

Internet Enabled Platform for Bridging South African Emerging Farmers' Knowledge Gap

Olabode S. Akinsola and Johnson O. Dehinbo

Abstract—The aptitude of South African emerging farmers to manage complex agricultural resources for market-oriented farming is lacking. This is due to the injustices of the past characterized by substandard education of this group of intending market-oriented farmers. Ensuring equal participation in South African agricultural domain, particularly in market-oriented farming would necessitate that their agricultural knowledge gap be bridged. In this study, qualitative interpretive field research approach and grounded theory design was adopted. An internet enabled agricultural knowledge-support platform that is aimed at providing a one point of access and interaction that could lead to on-the-job training, just-in-time knowledge exchange and collaboration amongst farming stakeholders is proposed.

Index Terms — Internet enabled platform; Knowledge support; knowledge gap; emerging farmers; agricultural systems

I. INTRODUCTION

In the new dispensation of democratic South Africa, government is fostering to redress the unfairness to those segment of the society that have been deprived the opportunity of taking part in the main stream farming business [21]. These groups of farmers are commonly known nowadays as 'emerging farmers'.

In farming as in any other profession, knowledge is required for its various segments and activities in order to be successful. For instance, in agricultural land preparation, seeds, seedlings, fertilizers, pesticides, harvesting, and post-harvest handlings require that farmers or their employees be adequately equipped with intellectual capability or relevant intellectual support for evaluating and incorporating new experiences and information. Intellectual capability is vital for integration of ideas, experience, intuition, skill and lessons learned; enabling the potential to create value. Emerging farmers could not be described to possess these features due to substandard education and exclusion in formal agricultural training to which they have been subjected.

The current political and economic crisis in Zimbabwe as indicated by Lyne and Darrocoh [13] clearly illustrates that government intervention through land redistribution without requisite intellectual capability for factors of agricultural production's utilization [24] does not guarantee political stability and economic growth.

Manuscript received July 18, 2012; revised January 27, 2013. This work was supported in part by Tshwane University of Technology, under the postgraduate scholarship and National Research Foundation scholarship.

O. S. Akinsola is with the department of Informatics, ICT faculty, Tshwane University of Technology, Pretoria, South Africa (phone: +2712-382-9046; e-mail: AkinsolaOS@tut.ac.za or OSakinsola@gmail.com).

O.J. Dehinbo is with the department of Web and Multimedia Computing, ICT faculty, Tshwane University of Technology, Pretoria, South Africa (phone +2782-382-9219; email: dehinbooj@tut.ac.za or jdehinbo@yahoo.com).

A vast majority of Africa's smallholding farmers as indicated by Kelly *et al* [10] rarely use modern inputs; because a farmer who has no knowledge of inputs and lack training on how to use them will be unlikely to adopt them.

In South Africa, market-oriented farming is never a new enterprise to its citizen, in fact they are globally acknowledged to be well versed in modern agriculture, excluding emerging farmers [12]; [5]; [13].

Moreover, the problem is not that agricultural knowledge providers in South Africa are incapable of generating high-quality innovative knowledge materials; on the contrary, there is a vast supply of potential agricultural knowledge generators, and a significant demand for their work. The problem as indicated by Gruber, Tenenbaum and Tenenbaum [7] is that the infrastructure for development and delivery of generated knowledge materials are extremely inefficient [3]. Agricultural knowledge materials are often developed in isolation and without coordination; besides, exiting traditional agricultural media resources are seldom re-used.

The interactive process of making the right information or knowledge available in a comprehensive manner to people of common interest is known as knowledge sharing, which as suggested by Vikas [23], can take place at all levels and places. However, traditional knowledge support delivery such as knowledge libraries, training seminars held in auditoriums, and hotel boardrooms are limited by physical proximity. Meanwhile, the proportionally unevenly distribution of emerging farmers across the nation are hampering access to personalised, just-in-time, and on-the-job learning.

The purpose of this study is to bridge the knowledge gap of South Africa emerging farmers, currently struggling to participate in commercial or market-oriented farming in contrast to their previous subsistence farming practices.

The study main objectives were to strategically utilize Internet resources in creating a shared knowledge space to increase informal and casual contact among individuals in agricultural domain; particularly those without formal agricultural education. In addition, the study seeks understanding challenges hampering their transformation into market-oriented farming when using traditional agricultural knowledge diffusion approaches.

II. STUDY METHODOLOGY

Using a qualitative interpretive case study research approach, a total number of 25 emerging farmers and 10 knowledge support service providers participated in the study. Participating emerging farmers though had some level of formal education but lack formal education in agriculture and were selected using theoretical and snowballing sampling from four South African provinces namely Gauteng, Mpumalanga, North West and Limpopo.

The qualitative interpretive field research approach and grounded theory design was adopted because it enables the researcher to collect empirical data directly from the subjects themselves while sitting with the respondents presenting their views, perceptions and detailed expectation [2]. The empirical data obtained through the use of audio tape recorder from semi-structured interviews were transcribed verbatim; the transcribed interview result was then taken for confirmation to ensure that respondents' opinions were correctly expressed. The transcribed interview was then reviewed and coded to create data sets.

In the process of reviewing transcribed data, responses were treated according to the research questions being responded to. In this process, data set was created. This data set with data from other data collection instruments used was then categorised under the sub-headings of the themes emanating from the questions. Inductive themes were produced according to each of the research question and then compared with outcome of the literature review and experience from the field to overcome biases.

III RESEARCH RESULTS PREAMBLES

Data were collected from the participants using semi-structured interviews, observations and discussions. The participating emerging farmers expressed their inability to secure the needed agricultural knowledge. The fact that they have to seek for solutions from locations that are most often far away from their base of farming operations is also identified as a major challenge.

While agricultural knowledge service providers expressed their inability to meet the heterogeneous need of the farmers and their lack of resources, such as human capital and transportation to move across farm locations, which are geographically dispersed with uncommon needs; all participants do expressed their readiness to contribute to any internet enabled platform that could foster interaction and collaborations between agriculture stakeholders.

IV EMERGING FARMERS' AGRICULTURAL KNOWLEDGE SUPPORTS CHALLENGES

In this study, a strategy of agricultural knowledge support that would facilitate the bridging of emerging farmers' knowledge gap and enabling optimal agricultural production is proposed. The support platform is aimed at providing one point of access, interaction, knowledge exchange and collaboration amongst farming stakeholders. This type of one point of access, interaction, knowledge exchange and collaboration on issues relating to farming, which are currently in disparate sources and locations, lacking the needed coordination that may enhance farmers' quick and better decision making is required.

While knowledge support experts are often required to provide personalised support to farmers whose need are heterogeneous in nature, there is no single platform in existence, that could enable knowledge support experts to attend to individual farmer's needs. In other words, farmers may have to individually visit knowledge sources centres or the support providers directly visit individual farms to get farming problems solved. Internet platform consists of

resources that could be utilized to foster a one-point of access, interaction, knowledge exchange amongst farming stakeholders and the integration of disparate agricultural knowledge resources. A platform where local farmers, and their problems could be easily expressed, and their subject's knowledge is considered when providing immediate and needed solutions.

At the moment, the various techniques been utilized to support emerging farmers' knowledge acquisition based on this study findings are simply within the information broadcast mode, for example use of community radio, televisions, workshop, seminars and conferences, print media, CD/DVD, and static organizations' websites. Presentations in all of these modes are often generic, static and required pre-planned solutions of previous challenges faced by the farmers. Besides, farmers' specific circumstances are never the focuses of these techniques as elucidated by participating emerging farmers. Moreover, the techniques are inadequate to handle unique and immediate farming problems which could sometimes be farm specific.

The empirical study clearly indicates the dare need of user centred agricultural knowledge support of emerging farmers. Incidentally, the existing techniques of agricultural knowledge support were more appropriate and may only add value to those with previous basic agricultural expertise, requiring further explanation on specific farming practices. Thus, the study's empirical findings bring to fore the importance of providing agricultural knowledge support platform that could enhance direct interaction, knowledge exchange and collaborative effort of farming stakeholders, which may help in proffering solutions to farmers' varied problems and establishing their farming educational foundation, which is currently lacking.

Summary of research finding on issues raised by participating Emerging farmers include:

- 1) Complexity and cumbersomeness of the process involved in agricultural knowledge acquisition (attending varied courses, depending on farms produce focus; conference and workshop attendance, joining of varied farmers' association and farmers cooperative groups; subscribing to varied farmers' magazine; and need to synthesise varied government policies such as land tenure, health issues, market regulation and the likes);
- 2) Attendance of training does not guarantee solution to prevailing challenges in the farms;
- 3) Conference and workshops participation does not often complement learning at training centres. Inability to integrate the knowledge gained at conferences, workshop and courses attendance for practical application in farm location, may sometimes require other interventions;
- 4) Current farm employees' educational attainments are within the level of diploma and they lack market-oriented farming experiences, thereby making interpretation of scientific report difficult during implementation;
- 5) Inability to produce high quality farm outputs. Products of quality outputs' grading level "A" are difficult to attain, farm produce quality output are often graded at level "C" and at best in grade "B". Hence the grading in terms of produce quality is making it difficult to attract more promising market;

6) Community radio or television broadcast rarely discuss current farming activities;

7) Recommended technology from input suppliers' extension services are sometimes labour intensive and hardly able to achieve the intended objectives (for instance: "vastness of farm land may not be accurately assessed before a hand held planter is recommended; even though the recommended tool may be cost effective, the labour intensiveness may become a challenge in achieving the objective of planting an expansive land within a short period of raining season").

Summary of research finding on issues raised by participating agricultural knowledge support services providers include:

1) Emerging farmers are currently being affected by what they term as "dependence syndrome"; that is, inability of farmers to make decision - they keep calling for help at every slightest challenges; even though the solutions to such challenges may be within their reach.

2) Due to specificity of emerging farmers' knowledge requirements; they are often difficult to cluster together when important messages need to be communicated;

3) The ratio of services providers to emerging farmers requiring their services is significantly low. Furthermore the emerging farmers are also most often geographically dispersed apart;

4) Due to the heterogeneous nature of individual emerging farmer's need, no single knowledge service provider is capable to effectively satisfy their demand;

5) Accessibility to farms for demonstration purposes of new technology is sometime difficult due to bad roads and costs of transportation.

The educational task consisting of communicating knowledge to farmers and helping them to adapt their farming methods to take full advantage of proven and acceptable technology aimed at improving the quality of farmers' life is considered as the ultimate goal of agricultural extension officers. Beside, extension services also aim at helping to educate the farmers on ways of increasing the quantity and quality of a country's food, fibre and forestry production. But the effect of such communication [20], [17], has not been quite as pronounced as one might expect. The reluctance to adopt and adapt new innovation by most small-scale farming communities are often attributed to inadequate knowledge, understanding, skills and sometimes negative attitudes to change.

Currently, according to Bembridge [3], South Africa's extension services are ineffective due to management and institutional problems hampering their capability to support emerging farmers. For example, a situation where farmers are only being advised on farmers' day, on what should be done or not, is an inefficient way of meeting the farmers' needs [16].

With the existing farmers' familiarity with the use of technology, navigating web based knowledge support should not be a problem. The findings show that most of the participants have at one time or the other used internet as a platform of searching for information. Meanwhile, emerging

farmers consider inappropriate the traditional agricultural knowledge support strategies currently been utilised to support their transformation into market-oriented farming.

For instance, most of the participants complained about the duration for which farmers mentorship programme are expected to last, knowing fully well that farming seasons are difficult to predict and the hostile attitude of most farmers' mentor, who often prefer to buy out the beneficiaries of land reform and re-distribution programme. Even the well-publicised use of community radio and television broadcast also come with their own challenges. All programmes for these media are expected to be pre-planned before broadcast. Consequently, it may be difficult to include all situations, particularly the prevailing circumstances that the farmers are facing, as at when such programmes are being planned. Besides, interpreting research outcomes to the specific requirements of individual farmers within the broadcast duration are unfeasible request.

In subsistence farming, skills and experience required for production are most often directly supplied by farm owners, their family, and extension services; whereas in market-oriented or commercial farming, production does not necessarily depend on farm owner's skills and experience but that of skilled farm employees. In South Africa, most skilled farm employees, predominantly those that can be considered as highly skilled or educated in agricultural practices are currently not obliged to work for emerging farmers. In other words, those willing and ready for employment in farms owned by emerging farmers are not well versed in agricultural practices due to the segregation of the past [5]. There is therefore, the need for changes in approaches of providing agricultural knowledge support to emerging farmers and their employees.

V. INTERNET ENABLED PLATFORMS FOR AGRICULTURAL KNOWLEDGE SUPPORT

In order to promote collaboration in a user-centred approach, knowledge creation, sharing, exchange, integration, dissemination and technology transfer amongst service providers and emerging farmers, as well as the intellectual capacity building of emerging farmers and their employees; an internet enable knowledge-support platform has the potential of providing rich and complex shared knowledge.

Internet enabled platform is being considered as most viable platform alternative that may be used to enables South African emerging farmers' transformation because of various services and tools that could be made available to provide the required personalised support in agricultural domain.

Internet consist of multimedia resources and host of other applications that could be used to provide the required agricultural knowledge in a synchronous and asynchronous mode, affording the user the opportunity to learn and respond to issues without the time constrained which happens to be the bane of the traditional channels of knowledge dissemination commonly used in agricultural knowledge support.

Application of Internet for agricultural knowledge support is a paradigm shift from the tradition of using radio, television, farmer days' show, conferences, workshops, seminar, symposium, print media and the likes; where

knowledge support services are restricted by location, duration, cost and space.

Even though emerging farmers' knowledge-support process currently involves real-time interaction (face-to-face or synchronous modes of knowledge support provisioning); the asynchronous technique of knowledge support is more dominant. Often when an expert's advice is sought on an issue and the expert is not available; either because of a communication breakdown or network problem, the farmer may be required to leave a message to schedule a meeting. An expert can also provide a solution on previously discussed problems, when the farmer is not available online at the time. This indicates that messaging and workflow systems are as essential as data management of the agricultural knowledge-support infrastructure [16].

The heterogeneous nature and the specificity of knowledge required by farmers, who are often difficult to cluster together, render the use of community radio inappropriate and inefficient. Radio, television and static websites are however, generally regarded as cost effective, considering the reach of their coverage. But knowledge-support is not only about breadth and width of coverage. It is also about the value, adoptability, relevance to current activities, and usefulness of the disseminated knowledge by the end user.

In user-centred multi-disciplinary research as pointed out by Schumacher and Feuerstein [18]; new product or service development that fails, does so, not for lack of advanced technology, but because of a failure to understand real users' needs. There is a higher motivation in involving users at the earlier stages of the research and development process. This is in order to better understand the relationship between new innovative concepts and related users' behaviour, within specific situations, as well as the potential cognitive workload in interpreting received signals.

Sharp, Rogers and Preece [19] point out that the best way to ensure that development continues to take users' activities into account is to involve real users throughout development. This according to Duin *et al* [6] has proved to reduce business risks such as the invention and acceptance of products and services and their application.

With the advent of Internet and the latest collaboration technologies such as Web 2.0 and now Web 3.0, team work is no longer limited to a small group of people in an enterprise; team work could spread across to all stakeholder-suppliers, customers or other members of interest. Thus, groups of people organized in public self-organizing workgroups and specialized communities (communities of interest, and- practice) generate knowledge that is shared, not individualized [8].

Therefore, with a user-centred multidisciplinary concept, involving the integration of end-users and other farming stakeholders; South African emerging farmers' transformation challenges may be overcome. The techniques of which, as indicated by Duin *et al* [6], remain a difficult task.

Securing suitable technology enhancing learning for emerging farmers is problematic, considering their peculiar background and circumstance. Integrating interdisciplinary knowledge resources, disparate agricultural knowledge experts, and varied subject specialists, coupled with farmers' low level of experience; and challenges for support provisioning to farmers with uncommon objectives, educational background is indeed a difficult task. In order

to elaborate on this view, proposed internet enabled agricultural knowledge support platform is as depicted in Fig. 1. The figure illustrates an interactive forum, virtual innovation research laboratory; agricultural e-learning, knowledge repository and knowledge bureau services to enable collaborative discussion, on-the-job learning, knowledge creation, exchange, storage and shared meaning.

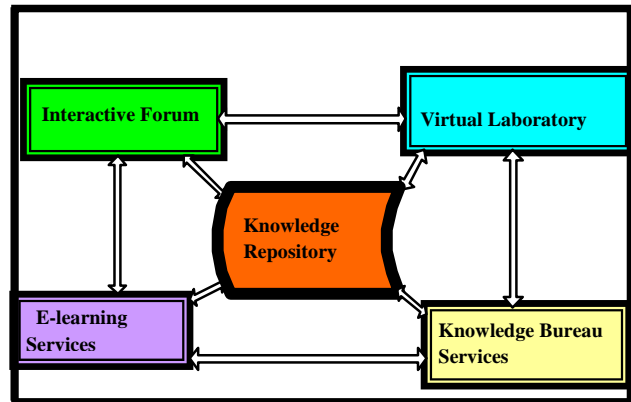


Fig. 1. Agricultural knowledge-support model

Source: Akinsola [1]

The purposes of these essential components of internet enabled agricultural knowledge support platform and its intended improvement over the traditional agricultural knowledge support strategies, where knowledge support materials in most circumstances are restricted due to selectivity, location, space, duration and cost of provision and acquisition are as follows:

Interactive Forum Services: The interactive forum module focuses on direct contact and information exchange between participants, and allows users to engage on issues concerning farming problems that require urgent attention. Synchronous and asynchronous communications are supported, with instant messaging, chat and similar synchronous technologies allowing multiple users to engage with each other. Problems pertaining to an individual farmer or those affecting the general farming community or a given locality of farms can be raised by any of the participating online members [22];[13].

It is likely to have profound impact on personal, social, and institutional practice. Unlike face-to-face or telephone conversations, responses can be at a user's own convenience.

Virtual innovation laboratory: The virtual innovation laboratory is meant to enhance joint research on common projects among agricultural role players, research institutes, private companies such as farm commodity and input suppliers, and farmers. This is a virtual space for researchers from all over the world to conduct joint research projects [14]. It could also be a forum for knowledge sharing and research dissemination among recognised specialists, national and international researchers and agricultural professionals.

Virtual knowledge bureau: The virtual knowledge bureau is meant to serve the need of farmers whose problems/knowledge requirements lack immediate solutions in a given task through the interactive forum module or learning resources. The problems/knowledge requirements will then be well articulated with the assistance of a

“knowledge broker” (for example, extension workers, NGOs, community centre administrators, and the like) for subsequent submission. Farmers can then be linked with specialists or experts, or other farmers who have had similar experiences. All the same, where solutions are difficult to find, the problems will remain in the bureau storage until experts or subject specialist could access it for further research, using the virtual innovation laboratory module.

Knowledge repository: The knowledge repository is a comprehensive digital repository through which agricultural role players can submit artefacts (raw data, research results, photographs, reports, multimedia documents and the like), best practices and project experiences. The knowledge repository will have a direct linkage to other modules of the model, to provide adequate support for the portals functional activity. Factual and procedural knowledge created by subject-matter experts and farmers, and best practices will be captured in the repository to assist the farmers in their quest to find previous solutions that could help them with their current problems [25].

E-learning services: The e-learning services of the agricultural knowledge-support model in Fig.1. is intended to be used in order to assist emerging farmers and their employee to acquire new knowledge, as well as packaging and delivery of available agricultural knowledge through on-line learning. Internet resources that are available to e-learners, while learning on-line, include: e-mail, newsletters, list-servs, discussion groups, chat, instant messaging, wikis, downloadable documents, e-books, multimedia, interactive forms and Internet broadcasts that can be used for communication. The cost-effectiveness of communicating learning resources and artefacts among geographically dispersed community members, and the unrestricted nature, in terms of time and space as well as personalisation based on learners' profiles, make its use inevitable for the development of agricultural production in South Africa.

VI CONCLUSION

Bridging emerging farmers' agricultural knowledge gap could hold tremendous benefits including sustainable employments, food security, poverty alleviations, active manufacturing industry, improved national economy and may lead to crime reduction. However, considering the complexity of harnessing agricultural knowledge from desperate sources to meet the heterogeneous emerging farmers' need; bridging emerging farmers' knowledge gap is a great challenge.

Unless effective and efficient strategy is adopted; considerable resources being ploughed by the South Africa democratically elected government into redressing past injustice, which is either direct or indirectly related to maximally utilising land acquired through reforms and re-distribution would remain a colossal waste. While existing emerging farmers' agricultural knowledge support could be considered as inefficient, internet enabled agricultural knowledge support platform possess potential resources that may be applied to improve their transformation into sustainable market-oriented farming business.

REFERENCES

- [1] O. S. Akinsola, “Agricultural knowledge-Support Portal-Model for South African Emerging Farmers,” D.Tech. thesis, Tshwane University of Technology, South Africa, 2009.
- [2] E. Babbie, “The Basic of social research”, Wadsworth, Canada: Thomson publishing co., 2005
- [3] T. J. Benbridge, *The practice of agricultural extension, a training manual*, Development Bank of Southern Africa, 1993.
- [4] R. Chapman, R. Blench, G. Kranjac-Berisavljevic, and A. B. T. Zakariah, *Rural Radio in Agricultural Extension: The example of Vernacular Radio Programmes on Soil and Water Conservation in Ghana*; Agricultural Research and Extension Network; Network Paper No 127, 2003.
- [5] P. A. Donovan, “*The management, funding and organizational structure of agricultural R & D in Zimbabwe, Malawi, and South Africa. Part II-Organizational structure*. Agricultural Systems 47 (1995), pg 273-290
- [6] H. Duin, J. Jaskov, A. Hesmar, and K. D. Thoben, Towards a framework for collaborative innovation: in IFIP International Federation for Information Processing, Volume 277; Computer Aided Innovation (CAI);Graetano Caseini; (Boston: Springer), 193-204, 2008.
- [7] T. R. Gruber, A. B. Tenenbaum, and J.M. Tenenbaum, *A National infrastructure for knowledge exchange: A whitepaper advocating on ATP initiatives on technologies for lifelong learning*; 1994. Available [Online] at: <http://www.eit.com/papers/nike/nike.html>; accessed 06/08/2007.
- [8] V. Janev, and S. Vranes, “Knowledge Processes in Enterprises and the Role of knowledge management solution. Proceedings of I-KNOW'04, Graz, Austria, 30 June 2 July 2004.
- [9] S. M. Karuiki, *An Integrated Critique of the Land Reform for Agricultural Development*. Africa Studies Centre working paper 56.2004. [Online] Available From: <http://www.ascleiden.nl/workingpaper56.pdf> [Accessed: 01/03/2007].
- [10] V. Kelly, A. A. Adesina, and A. Gordon, “Expanding access to agricultural inputs in Africa: a review of recent market development experience.”. *Food Policy*, vol. 28, pp. 379-404, 2003
- [11] A. Kille, *Wikis in the workplace: How Wikis can help Manage Knowledge in Library Reference Services*. 2005. Available [Online] at: http://www.ischool.utexas.edu/~i385q/archive/kille/kille_wikis.html. [Accessed 15/06/2007].
- [12] N. Kinnear, A. Baird, T. Freeburg, and J. Mink, *Small Farm Education and Extension in Swaziland and South Africa*. [Online] Available from: <http://aee.uguidaho.edu/~~/SouthAfricaAgDevProjFinal.pdf> [Accessed 29/09/2000]
- [13] J. Kolbitch, “An integrated community-based platform for collaboration: proceeding of the 2007 international conference on knowledge management, New York, 2007, pp. 8-16.
- [14] I. Kondratova, and I. Goldfarb, *Knowledge portal as a new paradigm for scientific publishing and collaboration*. 2004 [Online] Available from: <http://www.itcon.org/2004/11> [Accessed 24/09/2006].
- [15] M. C. Lyne, and M. A. G. Darroch, *Land redistribution in Kwazulu Natal, South Africa : Five census surveys of farmland Transactions, 1997-2001*. [Online] Available at <http://www.basis.wisc.edu> Accessed [30/09/2006].
- [16] N. M. Oettle, and B. R. I. Koelle, *New direction for extension in democratic South Africa: Enhancing farmer's initiatives to conserve their resources*, 2003.
- [17] M. A. Roth, D. C. Wolfson, and J. C. Nelin, “*Information Integration – a new generation of information technology*. IBM Systems Journal, 2002, vol 41, No. 4, pp. 563-577.
- [18] J. Schumacher, and K. Feuerstein, *Living Labs- a new multi-stakeholder approach to user integration*; presented at the 3rd International Conference on Interoperability of Enterprise Systems and Applications (I-ESA'07), Funchal, Madeira, Portugal.
- [19] H. Sharp, Y. Rogers, and J. Preece, *Interaction design: beyond human-computer interaction*. John Wiley & Sons; England, 2007.
- [20] K. N. Singh. *Extension Education and Rural development Volume 2: The need for a communication strategy for rural development*; New York; John Wiley & Sons, 1981.
- [21] SOUTH AFRICA. Department of Agriculture. 2001. *The strategic plan for South African Agriculture*. [Online] Available from: <http://www.nda.agric.za/docs/sectorplan/sectorplanE.htm> Accessed [14/03/2005].
- [22] J. C. Thomas, W. A. Kellogg, and T. Erickson, *The knowledge management puzzle: Human and social factors in knowledge management*; IBM Systems Journal, Vol.40 No 4. pp 863-884.

- [23] N. Vikas "Heralding ICT enabled Knowledge Societies way forward for the Developing countries. [Online] Available from: <http://sdnp.delhi.nic.in/resources/internetinfo/articles/heralding.htm> [Accessed 12/03/2004].
- [24] K. Y. Wong and E. Aspinwall, *Development of a knowledge management initiative and system: A case study*; Expert System with Application; Vol. 30, pp 633-644. 2006.
- [25] M. H. Zack. Managing Codified Knowledge, Sloan Management review, Vol 40, Number 4, pp. 45-58, 2006. [Online] Available from: <http://web.cba.neu.edu/~mzack/articles/kmarch/kmarch.htm> [Accessed 11/11/2006].