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Mobile phone adoption in agri-food sector: Are farmers in Sub-Saharan Africa connected?

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ABSTRACT

In recent years user acceptance of a new technology has become of much interest. One of the most outstanding global problems facing Africa is the digital divide. However, the use and adoption of mobile phones is reducing the digital divide in Africa. In view of the role that mobile phones play in bridging the digital divide in Africa, this study extends the applicability of the technology acceptance model (TAM), without altering its parsimony and information technology focus, in mobile phone adoption. This paper extends the TAM model by adding two new constructs, perceived advantage and socio-economic characteristics. Consequently, the extended TAM was applied to adoption of mobile phones in farming communities in Sub-Saharan Africa. The study relies on a sample from 300 dairy farmers in Uganda which was analysed using structural equation modelling. Theoretically, it contributes to the limited literature on mobile phone adoption in agri-food sector in Sub-Saharan Africa and provides empirical evidence from Ugandan farmers. The research contributes to promoting mobile phone usage in farming communities beyond just normal communication. The research also has a strong practical implication for farmers as well as other stakeholders from the agri-food sector.

1. Introduction

Advancement in information and communication technologies (ICT) has facilitated doing business and economic development in the world. The impact of this technological advancement, to some extent, is not equitable. Although much of the impact of this technological advancement is in American and European countries, its rate of spread is fairly low in many African and Asian countries. This slow rate of spread of these impacts can be attributed to digital divide (Fuchs and Horak, 2008; James, 2009a).

Digital divide refers to the gap between demographics and regions that have access to modern ICT and those that do not or have restricted access (Rouse, 2014). These ICTs include mobile phones, television, personal computers and the internet. Among these, the mobile phone has become popular in recent years; its use and adoption is reducing the digital divide in Africa (Costantini and Liberati, 2014). The mobile phone is changing the face of Africa. Compared to other ICTs, the mobile phone is less demanding in terms of affordability, user capabilities, and infrastructure requirements (James, 2009a; Osabutey and Jin, 2016). Doing business in Africa has improved since the

introduction of mobile phones. Because of the mobile phone, Africa has been able to develop by skipping landline and associated infrastructural development costs (Amankwah-Amoah, 2016; James, 2009b). It is in Africa where the mobile phone overtook the number of fixed line telephones (Galang, 2012; James, 2009b). Consequently, Africa is connected and opportunities for doing business in Africa have increased (Amankwah-Amoah, 2015).

User acceptance of a new technology has become of much interest in research recently. The approach in studying this concept has comprised testing key factors of adoption, behavioural intention and usage of a technology by individual users (Park and Del Pobil, 2013). Several theories have been put forward to explain intention to use or adopt a technology. The most popular one with support from literature (Chuttur, 2009; Luarn and Lin, 2005) is the technology acceptance model (TAM).

The TAM is very flexible and can accommodate many variables. It has thus become popular in information technology acceptance and adoption literature. In this model, intention to use a technology determines its adoption. Subsequently, perceived ease of use and perceived usefulness determines intention to use the technology (Chuttur,

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2009; Kim et al., 2008; Wu and Wang, 2005). Some of its strengths are parsimony, validity and reliability of its instruments. One major limitation of the model is the assumption of non-existence barriers which may prevent an individual from using a given technology (Chuttur, 2009; Luarn and Lin, 2005). Circumstances such as time constraint, lack of money and expertise may limit an individual from using a technology (Malhotra and Galletta, 1999; Mathieson et al., 2001).

Mobile phones are not very well spread among the farming communities in the agri-food sector in Sub-Saharan Africa. The technology, however, is popular amongst traders. Unlike traders who use mobile phones for searching for price information in different agri-food markets, the majority of farmers use them for normal communication, i.e., to keep in touch with family and friends. Research has shown that farmers in Sub-Saharan Africa hardly use mobile phones to keep themselves updated with prices of different produce/commodities in different markets (Aker, 2009; Aker and Mbiti, 2010; Muto and Yamano, 2009; Overå, 2006). With the popularity of the mobile phone in Sub-Saharan Africa, all stakeholders in the value chain can be connected. In the current situation, however, farmers do not seem to be well connected with other value chain actors. Farmers, being at the upstream, are liable to exploitation from other chain actors, especially the middlemen. They are ignorant about what takes place in markets. Consequently, they accept any price that the middlemen offer them for their produce/commodity. If farmers, like middlemen, can keep themselves connected with different markets, they will be safe from exploitation. Further, research has indicated that mobile phones, if well utilised, can improve the influence of Sub-Saharan African farmers in the value chain (Faida, 2006). They can be transformed into chain partners.

Previous research indicates that farmers in Sub-Saharan Africa (Aker and Mbiti, 2010) may choose not to use a new technology (like a mobile phone) due to lack of required knowledge, skills or abilities. Besides, farmers may also fail to use a technology if they are unaware of its advantages (Luarn and Lin, 2005). As a result, farmers are likely to miss the full potential of this new technology, which has the potential to improve their welfare. A person may feel that a mobile phone is useful and easy to use, however, he/she may not maximally use it until he/she realises some perceived advantages associated with it. These advantages include making timely decisions and getting updates on market prices. Realising the benefits that technology can bring to farmers welfare is therefore essential to understand how people accept new technologies. The original TAM model doesn't consider perceived advantage and socio-economic characteristic aspects. This study therefore aims to address this gap by extending the TAM by adding two new constructs, perceived advantage and socio-economic characteristics (Bayard and Jolly, 2007; Mittal et al., 2010). In addition, the study contributes to scant literature on mobile phone adoption in Uganda and Sub-Saharan Africa at large. Moreover, this study also provides empirical evidence from Ugandan farmers. Practically, the study will enhance an understanding of an individual's behaviour to adopt and fully utilise mobile phones.

Next section discusses the theoretical background of this study. A brief overview of the mobile phone adoption in Sub-Saharan Africa has been provided and TAM model has been discussed in detail. Section 3 discusses the research model and proposes a number of hypotheses that were empirically tested. Research design and method is presented in Section 4. Section 5 presents the results of this study. Discussion of the findings is provided in Section 6 whereas Section 7 concludes this study and also highlights some limitations and areas for future research.

2. Theoretical background

A survey of literature by Feder et al. (1985) on factors underlying adoption decisions in Africa forms a basis for most studies on adoption. Extensive work has been done on adoption of technologies in Africa since it provides a basis for increased production and income

(Croppenstedt et al., 2003; Feder et al., 1985; Kassie et al., 2013). However, much of this research focuses on adoption of improved crops and new methods of cultivation (Fisher et al., 2015; Kassie et al., 2013; Kassie et al., 2015; Khonje et al., 2015). In addition, most of these studies are dichotomous in nature (i.e. compare adoption to non-adoption) (Feder et al., 1985). One major weakness with most of these studies is the fact that they ignore the role of ICT in adoption (Doss, 2006; Feder et al., 1985). In the context of Africa, in order to realise increased production and income resulting from adoption of technologies, there is need to refocus studies on adoption (Doss, 2006; James, 2009b; Ndiritu et al., 2014). The mobile phone technology, which is spreading tremendously in Africa, plays a vital role in facilitating realisation of benefits from adoption of technologies.

2.1. Mobile phone adoption in the world, Sub-Saharan Africa and Uganda

Mobile phones have become a major form of communication in the world. Mobile phone networks play the same role that fixed-line phone networks did in facilitating growth in Europe and North America in the 20th century. The expansion of the mobile phone networks has been tremendous in the recent past. In 2015, there were 4.7 billion unique mobile subscribers globally, equivalent to 63% of the world's population (GSMA, 2016; Katz, 2008). GSMA (2016) further projects that by 2020, almost three-quarters of the global population will have a mobile subscription, with around 1 billion new subscribers added over the period. However, developed markets are growing more slowly as penetration rates approach levels close to saturation. Adoption rates reached 65% of the connection base in the developed world at the end of 2015, ranging from 59% in Europe to 74% in North America (Aker and Mbiti, 2010; GSMA, 2016; Katz, 2008). Smartphone adoption is accelerating across the developing world; smartphone connections reached 40% of the total connections base by the end of 2015 (up from 5% in 2010), largely due to growth in Asia Pacific and Latin America. The number of smartphone connections will increase by 2.6 billion by 2020, with > 90% of that growth from developing regions.

In Sub-Saharan Africa, the mobile industry continues to scale rapidly reaching 367 million subscribers by the end of 2015 (Aker and Ksoll, 2016; GSM, 2015; GSMA, 2016; Katz, 2008). Migration to higher speed networks and smartphones continues apace, with mobile broadband connections set to increase from just over 20% of the connection base today to almost 60% by the end of the decade (Albiman and Sulong, 2016; Asongu and Le Roux, 2016). Falling device prices are encouraging the rapid adoption of smartphones, with the region set to add > 400 million new smartphone connections by 2020, by which time the smartphone installed base will total over half a billion (Aker, 2010; GSMA, 2016).

The mobile industry remains a key driver of economic growth and employment across the region, making an important contribution given the population growth and high unemployment levels (James and Versteeg, 2007). In 2014, the broader mobile ecosystem generated 5.7% of GDP in Sub-Saharan Africa, a contribution of just over \$100 billion in economic value (Aker, 2010; James and Versteeg, 2007). Migration to mobile broadband and the growth of new services will see this figure increase to 8.2% of GDP by 2020, reflecting how increased access to mobile services generates regional growth and development (Albiman and Sulong, 2016; Asongu and Le Roux, 2016).

Mobile phone technology plays a central role in addressing a range of socio-economic developmental challenges across the region, particularly digital and financial inclusion (Abraham, 2006; Albiman and Sulong, 2016; James and Versteeg, 2007). Greater digital inclusion will drive economic and infrastructure development, increasing productivity and employment across the economy, and will improve access to vital services such as agriculture, education and healthcare.

Deichmann et al. (2016) reviewed literature on how technology impacts rural sector in developing countries and how digital technologies overcome information problems that hinder market access for

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