6				
1	100	15.1				
2<	115	17.4				

Source: Own data and calculation

4.2 Mixed logit model in willingness to pay space

In this subsection, the outcome of the analysis using the data for the whole sample is at first described. Second, the results for different subgroups, that is (1) merely respondents working with a partner organisation, (2) merely respondents without training participation in the last 12 month and (3) merely male respondents, are explained in details. All of these modelling results are presented in the Table 3.

Total population

Analysing the whole sample, the attribute *training method* is described by the levels: mass media and classroom training. Both are highly significant and both coefficients are negative. This reveals that mass media (-175 INR) is the least preferred method of training but classroom teaching (-152 NR) is not favoured either. Both values imply that the reference level, which is classroom training with demonstration, is the more preferred alternative (see also Table 3). Regarding the attribute *trainer*, the academic trainer is the most preferred one. The value is highly significant and indicates that the respondents are valuing the academic trainer with 60 INR. The level, expert is significant with a coefficient of 22 INR. Given that facts, a farmer's colleague as a trainer is the least preferred one. All *additional offers* have a positive value, which shows that any additional offer is more preferred than no additional offer (reference level). Inputs as fertilizer or seeds have the greatest marginal WTP (159 INR). Subsequently, credits (135 INR) followed by network activities (121 INR). Both *training duration* levels are significant and negative. A two-day training is the least preferred one (-84 INR) followed by one-day training (-30 INR). The reference level (half-day of training) is the most preferred one. The attribute *location* is represented by two negative coefficients. Training in remote areas is significant and the least preferred training (-45 INR). The reference level -training in the village- is the most preferred one.

In the comparison of all attributes and levels, the *training method* is most important for the farmers. Second, the *additional offers*, and thirdly, the *duration* of training followed by the *trainer* and the least important attribute is the *location* of training.

Comparison with partner organisation, training participants and gender

Beside the model including all respondents, we ran separate models merely with respondents working with a partner organisation, with those who did not receive any training as well as merely with male respondents. Those respondents working together with a partner organization usually have more contact with consultants and staff of the organisation. Already by knowing stakeholders, the preferences for training with certain characteristics might be influenced. Furthermore, farmers without training in the last 12 month might chose differently as they lack of experience (Dror et al. 2016; Birner et al. 2009). Bihar is still affected by the Gender-Gap, which makes it necessary to also analyse the different preferences of the gender (World Bank 2010; Ghosh & Ghosh 2014).

Analysing the data with respect to subgroups, also called covariates, could be done by interaction terms. However, this method of analysing covariates on a bigger scale is mostly not working and other methods are rare (Kwak et al. 2016). This fore we decided to analyse all subgroups separately

with the same method and starting point. Respecting those subgroups always the greater group was chosen (see also descriptive statistics) to have more robust and reliable results.

By using the covariates per respondent and per Level we calculated the Kernel-Density-Estimates for each Level and each group. The distributions by the Kernel-Density show that most of the levels are normally distributed. The distributions also show that it is necessary to differentiate between different groups defined by the covariates visible for example at the distribution of Method of the training- Mass Media; Trainer- Expert trained on the job; Trainer Expert trained by university; Additional offer- Credits; Additional offer- Inputs; Duration of training- Two days; Location- Regional; Location- remote (See also Annex Table 4).

There are only few differences between the results of the model for the whole sample on one hand (see above), and the results of the separate models for the different subgroups on the other hand. The most obvious differences are that the level of most WTP measures for those respondents, who work with a partner organisation and for those, who are male, is higher than the WTP levels in the model for the whole sample. In the following, the results for the different attributes are explained one by one, each covering the three different separate subgroups:

- **Method of training:** Respondents working with a partner organisation as well as male respondents have chosen mass media as the least preferred option. The respondents working with a partner organisation agree with a significant marginal WTP of -181.85 INR and, also the male respondents have the same significant result (-224.17 INR). Those who did not receive any training almost do not show any difference in mass media (-173.45 INR) or classroom training (-175.72). But they also agree that classroom training with demonstrations is the most preferred ones. Male respondents have a greater aversion regarding mass media than all the other groups.
- **Trainer:** All groups would prefer the academic trainer. The difference is the WTP for each group. The complete sample would pay 61INR in average, respondents with a partner organisation would pay 72INR, those without training experience would pay 36 INR and male respondents would pay 105 INR.

Table 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	Credits	**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

* P < 0.10 ,** P < 0.05, *** P < 0.01

Source: Own data and calculation

- **Additional offer:** Respondents being part of an organisation are less interested in inputs (151.93 INR) in the form of an additional offer, compared to all respondents (158.79 INR). Male respondents are more interested in network activities (180.03 INR) than in credits (165.91 INR). On the contrary, the whole sample and all other subgroup show more interest in credits than in network activities. Overall the whole sample and each subgroup are most interested in inputs.
- **Duration of training and location:** The whole sample and each subgroup show that training in the village and training over half a day is the most preferred training. Farmers of the whole sample (-84.33 INR) and all groups show that training of two day is the least preferred one. Followed by training of one day (29.53 INR). Training at a remote place relatively to the farmers home is the least preferred place by all respondents (-44.93 INR) and also by all groups. Training at a regional place relatively to the farmers' home is not significant for any subgroup. However all marginal effects are negative. So we can conclude that training in the village is most preferred by the farmers.

5. Discussion

We analysed the data of 664 Biharian small-scale farmers with a mixed-logit model in a WTP space as a whole group and also split the sample in different subgroups.

The most important attribute for farmers regarding the agricultural training is the *method* and within this the level classroom training with demonstrations. As most of the farmers are not able to read and have a low educational level, it is important for them to understand the content with the help of demonstration. Mass media such as smartphones is the least preferred method. This could be explained by the lack of ownership and experience. However, this outcome is in contradiction to the actual development of information and communication technologies in the agricultural sector (e.g. Aker 2011). For male participants, the methods mass media is less acceptable compared to the whole population and all other subgroups. So women are more open-minded for new technologies even though the men traditionally are more powerful in the households.

The farmers are willing to pay 61 INR for an academic *trainer*. Male farmers would even pay 105 INR for an academic trainer and farmers with a partner organisation are willing to pay 72 INR. This is also the biggest difference to the current training carried out in Bihar and other developing countries, where most NGOs follow the approach of self-help-groups, innovation platforms or train-the-trainer (Waddington et al. 2014). Even though most of the approaches work together with scientist and academics, they all have a participatory idea of the farmer in common. The approach of teaching small-scale farmers by academics was used around 30 years ago and was not very successful in comparison to the participatory approach by evaluation of scientists (Jones & Garforth 1997).

Additional offer is the second most important attribute. Input is the most preferred additional offer which increases the yield and the farm income most direct in comparison to the others. The second most important additional offer is credit because of money farmers are able to invest in inputs or other production technics (Bingen et al. 2003; Gray et al. 2009; Peterson 1997). Male participants prove a greater WTP for any kind of additional offer compared to other groups. Male participants also show a greater WTP for network activities as for credits. This is outstanding compared to the other groups and to the literature as women are normally more risk averse regarding finances and taking credits. Normally men are in charge of the household budget even though women financial empowerment in the household has a positive influence on nutrition, education and health of the household (Fletschner 2009).

Farmers prefer training with a *duration* of half a day. The daily schedule farmers have, depends on season, workload and production technic. Mostly they start to work at 4 AM with a break during temperature peaks and end at 7 PM. Other responsibilities such as livestock keeping, education and household also influence the schedule. Especially women are affected by most of the daily responsibilities. These are the main reason why farmers prefer having training with a duration of half a day (FAO 2011). All farmers would prefer to get trained in their village. The *location* is the least important attribute also confirmed by the FAO (2011). For farmers working with a partner organisation, it would be more acceptable to have a one-day training and it would also be more acceptable to travel to the next villages for training. One possible explanation for this could be a positive experience with their partner organisation and training given by them. Male respondents also have a higher acceptance of training in other villages compared to all respondents' due to less daily responsibilities inside the household.

6. Conclusion

Bihar is one of the poorest state in India with a large share of the population living in rural areas with a poor infrastructure and decreasing agricultural productivity due to resource scarcity and weather conditions (Census Organization of India 2015; World Bank 2016; World Bank 2005). These characteristics are representative for a lot of regions in developing countries and more important for a lot of people living below the poverty line. To be able producing agricultural goods under these circumstances and furthermore to gain a stable and sufficient income with this activities, small-scale farmers living in rural areas need to develop their agricultural capacities. To improve agricultural capacity development activities it is necessary to understands farmers needs and also demand regarding those training. There is only little literature about it and more rare literature about farmers' preferences regarding agricultural training. This study is the first analysing farmers'

preferences for agricultural training regarding method, trainer, additional offer, duration and location and the first doing this with a DCE. The data was analysed by means of a mixed logit in WTP space to determine the WTP of the attributes and levels.

The results imply a willingness to pay of small-scale farmers for capacity development activities. *Training method* is the most important attribute. Within this attribute demonstrations are most important for farmers as the educational level of farmers is low. Regarding the *trainer*, farmers show the greatest marginal WTP towards an academic trainer which is in contradiction to the current training given in the field. Farmers prefer any kind of *additional offer* and mostly inputs or credits. These additional offers seem to be the best option increasing the agricultural yield from the farmers' perspective. The respondents opt on having training closed to their house and those trainings' fitting into their schedule. This is important as especially women have more daily responsibilities in the household. However, these are the least important attributes.

The findings of this study are of practical importance for farmers, stakeholder being active in agricultural development, scientist and policy makers. Farmers proof an aversion regarding smartphone usage. This is a contradiction with increasing accessibility of smartphones and, also the technical possibilities to earn knowledge as well as information access throughout smartphone usage. The results show, that the involvement of mass media in capacity development strategies should take into account the local circumstances and attitude of farmers regarding mass media. Mass media also opens the possibility to involve academic trainer in the training via digital media without higher costs of direct attendance. This could be another improvement of the current training which is on the other side an important topic for further research and also an implementation. However, another implementation to policymakers is to include an academic trainer in their capacity development activities. This could also be done by direct training of an academic or including video materials into the training. Stakeholders who would like to increase their activity or have a lack of financial resources could introduce a payment system for training as farmers show a WTP. This fee could also be used to hire an academic trainer or offer additional goods and services in combination with the training. Agricultural trainings would also be more attractive to farmers if they would include inputs as seeds or fertilizer.

The results open further research questions due to limitations. First, even though DCE is well accepted the method used is a hypothetical experiment as most of the studies applying laboratory experiments. This criticism has to be taken serious and need be analysed by other studies about the farmers' behaviour in regarding training preferences in real decision situations. Second, in this case, as interactions-terms could not be used we calculated separate models with the justification of Kernel Density estimation of each group. This analysis could be improved if more interaction terms in

the mixed logit would be possible or other methods further evolve. Third, the current training approaches try to involve farmers in the capacity development process and activities with Self-Help-Groups for example, which is a contradiction to the preference to get trained by an academic as decades ago. Further research is needed about how the farmers would like to be taught by an academic and how could this be applied on a bigger scale.

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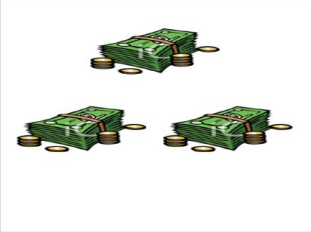
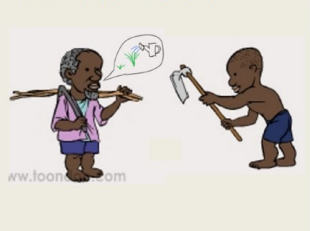
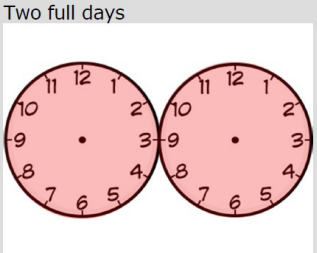
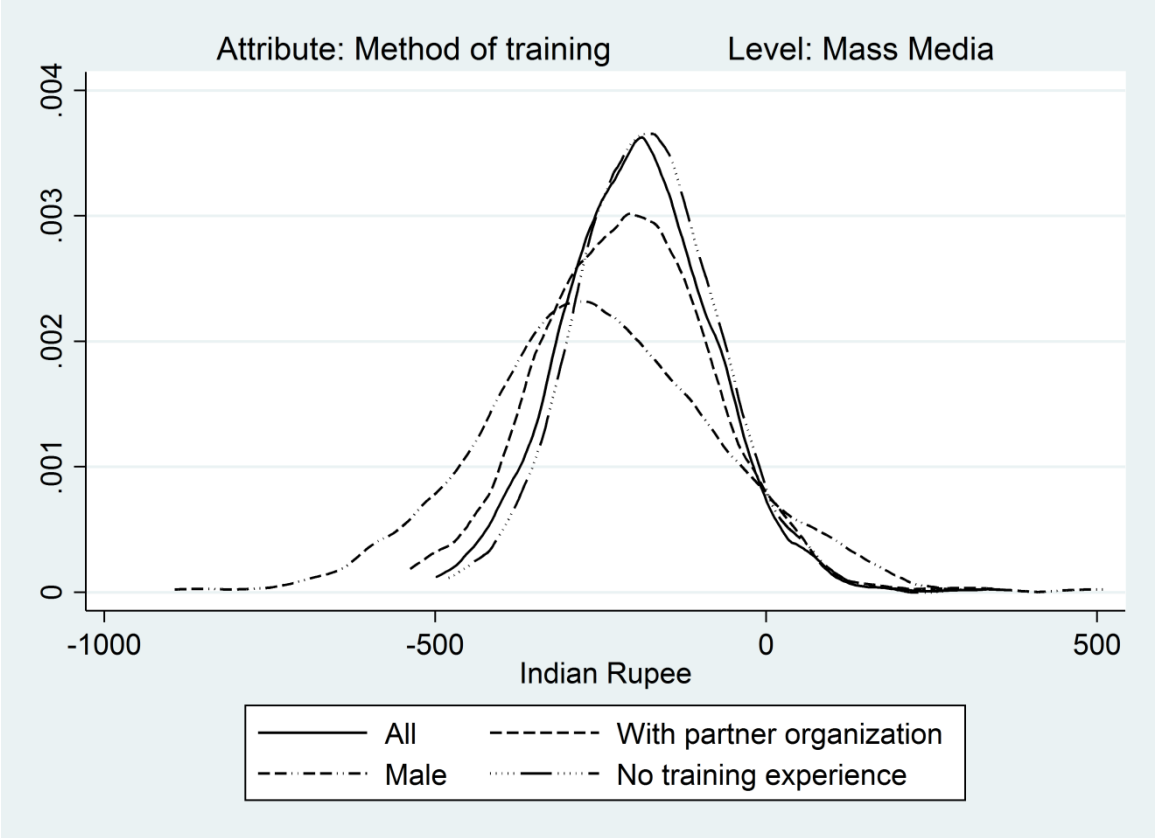
Annex

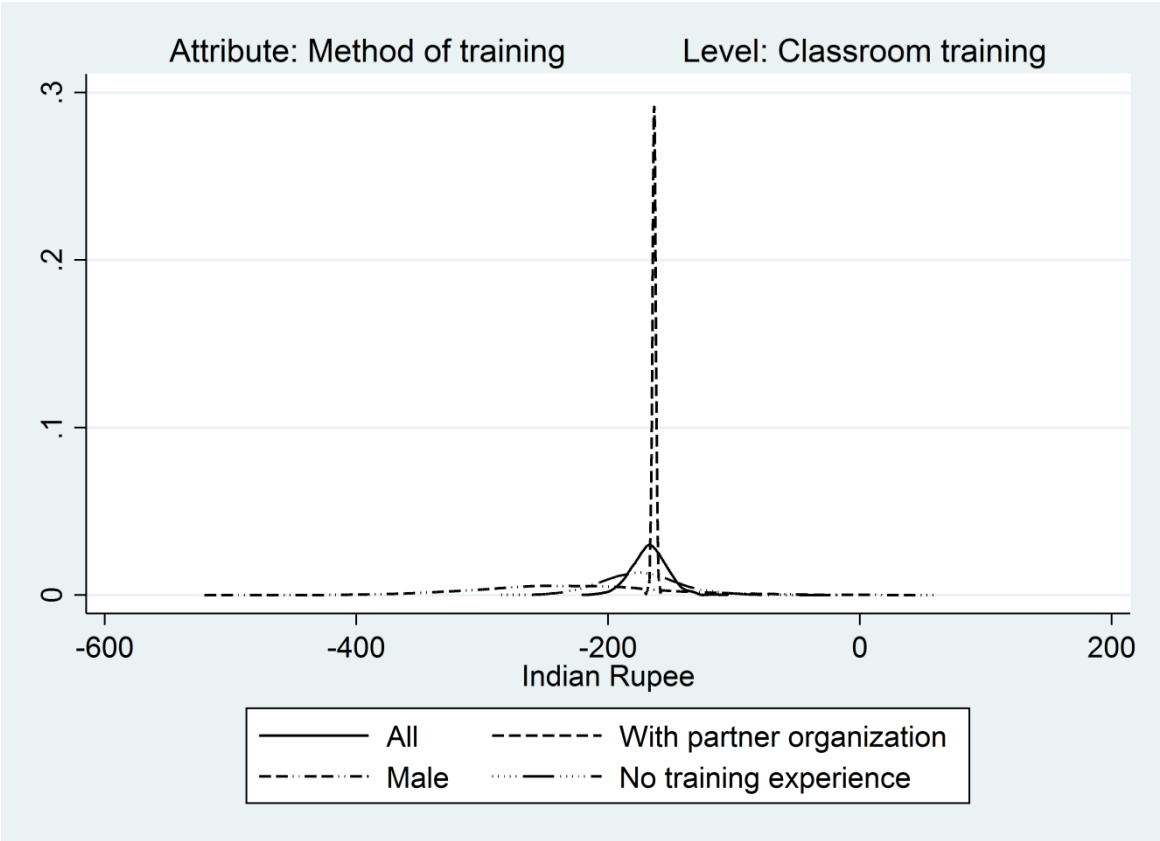
Figure 1: Example of a choice card

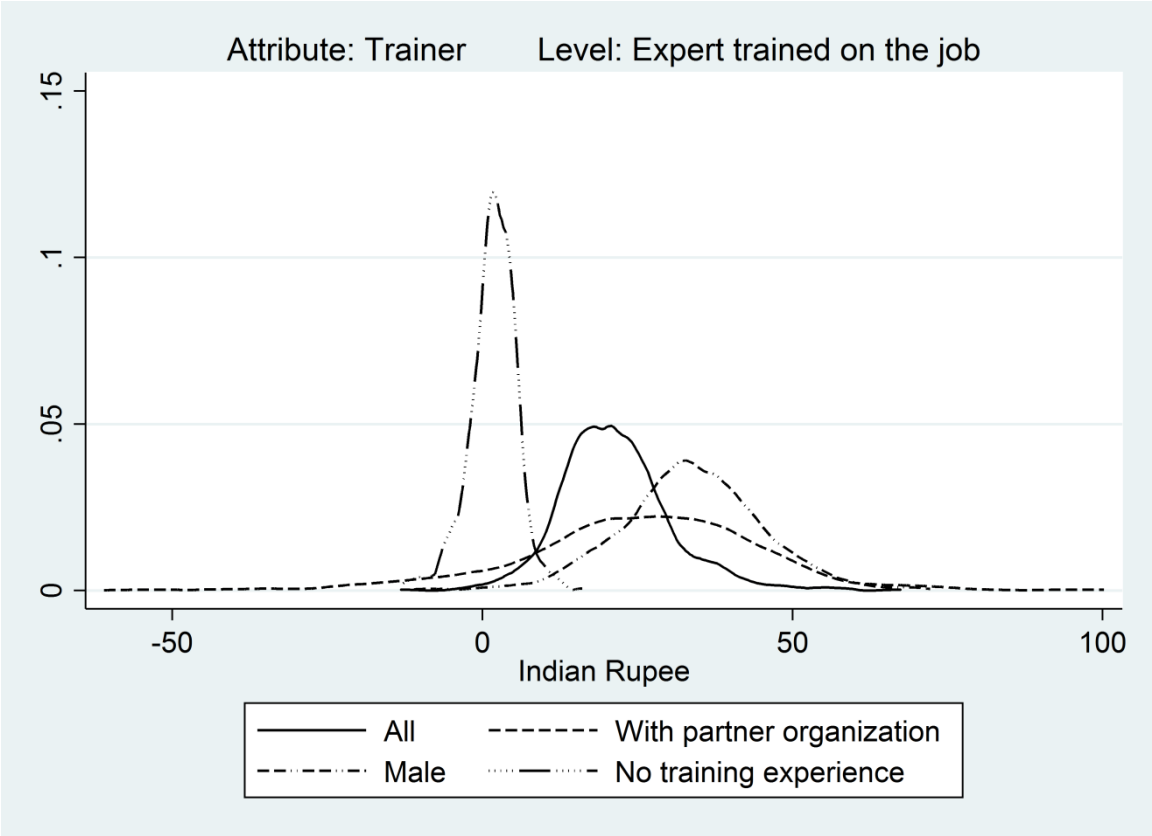
Training costs	50 INR	150 INR 
Location	Regional- travel costs compensation	Remote- travel costs compensation
Trainer	Expert trained on the job 	Farmers colleague- Known by participants
Additional offer	Credits (Financial support)	Inputs (Trials of Seeds/ Fertilizer)
Duration of one training	Half a day	Two full days 
Method of training	Mass Media	Class-room-training with field demonstration

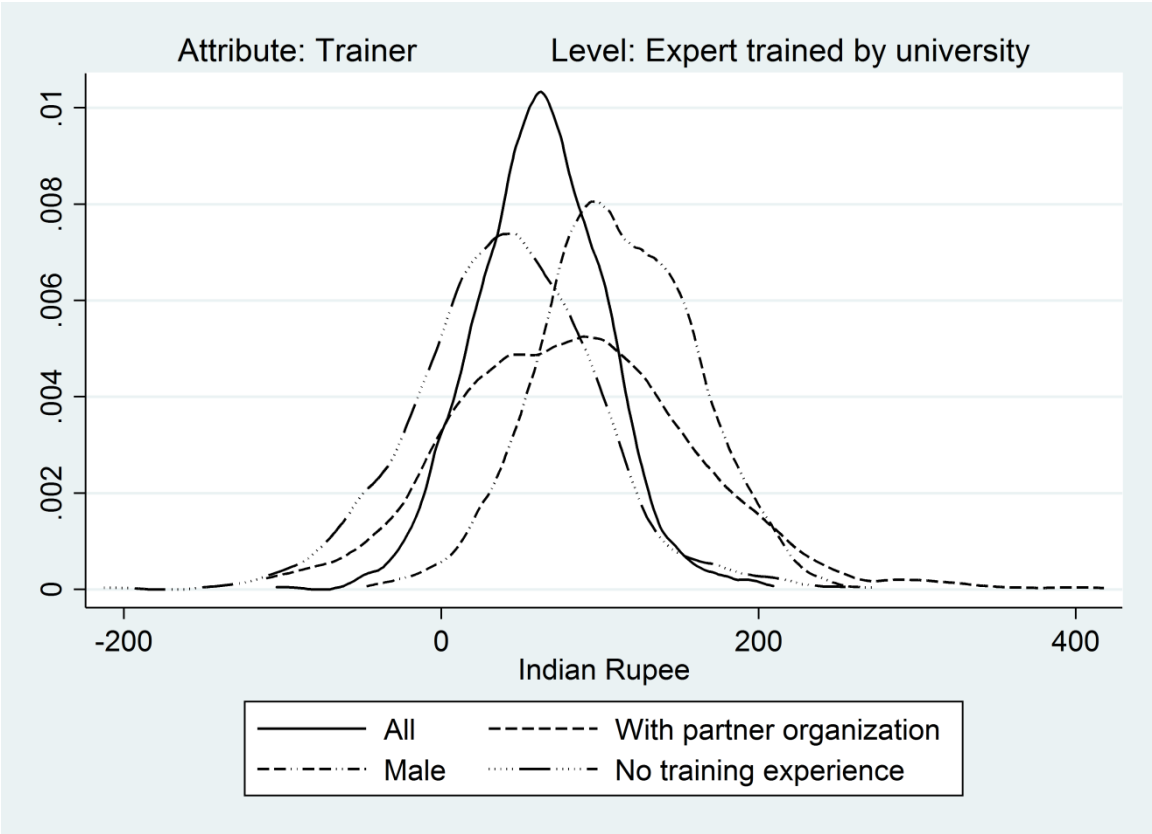
Source: Authors own illustration

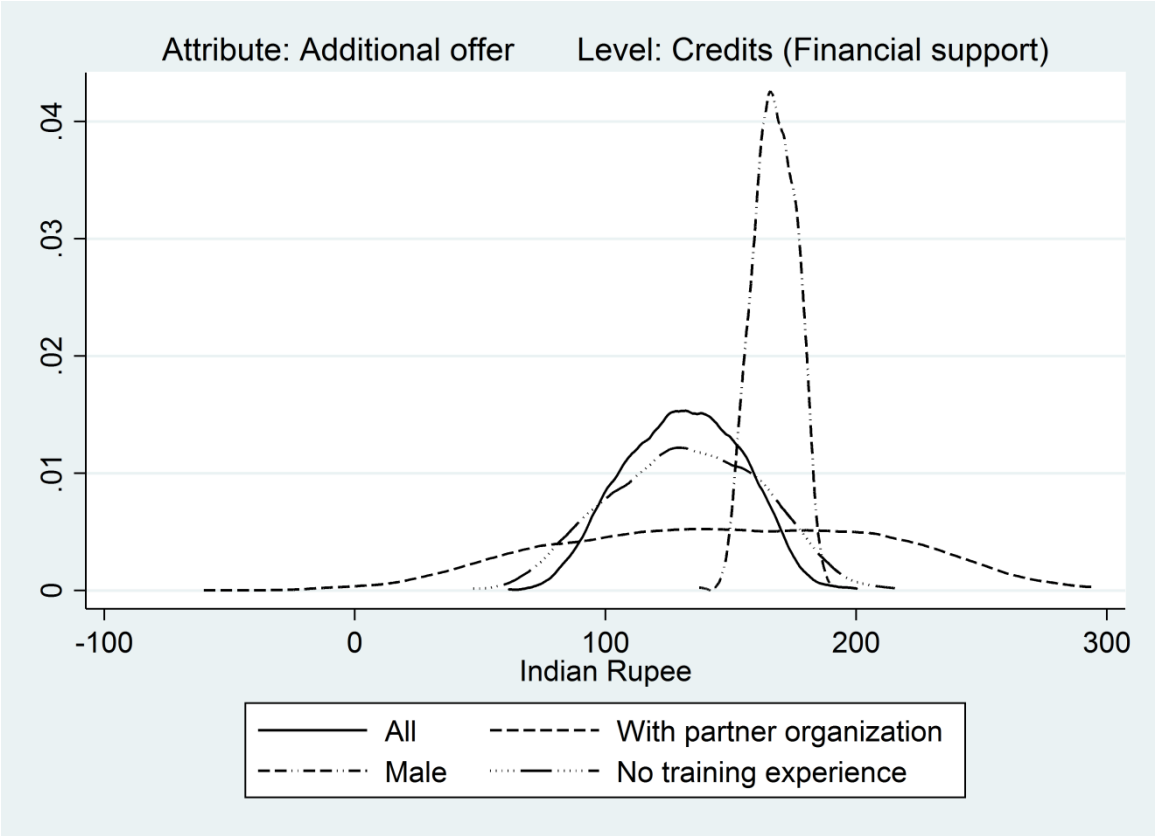
Table 4: Graphs of Kernel Density estimation of each attribute and level and group

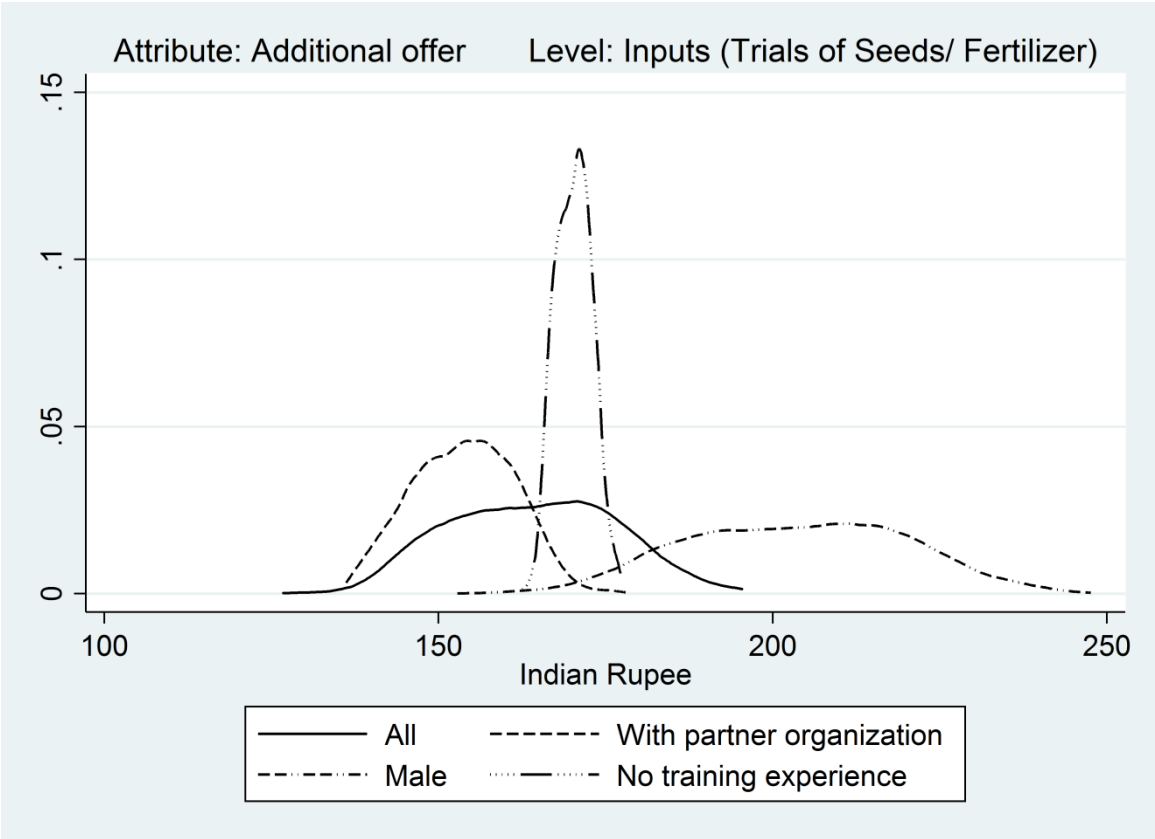


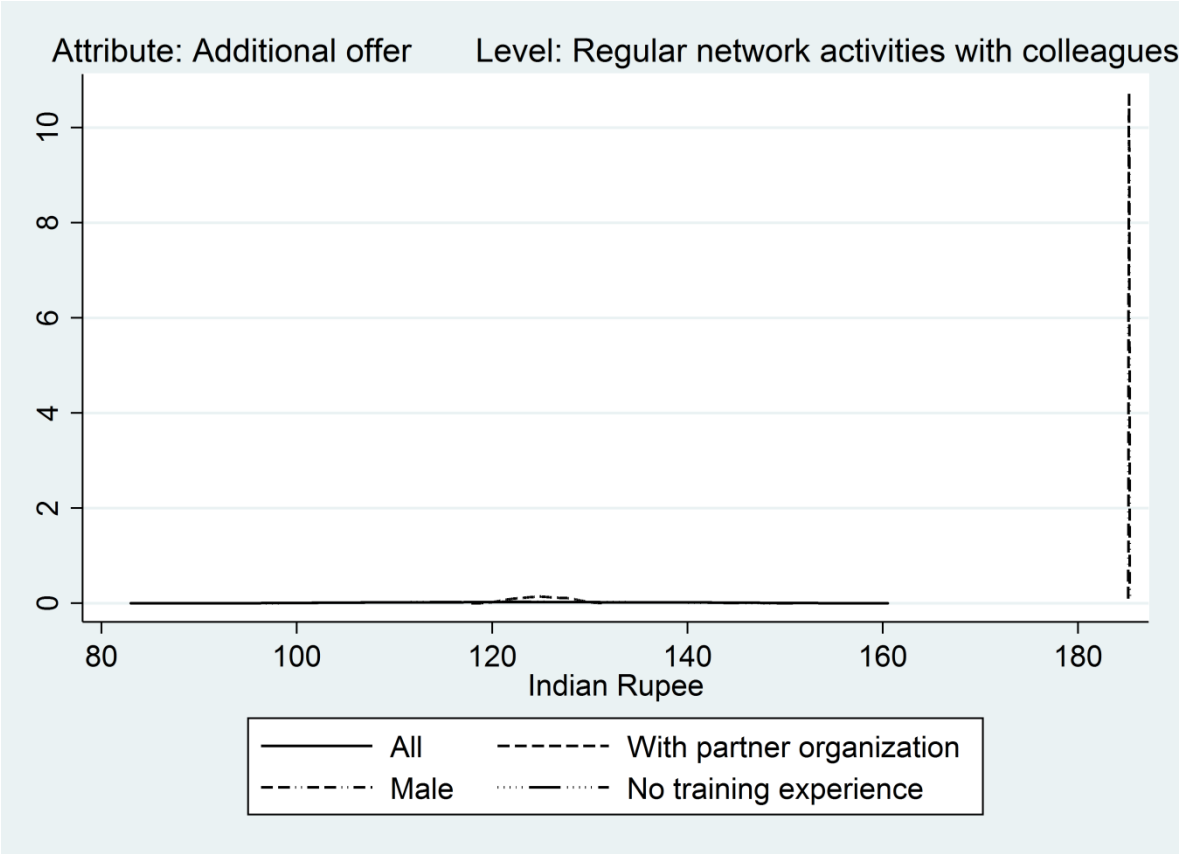


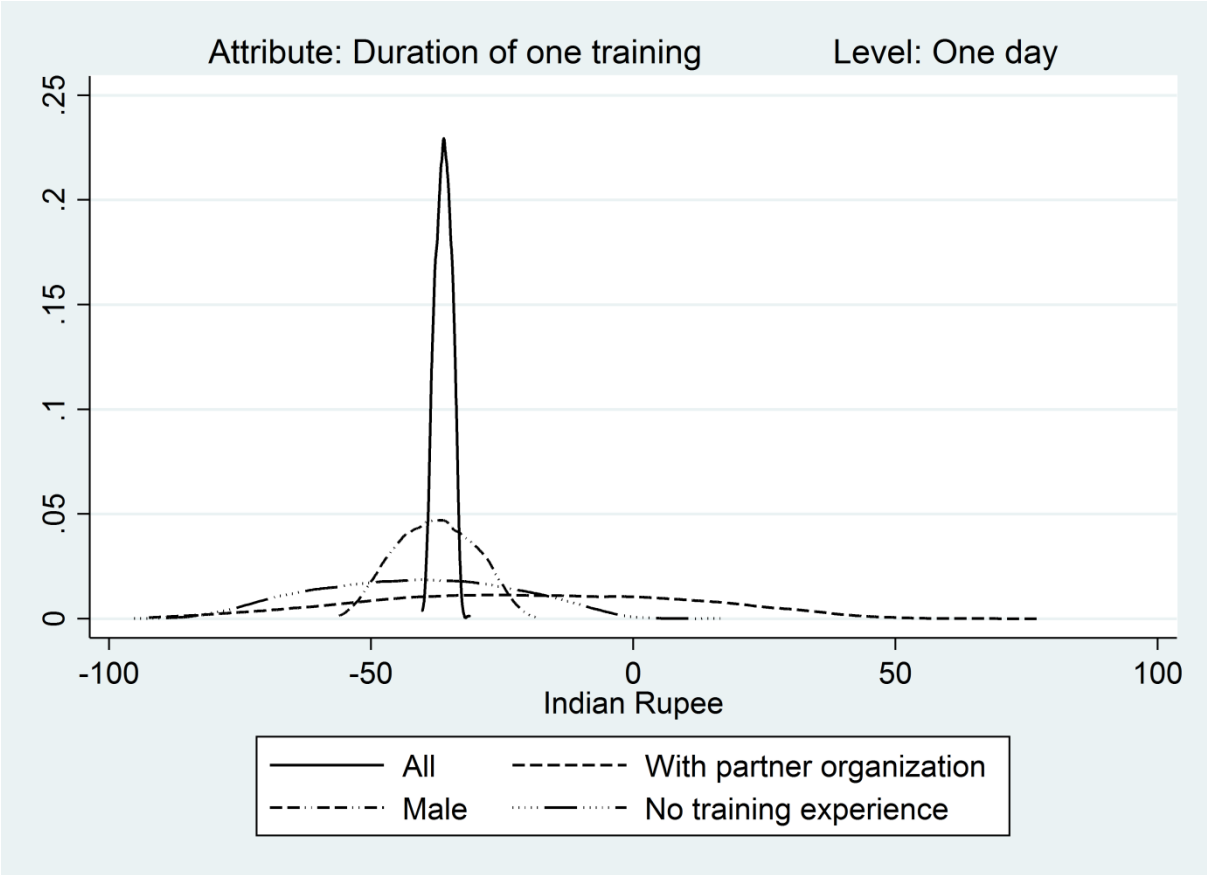

Attribute: Trainer
Level: Expert trained on the job
.15
.1
.05
0
-50
0
50
100
Indian Rupee
All
With partner organization
Male
No training experience

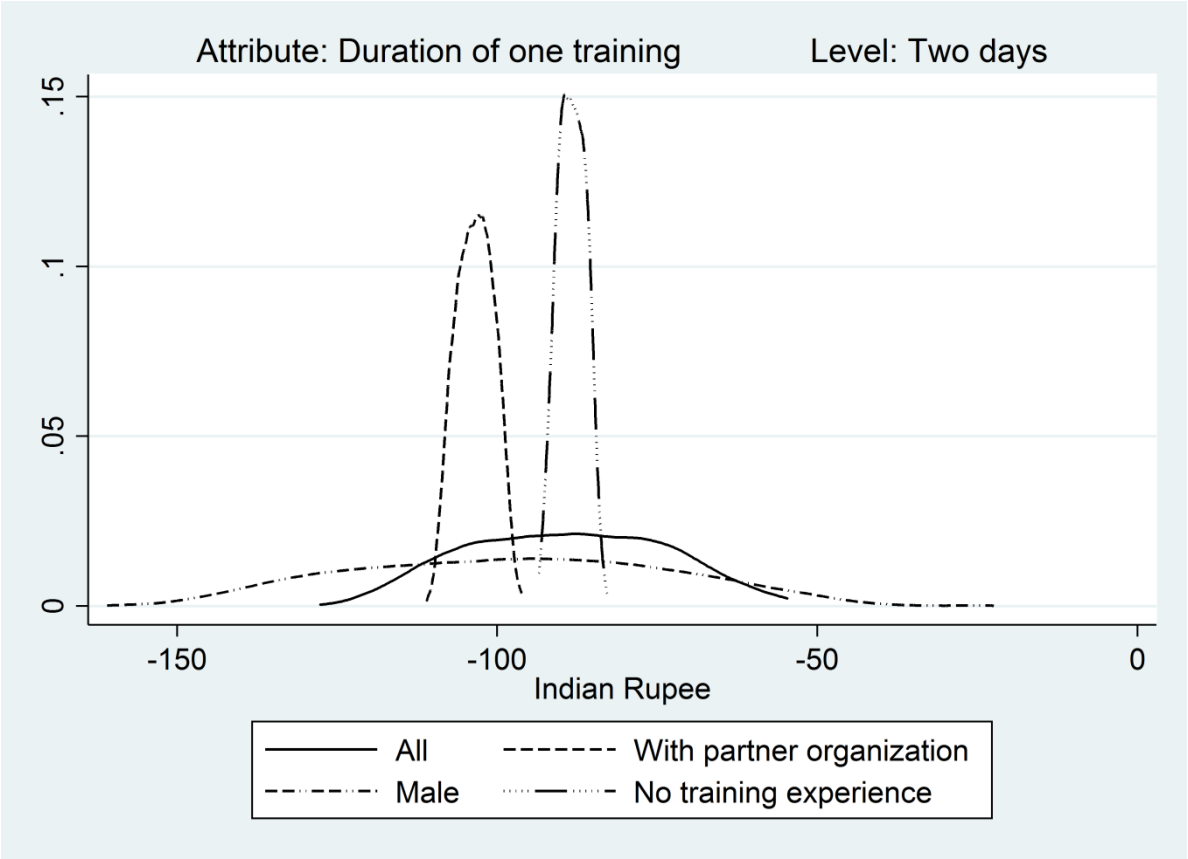

Attribute: Trainer
Level: Expert trained by university
.01
.008
.006
.004
.002
0
-200
0
200
400
Indian Rupee
All
With partner organization
Male
No training experience

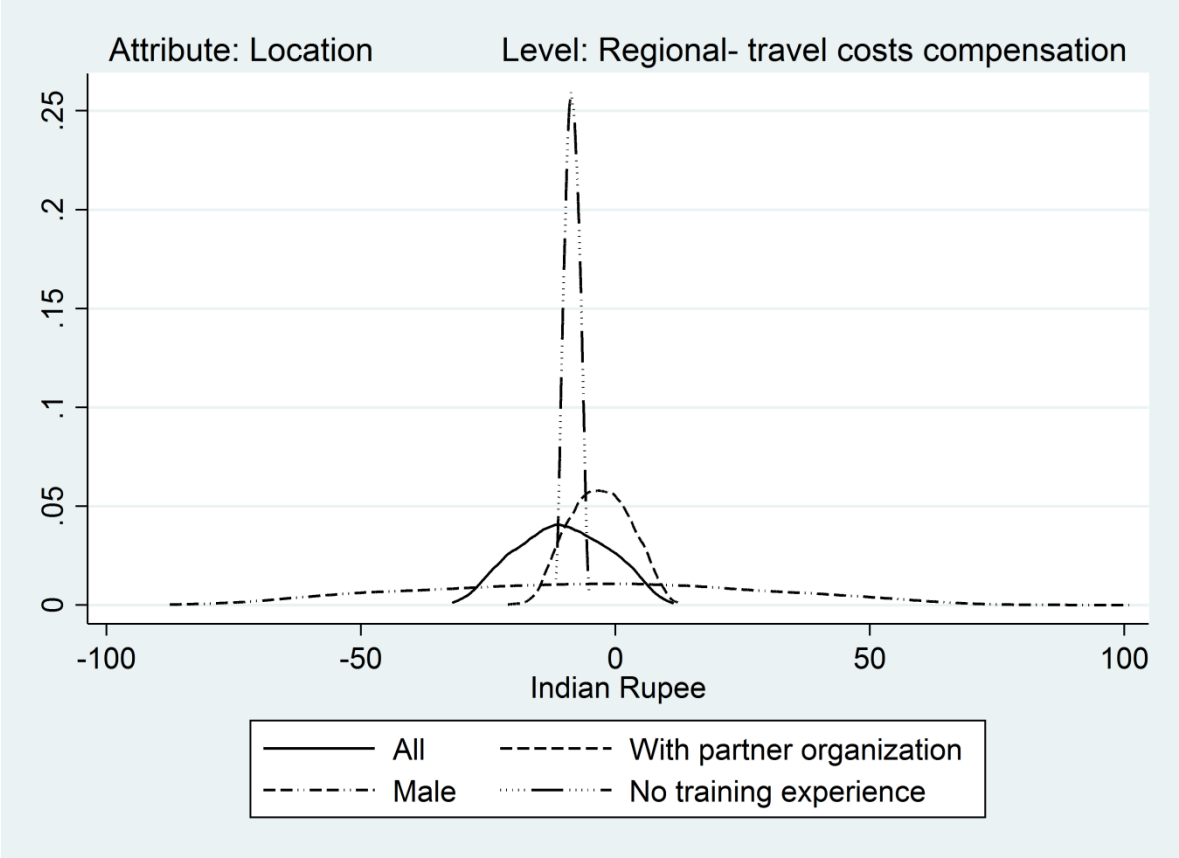

Attribute: Additional offer
Level: Credits (Financial support)
0
.01
.02
.03
.04
-100
0
100
200
300
Indian Rupee
All
With partner organization
Male
No training experience

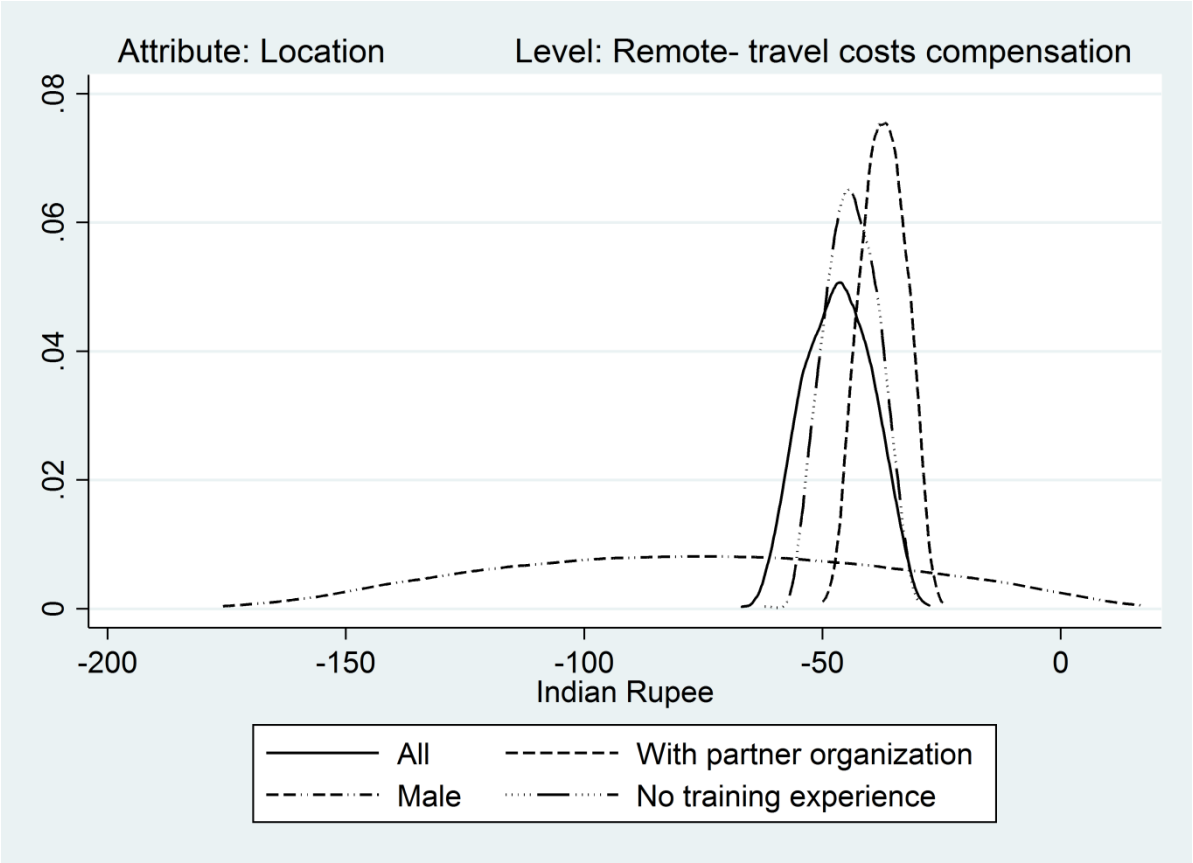

Attribute: Additional offer
Level: Inputs (Trials of Seeds/ Fertilizer)
0
.05
.1
.15
100
150
200
250
Indian Rupee
All
With partner organization
Male
No training experience


Attribute: Additional offer
Level: Regular network activities with colleagues
0
2
4
6
8
10
80
100
120
140
160
180
Indian Rupee
All
With partner organization
Male
No training experience


Attribute: Duration of one training
Level: One day
0
.05
.1
.15
.2
.25
-100
-50
0
50
100
Indian Rupee
All
With partner organization
Male
No training experience


Attribute: Duration of one training
Level: Two days
0
.05
.1
.15
-150
-100
-50
0
Indian Rupee
All
With partner organization
Male
No training experience


Attribute: Location
Level: Regional- travel costs compensation
0
.05
.1
.15
.2
.25
-100
-50
0
50
100
Indian Rupee
All
With partner organization
Male
No training experience



Source: Authors own calculation