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# **A THEORETICAL FRAMEWORK FOR THE STUDY OF AGRICULTURAL KNOWLEDGE AND INFORMATION SYSTEMS IN A DEVELOPING COUNTRY**

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## **ABSTRACT**

With poverty and hunger growing in sub-Saharan Africa, increased agricultural productivity is urgently required. Agricultural extension services should improve their delivery to those small-scale farmers who play a key role in production. There is a need to build on previous research focusing on the integration and sharing of knowledge from different sources, and into the role of small-scale farmers in an agricultural knowledge and information system (AKIS). Studying an AKIS requires a broad theoretical framework to explain its different facets comprehensively. This article reviews perspectives, theories, concepts and models for studying the AKIS of small-scale farmers. A critical review and analysis of the literature, it offers a holistic theoretical framework to underpin research, to ensure a deep understanding of the complexities of the AKIS of such farmers in a developing country context.

## **KEYWORDS**

Agricultural knowledge and information systems; Cynefin framework; knowledge and information systems; Meyer's model; sense-making; social capital; soft systems; Wilson's model

## **1 BACKGROUND**

Poverty and hunger are increasing in sub-Saharan African rural areas in particular (International Fund for Agricultural Development [IFAD] 2002; World Bank 2007), and increased agricultural productivity is urgently needed. In many developing countries, agricultural extension services have failed to deliver the support required for such productivity (Chapman et al 2003; Richardson 2006). Further research on the role of farmers – and especially that of small-scale farmers who play a key role in agricultural production and agricultural knowledge and information systems (AKISs) – is urgently required. It was this problem that the authors sought to address, but with regard to the choice of a suitable theoretical framework for researching the AKISs of small-scale farmers in a developing country context.

## **2 STATEMENT OF THE PROBLEM**

Rees et al (2000) and Garforth (2001) argue that the AKISs of smallholders are complex, diverse and vary from site to site, depending on the site's agro-ecology and agricultural enterprises. Their studies indicate the necessity for a comprehensive investigation of the role of small-scale farmers in an AKIS. There is thus a need to build on the work of previous research, focusing in particular on the integration and sharing of knowledge from different sources, as recommended by Meyer (2000, 2003) in South Africa.

The importance of choosing an appropriate theoretical framework for research is evident in the comments of Wilson (2001). He notes that approaches to developing systems often fail to satisfy users' problems, because the problems are not identified. Understanding the situation of the user requires the use of systems thinking, or a conceptual framework that entails seeing interrelationships between components, rather than linear cause-effect chains, and the observing of processes of change as opposed to providing snapshots (Wilson 2001). Fisk et al (1998:218) support this view, arguing that community members do not exist in isolation, but rather are enmeshed in the fabric of the society and culture from which they come. Solutions to complex social problems emerge from community members, and systems thinking helps them to see the whole, and to recognise patterns and interrelationships. The problem the authors sought to address here, is which theoretical frameworks are suitable for the study of the AKISs of small-scale farmers.

## **3 PURPOSE OF THE REVIEW**

This article, which has been distilled from a critical review and analysis of the literature on AKISs, presents a theoretical framework for researching an agricultural knowledge and information system. This is motivated by the belief that there are benefits to combining these literatures in a study of the information behaviour of small-scale

farmers within an AKIS. The article draws on a larger study by Munyua (2011). Munyua and Stilwell (2012) reviewed suitable paradigms for studying an AKIS and the specific methods used. Some of the results from the larger study are found in Munyua and Stilwell (2010) and Munyua and Stilwell (2013), but due to space constraints they are not repeated here. The purpose here is to draw out the issues underpinning the review of the potential theoretical perspectives, models and frameworks, and to put forward an holistic, theoretical framework that could inform a more complete understanding of the complexities of the AKIS of small-scale farmers in developing country contexts.

## **4 METHODOLOGY**

The methodology used was a critical review and analysis of the AKIS, and relevant library and information science literature. This methodology was used to apply and increase knowledge in a particular area of research, thereby showing proficiency in reviewing, synthesising and critically analysing the relevant research literature (University of Washington 2011).

To carry out the review, the authors searched the relevant databases on agricultural knowledge and information system research and innovation, and on information behaviour. Articles were read for relevance and the content was analysed and synthesised using thematic analysis (Braun & Clarke 2006).

## **5 REVIEW OF CONTEXTUAL AND THEORETICAL PERSPECTIVES, FRAMEWORKS AND MODELS USED IN STUDYING AN AKIS**

The review was underpinned by an approach based on the pragmatic paradigm, which was chosen for its emphasis on fitness for purpose. The paradigm assists in addressing research questions, using the most appropriate methodology and data collection methods. As concluded by Johnson and Onwuegbuzie (2004:17), the pragmatic paradigm “can help to build bridges between conflicting philosophies”. It provides a lens for looking at and making sense of phenomena in a complex, multidisciplinary and multifaceted study comprising multiple actors, different knowledge systems, information behaviour, and information and knowledge management practices.

### **5.1 CONTEXTUAL DEFINITIONS**

Many of the terms pertaining to an AKIS are not in general use in mainstream library and information science literature, and are therefore defined here, before the theoretical perspectives from the review are presented. An AKIS is



a set of agricultural institutions, organisations, persons and their linkages and interactions, engaged in the generation, transformation, transmission, storage, retrieval, regulation, consolidation, dissemination, diffusion and utilisation of knowledge and information, with the purpose of working synergistically to support opinion formation, decision making, problem solving and/or innovation in a given sector, branch, discipline or other domain. (Röling 1989:1–2)

An AKIS plays various important roles. It “links rural people and institutions to promote mutual learning and to generate, share and utilise agriculture-related technology, knowledge and information” (Food and Agriculture Organisation of the United Nations [FAO] & World Bank 2000); facilitates the interactions of agricultural actors (such as farmers, agricultural educators, researchers and extensionists); increases the synergy of its components, making the contribution of the total AKIS exceed the sum of the components (Röling 1989:2); and has the potential to harness knowledge and information from various sources for better farming, improved agricultural growth and livelihoods (Rivera et al 2005:vi). At the organisational level, an AKIS comprises the institutions and organisations of agricultural extension, research and education which generate and disseminate knowledge and information (World Bank 2004). It encompasses service providers and users involved in agricultural knowledge and information systems (Rivera et al 2005:11) to: support interrelated components in agricultural production, marketing and post-harvest handling (World Bank 2004); enable different stakeholders to exploit opportunities and facilitate innovation (Hoffmann et al 2007:355); emphasise social and human capital; and promote innovation by facilitating linkages between researchers, extensionists and farmers (Lele et al 2010:64); deliver knowledge to a clientele and describe a two-way flow of information and knowledge among different sub-systems, such as research and users (Bagnall-Oakeley & Ocilage 2002); and improve linkages and learning across all levels and between different actors (Opondo et al 2006).

In the context of research and development, an AKIS provides a conceptual framework that enables researchers to view the whole picture and provide comparative analyses (Röling 1989:74); is essential to community development (Röling 1989:2); and facilitates participation, and the sharing and exchange of knowledge and information (Engel & Salomon 1997); and fosters the transfer of technologies (Rivera et al 2005:11).

<An AKIS helps researchers and extensionists focus on key actors within the AKIS>. These actors contribute to agricultural innovation (Salomon & Engel 1997:19); assist in addressing problems inherent in the agricultural sector; and integrate the efforts of the different segments by collecting their intellectual capital in an holistic way (McDowell 2004).

This section argues that AKISs are dynamic and respond to farmers’ information and knowledge needs and changing policies (Karami 2006). An understanding of the AKIS of small-scale farmers is critical to improving agricultural productivity and livelihoods,

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as an AKIS reflects the local environment, value systems and social, economic, technological and regulatory parameters of its users (Moussa 2006).

For Salomon and Engel (1997:19–20) key concepts are: i) systems that are virtual and provide a way of thinking, such as the knowledge and information system (KIS), agricultural information system (AIS), agricultural knowledge system (AKS) and agricultural knowledge and information system; ii) the boundary, which is defined by the problem or geographical location and the lines of relationship between the actors who form the system, along with the importance of the actors; iii) linkages that illustrate how actors communicate and are directed to joint efforts; and iv) linkage mechanisms that facilitate communication, coordination and resource transfer.

The concept of “systems” represents complex phenomena that are hard to analyse using conventional scientific analysis, such as the agricultural information system. A system is an arrangement of parts comprising elements, components and sub-systems (Hurtubise 1984) that interact towards a shared goal, have synergistic effects on the whole, and have linkage mechanisms that facilitate interactions between system components (Röling 1988:187–188). Distinguishing between an information system and a knowledge system, Röling (1988:32) points out that while information is explicit and can be transmitted, knowledge is tacit, resides in the brain, and can be generated and utilised.

A KIS comprises a set of people, institutions, organisations and networks that are linked to each other for the purpose of innovation (Salomon & Engel 1997:74). KISs do not exist in practice, they are imaginary but provide “a way of thinking that helps us understand the social organization of innovation in agriculture better” (Salomon & Engel 1997:19). Understanding the KIS guides interventions aimed at increasing the benefits of the system to different actors (Salomon & Engel 1997:74). Although these systems have been critiqued for being abstract, they provide an understanding of the barriers and drivers of directional<sup>1</sup> technology and information flow between farmers and other actors in the system (Petersen 1997). All AKIS actors “manage, generate, transform, transmit, store, retrieve, integrate, diffuse and use knowledge and information”, and the performance of the system is dependent on their common objectives, and on how the different actors cooperate, communicate and coordinate specialised tasks (Salomon & Engel 1997:19, 74). The interactions and relationships between actors in an AKIS facilitate the capturing, recording and sharing of knowledge, and the unique knowledge assets held by the different actors form the fabric that holds together the various actors (Malekmohammadi 2009:233).

An AIS is a system in which “agricultural information is generated, transformed, transferred, consolidated, received and fed back in such a manner that these processes function synergistically to underpin knowledge utilisation by agricultural producers” (Röling 1988:xi, 33). Various vertical (top-down and bottom-up) and horizontal information flows occur within an AIS, generating a complex phenomenon (Röling 1988). An AKS, on the other hand, is a system of “beliefs, cognitions, models, theories,

concepts, and other products of the mind in which the (vicarious) experience of a person or group with respect to agricultural production is accumulated” (Röling 1988:33). The groups’ knowledge systems include local knowledge and affect the members’ perception, learning and reasoning (Röling 1988:33). Understanding the knowledge systems at the local level before deciding on any systems or improvements is important (Ekoi & Hepelwa 2003).

The study of an AKIS is thus complex and requires a broad theoretical framework to explain its different facets in a comprehensive manner. This article reviews the perspectives, theories, concepts, models and framework that constitute a theoretical foundation for studying the AKIS of small-scale farmers in the context of a developing country. Undertaking such a review requires an understanding of paradigms. It is widely acknowledged that there is a relationship between research paradigm, theory and methods (Easterby-Smith et al 2002:27, 31; Teddlie & Tashakkori 2003:22), and that alignment between these elements helps to avoid confusion; enhances the achievement of research objectives; and provides an opportunity to explore and discuss theory, methods and the research process (Knox 2004). Munyua and Stilwell (2012) review paradigms for studying an AKIS in some depth. While a paradigm provides a way of looking at phenomena, theory aims to explain what is observed in the world (Wagenaar & Babbie 2001:18, 19) and “no theory ever attempts to represent or explain the full complexity of some phenomenon” (McKelvey 1999:15). Many authors (Dervin & Nilan 1986; Dick 1993:54; Creswell & Plano Clark 2007:26, 95, 104; Kuhn 1970:79, 110) have proposed the need to triangulate paradigms and perspectives in research, and this applies to studying an AKIS. A triangulated approach facilitates the answering of research questions, and provides an understanding of phenomena from varied viewpoints.

Theories are generalised explanations of relationships among phenomena (Case 2002:135, 153), and constitute assumptions, principles and relationships (Bates 2005:2). They are concerned with the how and why of empirical phenomena (Johnson & Christensen 2008:20) and highlight patterns in phenomena (Mugenda & Mugenda 2003). In this article, theory is seen as a system comprising interrelated constructs, concepts, definitions and generalised propositions that explain or predict phenomena, or explain facts by specifying relations among variables and laws that interrelate those constructs (Mugenda & Mugenda 2003:5–6, 15). For Wilson (1994:17), failure to base research on theoretical frameworks is like “building a pyramid with no foundation”. Metatheory, described as “the philosophy behind the theory”, is related to the construct paradigm, but a paradigm is broader than a metatheory (Bates 2005:2). While theories are less abstract yet changeable, metatheories are more abstract and less changeable (Kari 1998:2).

Models, which are broader than theories, guide research in a systematic manner (Järvelin & Wilson 2003). Models focus on more limited problems; are defined in relation to theories (Case 2002:114); provide a logical arrangement among concepts and simplify

the view of reality by helping to visualise phenomena (Frankfort-Nachmias & Nachmias 1996:43–44). For Wilson (1999:250), a model is a “framework for thinking about a problem” which “may evolve into a statement of the relationships among theoretical propositions”. Some authors use “model” and “framework” interchangeably (Järvelin & Wilson 2003). Here, Wong and Aspinwall’s (2004:94) definition of a framework as “a structure that comprises relevant entities or a set of guiding principles and ideas that support a discipline” is used in a manner that secures links between theory and practice.

## **5.2 THEORETICAL PERSPECTIVES RELEVANT TO THE STUDY OF AN AKIS**

Social science researchers use one or more theoretical approaches to a research problem (Mouton & Marais 1996:191). There is a need to contribute to the theoretical foundations of the area being researched by looking at the research problem from various pertinent theoretical perspectives (Creswell & Plano Clark 2007:21). Pretty (1994:38) argues that it is necessary to triangulate theories to ensure proper interpretations of the world and ensure objectivity. Six perspectives which the authors consider relevant for studying the AKIS of small-scale farmers are described next.

### **5.2.1 Systems perspective**

This perspective provides an holistic approach for studying complex issues (Nakamori 2006:12), and projects beyond personalities and events (Senge 2006:7, 42, 73). The construct “system” has been applied to individual, institutional and network actors associated with knowledge processes (Röling 1992). Systems thinking is “an approach to studying the world and dealing with complex situations and intervening in it” (Engel 1997:24). A system is a complex whole that includes people and information, but because the system is not a reality, it is referred to as a soft system (Nakamori 2006:12). Such systems are diverse and vary depending on the subject. This approach shares a philosophical background with Nonaka’s *ba*<sup>2</sup> (Nonaka et al 2000; Nonaka & Toyama 2005). Systems thinking reveals patterns clearly, and forms part of the “soft systems” approach (Nakamori 2006:12) which is described next.

### **5.2.2 Soft systems perspective**

Engel and Salomon (1997) distinguish between hard systems thinkers who view the world as systemic and focused on models that represent the real world, and soft systems thinkers who view the world as unsystemic. Images are developed to convey the different perspectives and practices of social actors. The soft systems approach is attributed to Checkland (1988, 1999, 2000) who argues that groups of activities are linked to form a purposeful whole which is “meaningful only at the level of the whole” (Checkland 1988:309). The process of inquiry is necessarily systemic (Checkland 1985). Soft systems are social constructs that are present to the extent that the people

participating agree about their goals, and negotiate the boundaries, membership and usefulness of the system (Röling & Wagemakers 1998:16, 17). They provide analytical perspectives to study the interplay between agricultural actors, what they actually do, how they learn, how they share ideas and experiences, and how they manage knowledge and information (Engel 1997; Engel & Salomon 1997; Salomon & Engel 1997).

The approach underpins the soft systems methodology (Checkland & Scholes 1990) used for solving complex organisational problems, and for facilitating the integration of perspectives among key stakeholders (Engel 1997:23; Engel & Salomon 1997). It is based on systems concepts which are consistent with Complexity theory (Benbya & McKelvey 2006:16, 17). Soft systems methodology has three objectives: i) to identify opportunities to improve a KIS; ii) to create awareness among relevant stakeholders; and iii) to identify actors and potential actors (Checkland & Scholes 1990:27). Checkland's (1990:27) soft systems methodology facilitates the design of useful interventions. The soft systems approach allows a group of actors who are "faced with a shared problem to engage in a collective learning process in order to design a human activity system that can help solve the problem through collective action".

Critics of the soft systems approach argue that it places too much emphasis on seeking harmony and consensus (Engel 1997:28–29). The operational tools available for exploring the relational dimensions of social interaction are inadequate, and the emphasis on wholeness is considered ambitious. Nevertheless, the approach provides for wide participation and has been used to solve complex organisational problems and to address innovation, learning and choice making (Bawden 2006; Denzin & Lincoln 2005:562; Senge 2006). Linked to the soft systems perspective is the knowledge systems perspective.

### **5.2.3 Knowledge systems perspective**

Röling (1988) and Salomon & Engel (1997) developed this perspective. Embedded in the soft systems approach, it guides understanding of the social organisation of innovation (Engel 1995, 1997:23; Röling 1988, 1989, 1992). It is integrative and draws together the actual components or elements of a system of actors relevant to a given situation, such as farmers, farmer organisations, research institutions, NGOs and the private sector (Röling 1992). It is grounded in the assumptions that knowledge generated in one part of the system is transformed and utilised in other parts of the whole (Röling 1989:51); knowledge is socially constructed; and communication is a form of social interaction (Engel & Salomon 1997).

This approach focuses on sharing knowledge among key stakeholders and actors in an AKIS study and guides the integration of their perspectives (Engel 1995, 1997:23). It caters for what people know and how they respond to situations. The knowledge systems perspective views agriculture as a social effort requiring competent interrelated actors, and focuses on a diagnostic framework for analysis, design and management



intervention (Röling 1988; Salomon & Engel 1997). Engel and Salomon (1997) advance four major reasons for choosing systems thinking and the knowledge systems perspective to guide a study of the nature of AKIS. This perspective and the approach offer the potential for linking the macro and micro aspects of human actions at different levels (which require a systems thinking approach that facilitates the emergence of different qualities); addressing multiple actors (such as extension, research and education as well as mass communication) in the sharing of knowledge; incorporating a comprehensive “human agency” view regarding what people know and what they do, as opposed to merely focusing on their roles as innovators, adopters or laggards (Rogers 1983:22; Rogers & Shoemaker 1971); and for studying innovation in agriculture from a social context focusing on interrelated actors.

### **5.2.4 Knowledge and information perspective**

The KIS perspective centres on organisations, and the linkages and interactions among actors. KIS (as in AKIS) is a virtual concept as opposed to a tangible system. It is a way of thinking that helps us to understand innovation in agriculture (Salomon & Engel 1997:19). Falling within the soft systems perspective, KIS provides a diagnostic framework that brings to light organisational forms that facilitate knowledge and information processes (Salomon & Engel 1997:19). Since all agricultural actors manage, generate, transform, transmit, integrate, disseminate and use knowledge and information to some extent, this approach is appropriate for studying the interactions of actors in an AKIS, facilitating the design of effective communication and cooperation, providing opportunities for synergy in getting stakeholders together, and resulting in efforts that exceed the sum of the individuals involved.

### **5.2.5 Knowledge management (KM) perspective**

This perspective emphasises the intellectual, knowledge-based view of an organisation, and has been used to study how organisations create, distribute and use knowledge. For Styhre (2003:25, 80, 144), KM is “a mindset” that provides organisations with a way of thinking about how to foster knowledge. Sveiby (1997:37) sees knowledge as the “capacity to act”. It is conjured up in people’s heads. Having explored ways of asking questions about the role of knowledge in organisations (Sveiby 1994), he subscribes to the adoption of a perspective that capitalises on intangible assets. The KM perspective stems from the interpretive and postmodernist approaches which portray knowledge as socially constructed (Engel 1997:14, 32–33; Röling & Wagemakers 1998; Styhre 2003:21; Sveiby 1997:30). Postmodernists advocate pluralistic approaches to the questioning of ideas, and recognise that there are multiple understandings as well as inconsistencies, ambiguities and contradictions (Styhre 2003:27) in terms of what we know. The management of knowledge cannot be divorced from beliefs, culture and communication practice, and for this reason “knowledge must always be examined at its source ... the activities of the individual and communities of practice” (Styhre 2003:149,

157). Further, knowledge should be examined as a collection of skills, capacities and know-how in context.

### **5.2.6 Community of practice (cop) perspective**

A CoP is a group “of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an on-going basis” (Wenger et al 2002:4–6). CoPs are age-old practices in which the first knowledge-based social structures in pre-historic times allowed people to meet around the fire to discuss livelihood strategies. People find value in interacting and sharing information, insights and advice, and in discussing their situations, aspirations and needs (Wenger et al 2002). CoPs are variously described as “a learning space where both the tacit and explicit dimensions of knowledge are intertwined and developed further” (Nilsen 2006:5) or learning communities (Sallis & Jones 2002:24; Wenger et al 2002:24, 25); thematic groups, or informal knowledge or learning networks (Wenger 1998); “micro communities of knowledge” (Von Krogh et al 2000); and self-governing groups of people held together by a shared interest, problem, job or practice (O’Hara et al 2002:2–3). For Wenger et al (2002:42), CoPs refer to a specific social structure which has as its aim creating, expanding and exchanging knowledge, and developing individual capabilities. The members learn together how to develop their competencies and how to do things in a way that is easier and better, thus adding value to an organisation (O’Hara et al 2002:2–3). However, learning requires an open atmosphere where each community develops a distinctive ambience in which members deepen relationships, establish norms and build a foundation for collective inquiry (Coakes & Clarke 2006).

A CoP is an organic “structure” that arises naturally and is an informal, relatively loose, distributed group of people comprising members of a community who are closely knit because of what they do together (joint enterprise). Joining a CoP is voluntary (Wenger et al 2002:50) and members of a CoP define themselves in <the doing of what they practice> (O’Hara et al 2002:1). CoPs are defined by knowledge as opposed to tasks (Wenger 1998). Emphasising the need to disseminate local knowledge, Choo (1998) explains that tacit knowledge could be shared with a group, which then modulates personal knowledge through a network of roles and relationships or CoPs. CoPs connect people within and beyond groups or organisations. The end product reflects the understanding of what the members see as important (Wenger et al 2002:4, 6, 36). CoPs act as nodes for the exchange and interpretation of information and knowledge; and as temporary teams that provide a sense of identity and competencies to help keep the organisation at the cutting edge (Wenger 1998). In addition, they are self-organising and require time and space for collaboration (Wenger et al 2002:34). Internal leadership (formal or informal) is distributed within a CoP.

Both hard and soft knowledge are created and shared in CoPs, but soft knowledge cannot easily be learned by newcomers (Hildreth & Kimble 2002). For Wenger et al. (2002:6),



useful knowledge – unlike assets which can be stored, owned and managed – is not a “thing” or an “object” but resides in the skills, understanding and relationships of community members and in the tools, processes and documents they use. These authors indicate that knowledge is a living practice that results from accumulated experience comprising the residue of people’s actions, thinking and conversations. There are no clear beginnings or ends in knowledge communities, but rather individuals come together and develop, evolve and finally disband. This perspective has been applied to the study of learning in communities (Lave & Wenger 1991; Small & Irvine 2006; Wenger et al 2002), in KM and information behaviour (Davis 2005:106).

### **5.3 PRINCIPAL THEORIES AND CONCEPTS USED IN STUDYING AN AKIS**

The principal theories on which the study of an AKIS of small-scale farmers may be constructed, are described next. Patton (2002:247) and Creswell (2003:136) consider the triangulation of theories to be necessary for seeking objectivity and ensuring proper interpretations. This is particularly true in the case of the study of broad, multidisciplinary and multifaceted AKISs.

#### **5.3.1 SENSE-MAKING THEORY**

Sense-making is both a theory of communication practice and a research methodology (sense-making) which emphasises the solving of problems (Dervin 1983, 1998:36, 1999:728; Dervin & anonymous students 1997; Spurgin 2006:102; Wilson 1997:41, 2000). It focuses on the triad: the event; situation or a gap at the event; and uses obtained from responses to gaps in the event (Foreman-Wernet & Dervin 2006:289; Naumer et al 2008; Tidline 2005:113, 115). For Dervin (1998:39, 2006:6) the sense-making metaphor forms the starting point for understanding users and their needs by addressing the situation, gaps and help (bridges). The situation, gaps, bridges and outcomes are used as tools to focus on the gap and thereby to make sense. Sense-making theory is rooted in the metaphor of a person travelling through time and space from a historical background with incomplete instructions, and arriving at new situations, facing gaps, building bridges across the gaps, and finally evaluating outcomes and moving on. The approach guides researchers in how to think about people, how to talk to them, how to question them and how to design systems that meet their needs. The metaphor forms the basis of the interpersonal interface between the user and the interviewer, and questions pertaining to a specific micro-moment situation. Sense-making theory thus sets out a general motivation for information-seeking behaviour, and the main goal of sense making is to establish what users “really think, feel, want and dream” (Dervin 1998:39).

This theory is an approach to thinking about and implementing communication research that guides communication design and practice, as well as communication-based systems and activities (Dervin 2005b). It assumes that knowledge made today may be

tomorrow's gap (Dervin 1998:41; Gluck 1997:54, 55; Spurgin 2006:102). In order to design responsive systems, it must be taken into consideration that, as people move through time and space under dynamic conditions, they must make and unmake sense. For this reason, Dervin's (2005b:26, 28 and 2006:5) sense-making theory focuses on both sense making and unmaking. Dervin (1993) notes that we know a lot that we do not know. Castro et al (2010:356) support the need for probing questions to yield a complete picture, because restricted verbal responses yield "uninformative information". This is the value of the sense-making methodology.

In sense-making the unit of attention is the "person in situation" (the sense-making instance) (Dervin 1998:41–44). Through sense-making interviews, informants narrate how their actions, cognitions and feelings change along with their perceptions of reality. This allows for the viewing of the internal process of an individual's understanding, and helps to inform communication where there are differences in decision-making processes, the handling of uncertainty and culture (Romanello et al 2003). Sense-making theory attends to the potential of people to change across time and space, and addresses power issues which constrain human sense making and how people share their knowledge with others (Dervin 1998:40–41).

The sense-making approach more generally comprises a set of philosophical assumptions, propositions, methodologies and methods (Dervin 1999:728). The approach is grounded in realist, foundational definitions and constructivist learning theories, and emphasises problem solving through real actions and verbings (Dervin 1993, 1998:36, 1999:745). Sense-making borrows from work on information needs, seeking and use, such as in library and information science and communication research (Dervin 1999:728, 2003:111 and 130, 2006:5). Criticisms of sense-making theory include that it is fuzzy, and has not been clearly and analytically expounded to the empirical level, which has in some cases caused misunderstandings and misusages (Kari 1998:1); it is oversimplified, lacks depth and breadth (Naumer et al 2008), explicitness and development as a theory, and is merely a "conceptual lens or point of view" (Kari 1998:1, 16). The methodology has also been criticised for its reliance on memory. Some authors have demonstrated that sense-making has a high degree of overlap of micro moment steps, and that informants may not recall aspects that happened in the past (Gluck 1997:56). Gluck, however, argues that what one individual may forget is likely to be remembered by other informants in the same situation. Despite these limitations, sense-making theory has been applied in different contexts, including information behaviour and KM (Cheuk 2007a and b; Dervin 1998, 2005a; Dervin & Reinhard 2006; Mehra et al 2000; Spurgin 2006), communication practice and electronic communication (Dervin 2005a).

### **5.3.2 Social cognitive theory**

This theory (Bandura 1977) emphasises participation, and the origins and actions of human behaviour which are mainly social (Miwa 2005:54, 56). For Bandura (1977:22),

learning would be hazardous and laborious if the actions of individuals were informed only by the effects of their own actions. Observation helps people form ideas about new behaviour. These ideas are coded and, subsequently, determine the action taken. Action is also informed by seeing positive behaviour modelled and practised by others within the environment (Bandura 1977; Smith 1999). Social cognitive theory thus assumes that knowing is a matter of participating or being actively engaged in the world, and learning through engagement (Smith 1999). In brief, social cognitive theory allows people to “see” and build on the results of other people’s behaviour (Smith 1999).

This theory focuses on learning as social participation, observational learning and the psychological results of perception, learning and reasoning (Bandura 2007). It aims to explain how people think by emphasising the importance of personal factors affecting their thoughts (self-efficacy) and behaviour on learning. It centres on day-to-day human behaviour such as how people seek information. The theory helps to explain human behaviour in terms of continuous reciprocal interaction between personal factors such as knowledge, expectations and attitudes, and environmental determinants (Bandura 1977:vi, 9–10).

Social cognitive theory borrows from theories of practice, social structure, identity and situated experience, and is related to the social theory of learning (Wenger 1998:12). The key learning components considered necessary to characterise social participation as a process of knowing include meaning (learning as experience); practise (learning as doing); community (learning as belonging) and identity (learning as becoming). The social theory of learning thus assumes that people are social beings, and that knowledge is a matter of competence. The functioning of a community is, therefore, held together through relationships of mutual engagement (Wenger 1998:12). This theory has to do with learning through participation in routine practices as social groups, how group members influence one another, and how they arrive at shared meanings (Mayer 2005:266). For example, small-scale farmers can learn by observing other members in their farmers’ group or community, and discussing the outcome of behaviour change can instill appropriate behaviour. Learning may also occur without a change in behaviour (Wenger 1998).

### **5.3.3 Social capital concept and theory**

For some scholars social capital is a concept (Pretty 2003; Woolcock 2001), while others view it as a “theory” (Davis 2004; Landry et al 2001). Social capital is defined as the norms and networks that help people to act communally (Woolcock 1998, 2001; Woolcock & Narayan 2000:225) and provide opportunities to mobilise resources (Dekker & Uslaner 2001). Pretty and Wesseler (2004:3) identify connectedness and trust between people as key values of social capital. The construct of social capital comprises trust within a social culture, social organisations, networks and information channels, and is related to the social theory of learning (Coleman 1988, 1994), as well as beliefs (mental or

subjective knowledge), norms and sanctions (Coleman 1988; 1994), and rules (linguistic statements that express knowledge of values) (McElroy et al 2006:131). These features describe the collective resources enjoyed by individuals through community network memberships, which also facilitate collective action and secure benefits (Grootaert & Van Bastelaer 2001:8; Sobel 2002:139). Woolcock (2001:12) links social capital to the saying “it’s not what you know, it’s who you know”. It is viewed as an asset that can address social disintegration and division (Dekker & Uslaner 2001).

Social capital integrates information sharing (a crucial element of poverty alleviation) and the coordination of activities that ensure equal sharing (Grootaert 2001:10–14). It contributes to collective decision making, facilitates the sharing of information among group members, yields higher returns on investment, improves access to credit, and inculcates cooperative action (Grootaert et al 2002:33–34). For Grootaert (2001:10–14), social capital addresses associations that have a positive impact on development. It varies greatly in terms of geographic area and professional activity, and is multifaceted. It offers a new way to gain a competitive edge (Landry et al 2001:79). Despite the benefits of social capital, critics argue that it lacks a clear-cut definition (Kawachi 2000); it is perceived to be less tangible, hence its quantification remains a subject of debate; it lends itself to coverage that is too broad, encompassing a mix of social assets (Bebbington 2002) and excludes outsiders, restricts individual freedom and makes excessive claims on members of the group (Kawachi 2000). However, the concept of social capital has been widely applied (Clutterbuck 2001; Landry et al 2001:74; Woolcock 2001; Woolcock & Narayan 2000:225; World Bank 2003), and is considered useful in studying groups such as farmers. It “is emerging as a crucial concept in the understanding of healthy groups and communities” (Landry et al 2001:74).

## **5.4 PRINCIPAL MODELS FOR THE STUDY OF AN AKIS**

Wilson (1999, 2006a) and Järvelin and Wilson (2003) comment on the lack of consensus about a conceptual framework with which to provide a common language for information behaviour research. However, a number of theoretical perspectives which are used, and various information-seeking behaviour models relating to theoretical perspectives, are often used in combination in the literature. They are complementary because they serve different research purposes (Järvelin & Wilson 2003; Wilson 1999, 2006a). Models for explaining the information behaviour component of AKISs include Wilson’s general model of information seeking (Case 2002; Wilson 1999, 2005, 2006a and b). Aspects of merging local knowledge and external information can be guided by Meyer’s (2003) model of information transfer to rural communities.

#### **5.4.1 Wilson's general model of information behaviour**

Wilson's (1999) revised general model of information behaviour emphasises the complexity of information seeking (Case 2002:118; Wilson 1999:256). It identifies modes of information seeking, and explains how needs prompt people's information-seeking behaviour, particularly why some needs prompt information seeking more than others do; why some sources of information are used more than others; and why people may/may not pursue a goal successfully based on personal understandings of their own effectiveness. It throws light on actions taken to satisfy a need and the decision taken to search various sources. The model incorporates various types of search behaviours and provides a framework for understanding those factors that hinder people in the process of seeking information (Case 2002:118–119; Wilson 2005:31–35, 2006a:682).

Critics of Wilson's (1999) general model identify a need for further research on how to motivate people to seek and use information (Case 2002:119; Wilson 2006a:682); the model is limited in the way it reflects everyday information seeking, as it does not allow for secondary forms of information behaviour, and does not account for information practices such as scanning the environment or for chance encounters (McKenzie 2003:19, 37). Nevertheless, Wilson's (1999) general model has influenced the theory and practice of information research and is valued for its simplicity (Bawden 2006; Wilson 2005).

#### **5.4.2 Meyer's merger model for information transfer**

Meyer's model (2000:59–60, 173, 203–204, 2003; Meyer & Boon 2003) emphasises the role and use of information in ensuring the livelihoods of small-scale farmers. It is based on the transfer of agricultural information to small-scale farmers. For Meyer, the transfer of information to farmers is dependent on training and requires a knowledgeable facilitator to manage and coordinate information from both the IKSs and the external information systems. Bearing in mind that most small-scale farmers in Africa are illiterate, Meyer (2000:187, 207, 2005) argues for the use of oral culture, metaphor and storytelling, acting, demonstrations and repetition of key concepts during training. Meyer (2000:187–192, 214) states that because farmers are not familiar with external information and depend largely on local knowledge, it is necessary to push external (modern) agricultural information and knowledge to enable them to exploit such information and ensure rural development.

### **5.5 FRAMEWORK USED IN THE STUDY OF AN AKIS**

The Cynefin is a sense-making framework that originated in the practice of KM. A phenomenological framework (Kurtz & Snowden 2003; Mark & Snowden 2006; Snowden & Boone 2007), it is informed by Dervin's sense-making methodology. A powerful problem-solving tool based on narrative methods and complexity theory (Kurtz & Snowden 2003:462, 466, 467), it is used to reveal patterns of behaviour, and the



understanding of individuals and groups from multiple affiliations and contexts (Kurtz & Snowden 2003:467–468). It offers a categorisation framework that supports people's decision-making approaches (Kurtz & Snowden 2003:467, 473; Snowden 2005). The framework is not described in any depth here for reasons of space, but is described and evaluated in depth in Munyua (2011).

## 6 KEY ISSUES EMERGING FROM THE CRITICAL REVIEW

The following key issues emerged from the critical review.

- Studying an AKIS is complex, necessarily multidisciplinary and multifaceted. It requires a broad theoretical framework to explain phenomena, relationships and the different facets of an AKIS. With regard to the systems perspective, and linked to information systems specifically, is the observation that complex systems providing an holistic perspective of all stakeholders are formed by the accumulation of the explicit and tacit knowledge of interacting individuals over time. The systems perspective is thus a useful lens for studying an AKIS as well as the isolated parts of the AKIS of small-scale farmers.
- The soft systems perspective facilitates an understanding of social learning processes and choice making among different stakeholders (Checkland 1988, 2000; Checkland & Scholes 1990; Röling & Wagemakers 1998:16; Senge 2006). A further development of this perspective is the Relaxed (or Rapid) Appraisal of Agricultural Knowledge Systems (RAAKS) which Salomon and Engel (1997) recommend for studying an AKIS. The soft systems approach also helps with understanding innovation, and is used as a learning system (Checkland & Scholes 1990:27). For example, an AKIS has agricultural stakeholders who engage collectively to learn, address common problems and make joint discoveries. The actors are linked together through a virtual system which shows how they create, adapt, share, store and apply knowledge and information (Engel 1997; Salomon & Engel 1997; Röling & Jiggins 1998:304).
- The knowledge systems perspective is also deemed suitable for studying the AKIS of small-scale farmers, because in an AKIS different actors work together and share knowledge. They depend on one another for decision making, problem solving and innovation. The KM perspective is also useful in understanding and explaining most of the processes small-scale farmers use in capturing, recording, sharing and using knowledge. Related to the KM perspective is the CoP perspective, which has been applied to the study of learning in communities (Lave & Wenger 1991; Small & Irvine 2006; Wenger et al 2002), in KM and information behaviour (Davis 2005:106). CoPs are useful in understanding the social and institutional dimensions of small-scale farmers.

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- Sense-making theory is considered appropriate for studying an AKIS to identify the information and knowledge needs of small-scale farmers, their information-seeking behaviour, where they obtain information, the key actors, linkages and flows of knowledge and information between agricultural actors, and the use of ICTs for sharing and exchanging knowledge and information.
- The social cognitive theory is considered invaluable for understanding the learning processes amongst small-scale farmers through observing and imitating others, and the social and institutional dimensions of farmers' groups. It could help researchers studying AKISs to gain insight into information-seeking behaviour, and why some learning activities work in farming communities, and the factors that influence people's thoughts and behaviour on learning. The theory also holds potential for explaining how agriculture-related skills are acquired and shared.
- Social capital offers a framework for studying the information behaviour of small-scale farmers and explaining the knowledge-sharing mechanisms in farmers' groups, as well as the power structures in groups (Widén-Wulff & Ginman 2004:456). It is a prerequisite for improved agricultural production, as people benefit from being well organised in groups which share knowledge, thereby increasing their existing knowledge (Pretty & Wesseler 2004:3). It creates awareness of the cultural context to foster understanding and the evaluation of options (Sillitoe 2010:26).
- Among the information behaviour models, Wilson's (1999) general model has been successfully applied in studying information behaviour in many contexts (Ikoja-Odongo & Ocholla 2003), and provides a framework for understanding how needs prompt farmers to seek information, by focusing on personal variables of seeking in the context of the AKIS of small-scale farmers.
- Meyer's merger model combines the modern or external and indigenous information systems through communication mechanisms, and takes into consideration information behaviour, environmental and socio-economic conditions, local policies, infrastructure and the contributions of different stakeholders involved in farming activities (Meyer 2000, 2002:105, 2003; Meyer & Boon 2003). It provides a framework for studying the use of local agricultural knowledge and external information by small-scale farmers and their information behaviour.
- The Cynefin framework is useful for studying the AKIS of small-scale farmers, given its wide application, and its demonstrated potential for studying complex systems, innovation, culture and decision making among small-scale farmers and the relationships between AKIS actors. It provides the underlying structure for understanding the information behaviour of rural people.



Figure 1 brings together and provides an overview of the frameworks reviewed in this article and is regarded as suitable in studying the AKIS of small-scale farmers.

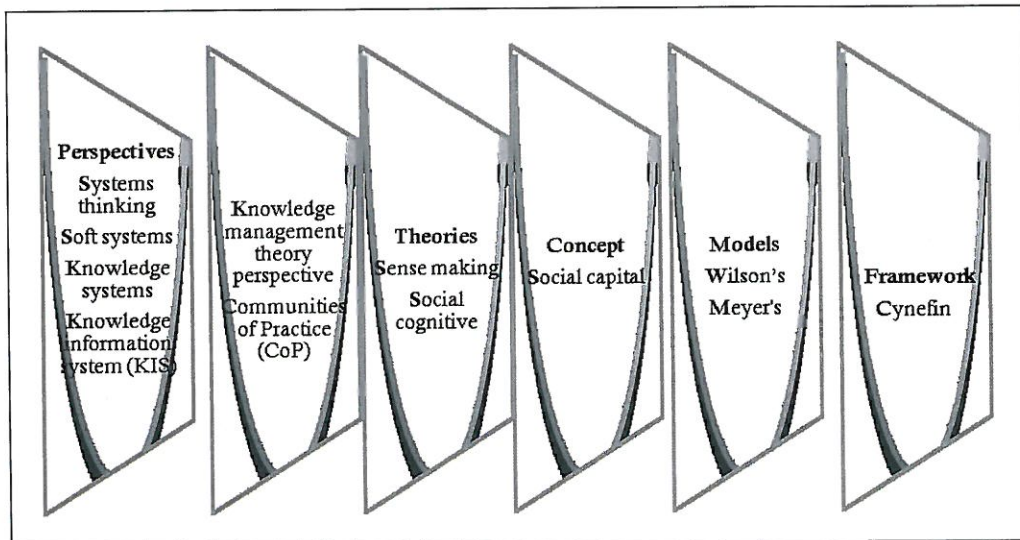


Figure 1: A theoretical framework for studying the AKIS of small-scale farmers

Source: Munyua and Stilwell

## 7 CONCLUSION AND RECOMMENDATIONS

The article has established the need to recognise that AKISs are dynamic and respond to farmers' information and knowledge needs and changing policies. It demonstrates that the AKIS of small-scale farmers is critical to improving agricultural productivity and livelihoods. The conclusion reached is that since "no theory ever attempts to represent or explain the full complexity of some phenomenon" (McKelvey 1999:15), the theoretical foundations underlying the study of the AKISs of small-scale farmers comprise an integration of paradigms, perspectives and approaches, theories and concepts, models and frameworks that complement one another.

The article recommends certain perspectives, frameworks and models found to be relevant in the critical review. These are described above, and their use has been motivated in terms of studying the AKIS of small-scale farmers in a developing country context.

The article demonstrates that researchers have a variety of interlocking options from which they can choose a research framework/combination of frameworks. The pragmatic paradigm suggests that researchers should be guided by the fitness for purpose of the

choices made for the nature of their research problem and its location. The authors recommend this approach.

## NOTES

- 1 Directional – meaning the technology improves information flow by transmitting and receiving information in a two-way manner (input and output) between farmers and other actors.
- 2 “Ba” is a Japanese word for “place” that is understood as a platform (shared place or space) for knowledge creation through emerging relationships, and knowledge is embedded in the *ba* (Nonaka 1998:40).

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