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Knowledge management working tool for agricultural extension practice: the case of Ghana

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Introduction

The over-reliance on scientific knowledge and the neglect of farmers' tacit knowledge in agricultural extension practice has long been identified as an impediment to increased agricultural productivity. Regardless of this setback associated with the current approach to extension practice, the emphasis continues to be placed on improving the intervention capacity of extension services (more staff, facilities, logistics) while the capacity to actively involve, listen and engage farmers' tacit knowledge in extension practice remains neglected (Roling, 1992). Therefore, for improved agricultural productivity based on sustainable practices, a new approach to knowledge management in agricultural extension practice becomes critical.

Such an approach should aim at connecting agricultural extension experts and farmers as a precursor to improved knowledge utilization in agricultural practice. Two differing justifications can be assigned for the existing knowledge divide between agricultural extension experts and farmers. The first is rooted in the communication-related theories, which emphasize the so-called 'two communities' metaphor. This position is premised on the assumption that the differences between the cultures of the agricultural extension experts and farmers lead to a lack of inter-group communication and, consequently, to low levels of knowledge utilization. The second suggests that the more sustained the interaction between agricultural extension experts and farmers, the more likely knowledge utilization will occur in agricultural practice. It is argued in this paper that the latter perspective, which emphasizes sustainable interaction between agricultural extension experts and farmers, is a critical intervention in connecting the knowledge divide between the communities of agricultural experts and farmers as highlighted by the former perspective.

This paper sets off with a conceptual framework of knowledge management, dwelling on the knowledge conversion model by Nonanka and Takeuchi (1995), and codification-personalization knowledge management strategies by Hansen et al. (1999). This is followed by an empirical assessment of agricultural extension services in Ghana as basis for the development of a knowledge management model for agricultural extension practice.

Forms of Knowledge

Knowledge can be formal (explicit) or informal (tacit). Knowledge is said to be formal when it is based on scientific evidence, whose validity and reliability can be tested over a reasonable period of time. Informal knowledge, differently, is experiential in nature and is acquired after an exemplary practice has been put to use over a period of time. Informal knowledge, unlike formal knowledge, is difficult to be replicated since the means for its acquisition is difficult to share.

Following from this general notion of knowledge, Polanyi (1967) identifies explicit and tacit forms of knowledge as the two forms of knowledge informing decision-making in almost all organizations. Polanyi believes that a large part of human knowledge is tacit. Knowledge of this type is action-oriented and has a personal quality that makes it difficult to communicate. Accessing tacit knowledge, therefore, presents a number of challenges, due to factors such as the absence of an explicit scientifically repeatable process for eliciting such forms of knowledge. Explicit knowledge, however, can be communicated across time and space. Polanyi's explanation of knowledge is similar to other definitions of knowledge in more recent literature (Sveiby, 1997; Alavi and Leidner, 2001).

The main methods for the acquisition and the accumulation of these two knowledge forms also differ. Explicit knowledge can be generated through logical deduction and formal study. Tacit knowledge, in contrast, can be acquired only through practical experience in the relevant context. Empson (2001) identifies these forms of knowledge as theory and practice, respectively. The distinction between these two forms of knowledge, though evident, it is not discrete or independent in the practical sense. These forms of knowledge are not dichotomous states of knowledge, but mutually dependent and reinforcing qualities of knowledge (Alavi and Leidner, 2001; Lam, 2002). Fostering a dynamic interaction between tacit and explicit knowledge, therefore, generates new forms of knowledge vital for improved knowledge utilization (Nonanka and Takeuchi, 1995). This is true in all industries including the agricultural sector.

Since tacit and explicit forms of knowledge complement each other, it is imperative for agricultural extension experts to pay more attention in harnessing the tacit knowledge of farmers and complement that with their explicit knowledge. Achieving this implies that a knowledge management working tool be institutionalized to guide agricultural extension practice. Such a tool should aim at harmonizing the communities and cultures of the agricultural extension experts and farmers as entities with a common course. This collaboration is critical because the two communities, although they may appear as distinct from each other in some regards, can hardly be functional without complementing each other's efforts.

Knowledge management is defined as 'the process by which an organization creates, captures, acquires and uses knowledge to support and improve its performance' (Kinney, 1998). It can also be understood as the exploitation and development of the knowledge assets within an organization, aimed at furthering the goals and objectives of the organization (Metaxiotis et al., 2005). It is presently recognized that successful

organizations are those that create new knowledge, disseminate it widely throughout the organization, and represent it into new technologies and products (Metaxiotis et al., 2005, Hansen, 1999; Leonard, 1999). Perceiving knowledge management as a condition of organizational success makes it crucial for agricultural extension experts to embrace and engage in it.

An effective knowledge management strategy for agricultural extension practice must aspire to bring the communities of extension experts and farmers together in all the knowledge management phases – from knowledge creation to utilization. Any attempt at bridging the knowledge divide between the two communities must be rooted in a knowledge management model that recognizes the significance and complementary roles of both tacit and explicit knowledge in decision-making. Examples of such models are the knowledge conversion model by Nonanka and Takeuchi (1995) and the codification-personalization model by Hansen et al. (1999). These models emphasise the importance of both tacit and explicit forms of knowledge in decision-making. Furthermore, they both provide a systematic understanding, development and utilization of knowledge in such a manner that all the processes involved in knowledge management are pursued in a systemic fashion.

The Knowledge Conversion Model

The knowledge conversion model by Nonanka and Takeuchi (1995) describes the creation of knowledge in five-phase processes involving four modes of knowledge conversion. The process begins with the tacit knowledge of one or several individuals, who share it with others, thereby developing a common understanding. This common understanding is transferred into explicit knowledge in the form of a concept in the second phase of the process. In the third phase, the emerged concept is justified by comparing and linking it to other explicit knowledge within as well as outside the organization. In the fourth stage the concept is manifested into a model operating procedure that can be further discussed and tested. In the final stage the new knowledge is cross-levelled or spread in the organization for practical purposes.

Nonanka and Takeuchi (1995) believe that four modes of knowledge conversion are at work. These are socialization (transferring tacit knowledge to tacit knowledge), externalization (transferring tacit to explicit knowledge), combination (transferring explicit to explicit knowledge) and internalization (transferring explicit to tacit knowledge). In this model, tacit knowledge is generally viewed as prerequisite for the use of explicit knowledge. It is through tacit knowledge that explicit knowledge is interpreted and manifested in practical sense.

Codification and personalization knowledge management strategies

Hansen et al. (1999) point at two contrasting strategies for knowledge management: codification and personalization. They believe that the best knowledge management strategy is always a combination of codification and personalization, but with a stronger emphasis on one of them. While the codification knowledge management strategy lends itself well as a medium for explicit knowledge to thrive, the personalization knowledge management strategy supports better tacit knowledge use in organizations. Since tacit and explicit knowledge forms are mutually inclusive, an organization's efforts towards knowledge management should be placed on instituting

the right strategies that support the integration of the two knowledge forms, with of course an emphasis on one of them for more effective organizational performance.

These two knowledge management strategies have distinct features. The codification knowledge management strategy ensures re-use of explicit knowledge by capturing, codifying, classifying and making available knowledge to support routine problem solving. Uniformity in action is ensured since knowledge is recycled to guide decision-making. This implies that organizations adopting the codification knowledge management strategy should reward the use of, and contributions to, document databases as recognition of staff adherence to policies. The codification strategy, in general, involves intensive investment justified by multiple knowledge re-use.

The personalization knowledge management strategy is suitable for a one-off, medium to long-term, high risk, strategic problem with no solution precedent. This strategy shares tacit knowledge by helping individuals to engage in relevant conversations to create novel solutions. The form which a solution to a problem might take, and who in the organization might know about it, is the primary user question guiding individuals pursuing a personalization knowledge management strategy. This strategy of managing knowledge entails a modest investment, justified by improved frequency and quality of communications (Hansen et al., 1999; Wyatt, 2001). Since codification and personalization knowledge management strategies exhibit contrasting features, they should be commensurate with the dominant knowledge form of any given organization.

A snapshot of agricultural extension practice in Ghana

This section of the study empirically assesses the state of agricultural extension practice in Ghana. Particularly important to the study is the issue of knowledge management in extension practice. This information is relevant in informing the design of a knowledge management working tool for extension practice. The East-Akim district of Ghana served as the study base. The district was purposively selected because of its prominence as one of the leading farming communities in the country. Four communities were randomly chosen to represent the four zones of the districts. The population for the study comprised all adults aged twenty-one years and above who were land users (farmers), all members of government as well as the leaders of the communities connected with land management. In each sampled study town, there was a cluster sampling based on the suburbs available. The simple random sampling technique was then employed to select areas for the study. A list of all households in the selected suburbs was made. Based on the households available, systematic sampling was used to identify the households to be used for the study. An adult, twenty-one years of age and who was a land user (farmer) was selected and interviewed in each household. On the whole, thirty households were systematically selected in each study town.

Purposive sampling was also adopted to seek the views of ten individuals connected with land management in each of the selected areas. These were leaders of the communities and members of government. Incidentally, all the members connected

with land management in the areas were farmers. Thus, forty respondents, all farmers, were interviewed in each study community. This brought the grand sample size for the study to be one hundred and sixty.

Interviewing schedule was the major technique for data collection. This instrument was adopted in order to gain a thorough understanding of the problem under study, offering the respondents the opportunity to express themselves as freely as possible. It also allowed questions to be explained to respondents for the appropriate responses to be gained. Data gathered from the field of study was edited to ensure that all interviewing schedules were complete and contained accurate information before it was coded and computerized. Statistics including frequencies and percentages were computed to aid the analysis of the data obtained from the survey.

The success of the extension service, to a large extent, depends on how the beneficiaries of the service – farmers – are brought into the picture. Even though the call for authentic involvement of farmers in extension services has long been made, current researchers are still re-echoing the call, which implies that there still exists a weak linkage between farmers and extension activities in the country. The poor linkage between farmers and extension experts constitutes a barrier for knowledge management to thrive. Without a doubt, there is an urgent need for new ways of seeking knowledge in aid of agricultural practice. This is particularly critical because of the enormous environmental hazard arising as a result of land degradation, caused unconsciously by land users, and the adoption of poor farming practices by farmers (Boateng, 2001). However, extension experts have been found to be not farmer-oriented because of the over-reliance on technical or scientific knowledge (Collinson, 1989).

As many as 89.4% of the respondents indicated that they had heard of the extension service; only 9.4% claimed they had not heard of it. A great percentage (84.4%) of the respondents who had heard of the agricultural extension services knew their fundamental function to be the education of farmers. Awareness of specific services rendered by the staff of the extension services to the farmers was also investigated, providing varying results: education of farmers (68.1%), inspection of farms (29.4%), and the supply of inputs (2.5%). Asked whether the extension service staff continued to come to the study area, 69.2% of the respondents responded in the affirmative with 30.8% giving a contrary response. This finding reveals that extension experts were not difficult to be contacted in the study area. This, however, did not indicate the frequency of farmers' interaction with them. Of the respondents who had contacted the extension staff, 50.9% contacted them once during the farming season prior to the studies. Twenty one percent contacted them twice during that same period, with 14% contacting them thrice, and another 14% contacting them four or more times during that farming season.

On the whole, 41.5% of the respondents indicated their satisfaction with the extension services, versus 58.5% who were not satisfied with the work of the extension services. Various reasons were assigned for the satisfaction or otherwise of extension services. The farmers satisfied with the extension services indicated the following: reliability of extension service (39.7%), advice leading to higher yields (22.2%), and a gain of

scientific knowledge or new technology (38.1%). Reasons assigned for no satisfaction included the following: expensive (47%), unreliability of service (46.9%), and no follow up from extension staff (6.1%).

These results depict the fact that though extension services were available in the study area, many farmers were not satisfied with their services due to various factors, in particular the high cost of applying extension services. Cost, therefore, becomes a barrier to the implementation of agricultural extension services in the study area. This barrier must be removed to enable as many farmers as possible to benefit from extension services. One way of doing that is for extension services to repackage their technologies to make them more affordable to the farmers. The respondents were also unanimous that they were not involved in the development of technologies passed on to them by the extension experts. Though this did not surprise the respondents, they believed that given the opportunity they would be resourceful in the activities pursued by the extension experts. Strategizing to involve farmers in the search of knowledge for agricultural practices, therefore, becomes eminent.

Bridging the knowledge divide – implications for agricultural extension practice

Evidently, the lack of attention to upstream flows and neglect of farmers' tacit knowledge by extension experts has contributed immensely to the negative impact associated with extension services (Roling, 1992). Extension experts should always be reminded of the fact that farmers' tacit knowledge is the bedrock in the search for new knowledge for farming. In other words extension services should always progress from farmers' tacit knowledge or know-how to the unknown explicit knowledge or know-what of extension experts. Following this reasoning, it is proposed that extension services utilise the Nonanka and Takeuchi (1995) knowledge conversion model and Hansen et al. (1999) knowledge management strategies as a fundamental step in improving knowledge placed at the disposal of farmers.

As described above, Nonanka and Takeuchi (1995) believe that four modes of knowledge conversion are at play. In this SECI model (Socialization-Externalization-Combination-Internalization), tacit knowledge is generally viewed as prerequisite for the use of explicit knowledge. To replicate this model in extension services, it is important for extension experts to adopt the following steps in harnessing and managing knowledge.

In step one or the *socialization* stage – transferring tacit knowledge to tacit knowledge – extension staff should encourage farmers to form a community of practice (informal network among individuals with common passion, values or identity). Farmers' co-operatives can provide the basis for this, providing an environment where farmers can transfer or share farming know-how among themselves (Boateng, 2005). Farmer-to-farmer communication is vital at this stage. Such informal interaction among farmers will offer them the opportunity to deepen the understanding of their practice, while at the same time finding solutions to common occupational problems confronting them. Extension experts must be actively involved in such communities, not as 'experts' to

teach the farmers at this stage, but predominantly as participants ready to encourage dialogue among farmers and learn from the tacit reasoning behind their practice. Farmers' own experimental efforts are supported at this point, so as to learn from the experiential/tacit knowledge tied to such efforts. Tacit knowledge, undoubtedly can serve as the basis for further scientific analysis and studies geared towards improved farming technologies.

In step two or the *externalization* phase, extension experts externalize farmers' tacit knowledge by transferring farmers' tacit knowledge into explicit form. This is achievable through enhanced communication between extension experts and farmers. The know-how of farmers gained as a result of their experimental efforts is extracted at this point to serve as basis for further scientific studies. Knowledge premised on farmers' tacit knowledge, all other things being equal, is likely to impact more on farmers because newly generated knowledge based on their experiences will be more familiar and acceptable to them. In view of the fact that farmers 'reengineer' technologies from the scientific communities before incorporating them in their production system (Rogers, 1983), they will be more susceptible to familiar rather than 'foreign' technologies. Such technologies lend themselves to farmers' needs, capabilities, potentials and more importantly, resource realities. Incorporating farmers' tacit knowledge in extension research represents a conceptual shift from knowledge as a 'thing or product' to be transferred top-down, to knowledge as a process involving multiple steps, players/actors, as well as networking and negotiations at various levels of managing knowledge for agricultural practice. Extension researchers, therefore, should engage farmers actively in the search for technologies to improve agricultural productivity.

Step three entails knowledge *combination* of explicit knowledge of extension personnel, and research evidence from the academic communities, such as universities and other research institutions, to explicit knowledge of farmers. This step is critical because it is at this stage that technologies are designed for agricultural practice. Since farmers' tacit knowledge is indirectly embodied in the explicit knowledge possessed by the extension experts, it is expected that such technologies or knowledge will be embraced and engaged in practice at the fourth stage, the *internalization* phase. This phase involves the transfer of explicit knowledge into tacit knowledge to guide actual farming practice. The knowledge creation process of extension experts, therefore, should progress in a circular manner – from socialization (tacit to tacit), through externalization (tacit to explicit), and combination (explicit to explicit) to internalization (explicit to tacit) – in order to ensure improved knowledge management is applied in agricultural practice.

An application of the knowledge creation model in agricultural extension practice, however, will remain incomplete if it is not fused with Hansen et al. (1999) knowledge management strategies. This model highlights the personalization and the codification knowledge management strategies as two ways of understanding and managing tacit and explicit knowledge respectively. Whereas personalization entails face-to-face exchange of tacit knowledge, codification strategy involves the extraction of knowledge or expertise from a person and making it independent of the person for general use. Since agricultural extension services thrive on both forms of knowledge,

it becomes necessary that these knowledge management strategies are adhered to in any attempt at improving knowledge management in agricultural practice.

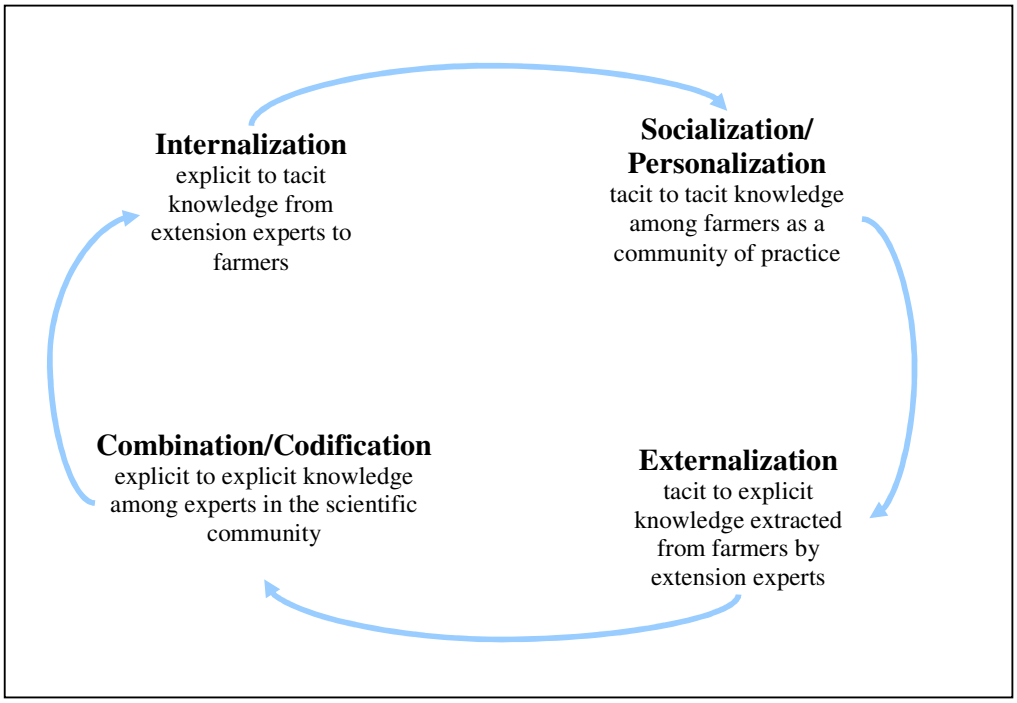

Figure 1: The circular knowledge management model for extension practice

The model presented in Figure 1 (above), is an amalgamation of the Nonanka and Takeuchi (1995) knowledge conversion model and the Hansen et al. (1999) codification-personalization model, and constitutes a working tool for extension practice. This model perceives knowledge management in a circular fashion, incorporating personalization and codification strategies at the tacit-to-tacit and explicit-to-explicit knowledge exchanges respectively.

Though the personalization phase is useful in all the phases of the knowledge conversion model, it is particularly important at the socialization phase involving the transfer of tacit knowledge among a farmers' community of practice. Similarly, the codification strategy is useful in all the phases of the knowledge conversion model with the exception of the socialization process, which thrives mainly on personalization or person-to-person interaction. The codification strategy thrives on the extraction of knowledge from individuals, making it independent of its 'owners' for general use at the externalization, combination and the internalization phases of knowledge conversion, but it is particularly useful at the combination stage where tacit knowledge extracted from farmers is enmeshed into explicit knowledge, and further reinforced or validated by other explicit knowledge.

Recommendations and Conclusions

In order to inform farmers' decisions regarding improved technologies or new ways of farming, it is recommended that agricultural extension experts adopt the circular knowledge management model as it reflects both tacit and explicit forms of knowledge. Farmers' are more likely to be motivated in adopting technologies from agricultural experts once they realize that their own inputs are incorporated in the design and development of such technologies. Adopting the circular knowledge management model by extension experts will significantly bridge the knowledge divide between farmers and extension experts in search of knowledge, thus placing science and practice on the same wavelength. Essentially, this will demystify the aura around science as the 'true' source of knowledge, paving the way for the incorporation of tacit knowledge as an important component to reckon with in knowledge management.

Though the circular knowledge management model is being recommended for use by agricultural extension experts as advocated in this paper, other experts and agencies involved in community-based programmes such as health, environment, and community/social services are encouraged to embrace this model as well in ensuring improved knowledge management at the grassroots levels for sustainable outcomes of programmes.

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Abstract
This study adopts the knowledge conversion model by Nonanka and Takeuchi (1995), and the codification-personalization knowledge management strategies by Hansen et al. (1999) as the benchmark for proposing a circular knowledge management model for agricultural extension practice. This model recognizes tacit and explicit knowledge forms as complementary in informing decisions regarding agricultural extension services. An empirical assessment of agricultural extension services in Ghana provided the foundation for the development of such a knowledge management model for agricultural extension practice. One hundred and sixty farmers from four farming communities in Ghana constituted the sample for the study. The three-stage multi-sampling procedure was adopted for this purpose.

The circular knowledge management model for agricultural extension practice is an approach to bringing farmers together in search of knowledge, and intensifies the collaboration between farmers and extension experts as change agents. This will significantly bridge the cultural and knowledge divide between the communities of farmers and extension experts, illustrating how tacit and scientific knowledge can be better harnessed towards improved agricultural extension practice.

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