

# Determinants of Smallholder Farmers' Intention to Use Smartphones - Evidence from Rural India

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**Abstract:** The introduction of smartphones in developing countries' agriculture has been targeted by different projects of NGOs and governmental institutions mostly without respecting social norms, attitude, self-control and anticipated emotions. Based on the theory of planned behaviour primary survey data from 647 farmers was collected in the Bihar region in India. The data analysis was conducted by using factor analysis and linear regression models. The results show that the factors social norms, attitude, self-control as well as positive and negative anticipated emotions have positive influences on the intention to use a smartphone for agricultural purposes. Thereby, negative anticipated emotions related to failure do not overwhelm the other factors. These results provide interesting implications for NGOs, politicians and ICT service providers.

**Keywords:** Smartphones, Theory-of-Planned-Behaviour, developing countries, emotions

## 1 Introduction

While smartphones are widely spread in agriculture in developed countries, small-scale farmers in less developed regions are still hardly affected by the digital divide. India, as the second largest country regarding the population, represents such a region in the world. Today around 1,326 billion people live in India representing 18% of the world population. Especially in Bihar in East India, 34 % of the population lives below the poverty line making this region the fifth poorest in India. In such regions smartphones can particularly bear the potential for the development of capacities, access to information, access to extension service, better market links and distribution networks as well as access to financial resources. In return, this may generate higher income for farmers, lower costs for suppliers, improved traceability and product quality for buyers as well as new opportunities for financial institutions [TA14; Qi12]. However, currently ICT devices and applications are mostly developed and introduced without respecting rural circumstances in developing countries such as farmer's attitudes, norms, self-control as well as emotions which in return influence the intention to use a smartphone. Thus limit the success of such projects. This study aims to close this gap by analysing the drivers of

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the intention to use a smartphone for agricultural purposes in remote areas of developing countries based on the Theory of Planned Behaviour (TPB).

## 2 Materials and Methods

Ajzen proposed the TPB using attitude, subjective norm and perceived behavioural control to understand human intention. Intention reflects the readiness of someone to perform in a certain way and also makes it possible to predict individual's behaviour. TPB has also been used in earlier studies for predicting IT-acceptance [Ch12]. Perugini et al. 2001 also included anticipated emotions into the TPB. Therefore, we decided to use the TPB including anticipated emotions as well as certain demographic data of the agricultural sector as the basis for the questionnaire design regarding the quantitative measurement of ICT usage and its determinants in developing countries (see also figure 1: regression model) [PB01]. Primary survey data was collected in Bihar between March and June 2016. Bihar was chosen because it is one of the poorest and less developed regions worldwide characterized by a high population density and growth, where 77% of the population is employed in the agricultural sector. However, only 25% of the Biharian GDP is generated through agriculture. The NGOs PRAN (Preservation and proliferation of rural resources and nature) and FnF (Farms & Farmers) were selected based on regions they are working in and the type of work they are doing. In total 647 farmers living in 25 villages located in three different districts from rural Bihar (Gaya, Nalanda and Vaishali) were chosen randomly for the interviews. In half of the villages NGOs are active and in the other half they are not.

## 3 Analysis and results

The sample (N=647) consists of 435 (67%) male and 212 (33%) female farmers with an average age of 43 years. 399 farmers (62%) own a mobile phone and 77 (12%) a smartphone. 154 (24%) of the non-smartphone-owners have access to a smartphone. The farmers are cultivating 1.5 acres (0.6 ha) on average. Only 15% (94 respondents out of 645) of the sample own a smartphone, which does not necessary mean that they use the smartphone to gain agricultural knowledge. Nevertheless, it can certainly be expected that also small-scale farmers will have increasing access to smartphones and services related to agricultural information in the near future.

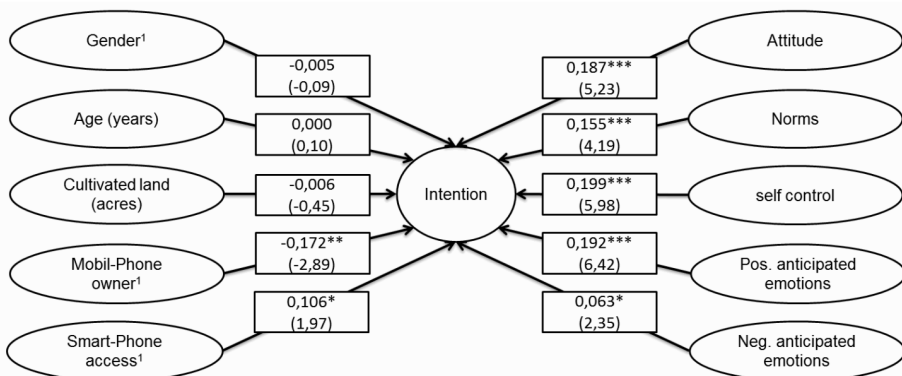
The analysis was conducted in two steps: First, factor analysis and second an OLS-regression model based on the framework described in chapter 2. The factors of attitude, norms, self-control, positive emotions, negative emotions and intention are calculated from Likert scale statements with a scale from 1= totally disagree up to 5= totally agree.

The factors attitude, norms, self-control, positive anticipated emotions and negative anticipated emotions contain six or seven statements each such as the following exam-

les: “The use of the smartphone as a learning tool excites me. “ or: “My own decisions and actions are decisive whether I will use a smartphone.”. The Eigenvalues of all factors are greater than one. The KMO value of each factor is greater than 0.75 except the factor intention where it is 0.5. Cronbach’s-Alpha is always greater than 0.682. The p-value of the Bartlett test of sphericity shows a value of 0.000 for each factor.

The regression shows that demographical determinants such as gender, age and cultivated land do not have a significant influence on the intention to use smartphones for obtaining agricultural knowledge. Owning a mobile phone has a negative significant influence on the intention to use smartphones for gaining agricultural knowledge, whereas access to a smartphone has a positive significant influence on gaining agricultural knowledge. The factors norms, attitude, self-control, positive anticipated emotions as well as negative anticipated emotions have a positive significant influence on the intention to use smartphones for gaining agricultural knowledge.

However, we see that positive emotions (b-value of 0.192) related to successful smartphone usage have a stronger influence than negative emotions (b-value of 0.063) related to a failure of smartphone usage.



t statistics in parentheses; n= 645; R<sup>2</sup>= 0.432; \* p<0.05; \*\* p<0.01; \*\*\* p<0.001; <sup>1</sup> Dummy Variable: 0=No/ Female, 1=Yes/ Male; dependent variable: Intention to use a smartphone for the generation of agricultural knowledge

Fig. 1: Regression

## 4 Discussion and Conclusion

Overall the results of this study give important evidence with regard to the drivers of the intention to use a smartphone for agricultural purposes in remote areas of developing countries. Even though descriptive statistics indicate increasing affordability of mobile- and smartphones also for smallholders in such regions, the regression results show that

owning a mobile phone has a negative influence on the intention to use a smartphone for agricultural purposes seems to be contrary to the fact that access to smartphones has a positive influence on the intention. This could be explained by the underestimation of the possibilities to improve agricultural production and information access as well as by the lack of experience in handling a smartphone. Another option could be that farmers do not think that they will get a smartphone in the near future so they also don't have the intention to use it for agricultural purposes. Furthermore, the regression model proves the influence of norms, attitude, self-control and emotions on the intention to use smartphones, however, to different extends. The influence of emotional expectation gives evidence that negative anticipated emotions would not overwhelm the positive influences of norms, attitude, self-control or positive emotions even if the farmers fail with increasing their agricultural knowledge with the use of a smartphone for agricultural purposes. Thus, farmers who fail with its usage still would prefer to use a smartphone due to their high expectations, social pressure and norms and ambitiousness to overcome the failure and to improve agricultural practises by using smartphones. In this regard our results confirm those of earlier studies on other countries and cases and, thus, the general usefulness of the TPB in this context.

The key-finding that the implementation of ICT is not only related to technical issues, but also to behavioural influences, lead to recommendations addressing NGOs, governmental offices as well as ICT service providers to understand the regional conditions. Concretely, regional conditions and behavioural inhibitions of the intention to use a smartphone need to be taken into account more intensively during farmer trainings in order to improve the implementation of smartphone usage for agricultural purposes in remote areas of developing countries. Further research should include aspects of smartphone-availability and –affordability, as well as consequential costs resulting from the investment into this innovation.

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