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A Human-Centred approach to e-Agricultural systems

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Abstract:

Within business enterprises farmers lags behind in the uptake of new information technologies for the control and automation of farming systems. In spite of decades of research into technology acceptance we still do not have a good understanding as to why this is the case. IT adoption in agricultural communities is perceived to be increasingly important by policy makers as a means of adapting to changes within agriculture. This paper proposes preliminary findings to validate a new systems framework of e- Agriculture adoption and innovation that will open new avenues of research for control and automation systems theory and practice informing policy in respect of e-readiness of rural communities.

Keywords**:** Technology adoption, agriculture, intuitionalism, human culture and values, community of practice.

1. INTRODUCTION

E-agricultural systems refer to the use of technology for the improvement of agricultural services, enhanced technology dissemination, and information delivery through advancements in Information and Communication Technology (ICT). A sustainable agriculture sector depends on farmer's capacity for adapting to markets situations and seizing opportunities, with many agencies advocating e- agriculture systems as an avenue for change (EIFTA (2009), World Bank (2008),DAFF(2009)). Rural communities are slower to adopt e-systems within their working day as technologies presented offered generic information that fails to address farm diversity with translation needed to make it relevant to the personal and situational life of the farmers Gakuru et al (2009). This paper adapts a formerly proposed

theory (Somers and Stapleton, 2014) and presents some preliminary results from an on-going empirical study. The paper will

1. Identify gaps in the information systems literature regarding the adoption of e-agricultural systems by rural communities and

2. Proposes a new lens of analysis for e-agricultural systems and a new position of thinking to systems development.

Understanding slow adoption of e-agricultural systems goes beyond technology, to the integration of knowledge and culture aiming to improve communication and learning processes within agriculture amongst all stakeholders

2. E-AGRICULTURAL INFORMATION SYSTEMS

Gakuru et al (2009) believed e-agricultural systems was an integration of knowledge and culture, aimed at the improvement of communication and learning processes among relevant actors in agriculture. Koutsouris (2006) suggested they were local farming systems, completive adaptive which co-evolved with human societies to fit ecological conditions which satisfied human needs.

For the development of such systems future studies should focus on the mechanism of the information systems, which was the interaction between components and activities and specifically the information requirements of farmers Demiryurek (2010).

Currently systems development following the reductionist paradigm fails to understand the human experience. The knowledge requirements, the culture and values embedded in the knowledge, and the working, and learning environment of the individual (Somers and Stapleton, 2013). To focus technology more to the human required a human-centred approach to systems development. This development trajectory

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generated a conceptual framework for technology innovations that understood the nature of knowledge and importantly its purpose in a societal context. The human centred approach interplayed between the notions of purpose, symbiosis, cohesion, diversity, and valorisation all the fundamentals for shaping the trajectory. This interplay allowed communities to build networks of users, producers, and creators of knowledge acting, as a tool for creating innovations (Gill, 2002) .Agricultural knowledgewas communal with learning or knowledge becoming sites for innovation. Krisis of the information systems world resulted in the separation between people and science ensuing from the separation of everyday life in the creation and development of any scientific methodology (Ciborro, 2002). This was evident in agriculture where adoption of e-systems remains poor relative to other communities and theories such as the TAM,UTAUT and the Diffusion of Innovation cannot explain (Somers and Stapleton(2012),Stapleton and Fouopi (2011).

2.1 UNDERSTANDING THE RURAL CONTEXT

Information systems theory concerns itself with the use of an artefact in human-machine systems linking the natural world, the social world and the artificial world of human construction (Gregor, 2006). Agriculture is the only sector of European society that is governed by a single policy, the Common Agricultural Policy (CAP). Governments within the EU have modernise and optimised interactions between themselves and farmers through e-systems as a means of implementing policy (Ntaliani et al,2010). However, the farming sector was one area where e-systems were not seen as sites of innovation by farmers (Somers and Stapleton,). Agriculture forms the backbone of rural life in terms of economics and social fabric making its survival of importance (Pyysiäinen et al, 2006). Many have argued that for sustainable agricultural practices farmers will have to adopt innovative technologies to complement traditional practices (Mackrell et al (2009). The World Bank (2008) suggested e-systems offered farmers' innovative practice and Jorgensen (2006) believed they were an avenue for change. To support e-agricultural innovations a deeper understanding of their context of use is needed, especially the social context (Somers and Stapleton, 2013). Waldrop (1992) and Cillers (2001) believed that alternative IS methodology accounting for system complexity could provide an understanding to encourage innovation and learning within e-systems. Could a methodology specific to an e-agricultural context and catering for the human system improve e-agriculture adoption? As a first step to supporting innovative agricultural workflow a new theory is needed catering for the complexity of a rural social system (agriculture), and emergent behaviours that are present with technology interaction.

However many existing information systems adoption models fail to offer insight to systems developers as to why E-Systems are not sites of innovation.

3. LITERATURE REVIEW

Acceptance and use of information systems is one of the most mature streams of information systems research (Benbasat and Barki 2007; Venkatesh et al. 2007). Despite the popularity of adoption research, no one-adoption model can yet identify and organise into a coherent model all the factors that influence innovation adoption among individuals and in communities. Models presented were either too complex (Tornatzky and Klein 1982) or simplistic and were technology-centred (Davis 1989) such as TAM and UTAUT. The first model the Technology Acceptance Model (TAM) (Davis, 1989; Davis et al., 1989) was a causal model. Davis believed that two determinants perceived usefulness (PU) and perceived ease of use (PEOU) could predict the adoption and continued usage of a technology. PU was the belief that using a particular technology would enhance job performance. PEOU was the extent to which a person believes that using a new technology was free from effort (Davis, 1989). Leeuwis (2003) argued the model was applied to numerous agricultural studies ((Flett et al,2004; Rezaei- Moghaddam et al,2010;Lee et al,2010)) and on review of these he noted the difference in magnitude and scope of the innovations. Leeuwis (2003) categorised farming innovations as regular or architectural innovations. Regular innovations do not challenge the main technological and social-organisational characteristics of the farming system, whereas architectural innovations require fundamental reorganisation of social relationships, technical principles and rules. Based on Leeuwis (2003) classification the studies focused on regular innovations from soil sampling to fertilizers. The authors believed the model was successful in predicating continued usage of such innovations. Innovation in animal husbandry (biological innovations), machinery (mechanical innovations), and chemical innovations such as fertilizers were adopted quicker by farmers as these innovations as they come with institutional support and scientific knowledge that has the potential to increase productivity and farm income (Feder et al 1985).

The UTAUT model was proposed by Venkatesh (2003) in an attempt to formulate a unified model for adoption. The model was based on eight prominent models within the IS field; the Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Technology Acceptance Model (TAM), the Motivational Model, a model combining the TRA and the TPB, the model of PC utilisation, the Diffusion of Innovation (DOI) and Social Cognitive Theory. Venkatesh (2003) proposed three determinants of intention to use, performance expectancy, effort expectancy, and social influences and two direct determinants of usage behaviour: intention and facilitating conditions. Performance expectancy appeared to be a determinant of intention in most