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A Model Knowledge Based System for Exchanging Agricultural Knowledge- A Case Study

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ABSTRACT

Abstract. It is highly essential to preserve traditional agricultural methods which have been followed by a group of farmers for decades in a particular geographical location. By using Modern technology we tried to extend the possibility of preserving these kinds of knowledge. Knowledge based systems is used for preserving and exchanging knowledge for various applications. This paper proposes a model of knowledge based system for exchanging traditional agricultural knowledge. Apart from the conventional knowledge type, agricultural knowledge based system should have a capacity to keep knowledge which are in multimedia format. The model aims to fulfill these objectives by incorporating knowledge of such types for effective knowledge preservation and exchange. The model constructed is based on the study conducted on two different banana farm fields in different geographical locations in Kerala.

Keywords: Agricultural Knowledge, Knowledge transfer, Knowledge abstraction & adaptation, Multimedia, Source, Sink

1. INTRODUCTION

The objective of this paper is to indicate the transfer of agricultural knowledge from an inter-agricultural farm point of view i.e., mainly transfer of knowledge between farmers in one part of Kerala to another part of Kerala. Argote et al; 2003 has expressed his view that knowledge can be transferred from one organization to another [1].

Agri-knowledge exchange is considered as an interactive process in which the knowledge is collected, stored and transferred from one part with the help of technology to another part. Many models were proposed by Bozeman et al; 2015 [2]. Knowledge transfer is the process to impart the success and goal achieved in one part of the state which can be transferred to another part. Transferring Technology is a process oriented interface between two entities, which can be shared and used mutually as indicated by Argote and Ingram; 2000 [3]. Lot of effort is involved in imparting such knowledge, where the knowledge used in one location is not suitable in another. Hence the main objective is to increase the utility and productivity of agriculture by using the knowledge inherited by the farmers from different parts of Kerala.

In this paper, we propose a model which helps in transferring knowledge from one location to another location, consolidating the different knowledge gathered from different locations of Kerala.

2. ENTITIES INVOLVED IN KNOWLEDGE TRANSFER

Riesman; 2005 [4] have suggested that there are three main categories of actors who are involved in knowledge transfer mainly the suppliers, research centers and consultants. In our study, many activities are

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involved in the process of knowledge transfer from the Initial Location (IL)/Source location to the sink/ destination. In between these two entities Initial Location and sink is the intermediaries. For example: for a knowledge transfer from the Initial location to the sink, many intermediaries like SAG (small agricultural group), VFPCK (Vegetable and Fruit Promotion Council Keralam) officials, Agricultural experts and many others were involved. Many a times, opinion of the agricultural experts from Agricultural Universities were also obtained and also the innovative ideas/concepts adopted or proposed by the farmers were also identified. Chesbrough; 2003 [5] proposed an internet technology and open source software for this purpose and recorded with the consent of the farmers. Farmers have problem in communicating the knowledge they have acquired either traditionally or through their experience. Amesse ad cohendert; 2001, has pointed out this very clearly stating that the emitting capacity from an initial location depends on the technological, organizational and cultural skills [6]. Difficulty was faced in acquiring the knowledge from farmers due to different terminology used for the farming process by farmers within different parts of the Kerala State itself. Although CPCRI (Central Plantation Crops Research Institute) gives training to the farmers, the farmers lack communication skills to express and understand the content of the training. The farmers come up with lot of innovative ideas and techniques, but there is no tool to check the authenticity of these. Autio et al; 1995, has mentioned about the technological capabilities like the technical capacity, managing technical system and the ability to get adapted to the specific needs of the recipient [7]. The farmers in different parts of the state of Kerala were either following farming techniques which they inherited from their ancestors or through some of the trainings from VFPCK/CPCRI. Crossan et al; 1999, has suggested that the performance of the individuals, knowledge acquisition and knowledge transfer can be enhanced if there is a proper routine for performing it [8].

3. BARRIERS IN KNOWLEDGE TRANSFER PROCESS

Farmers face lot of barriers for transferring knowledge, due to lack of confidence in what they are expressing and the terminology used for different farming processes. Dougherty & Hardy;1996, suggested that there are a lot of barriers involved in the knowledge exchange process like trust, communication and the distance between the parties [9].

So normally while acquiring the knowledge from farmers, we have to trust in what they express and convey. Multimedia recordings were done with the consent of the farmers, so as to ensure the originality of the knowledge and build trust. Amesse and Cohedet; 2001 has pointed out that trust can be established if there is a strong reciprocity between the initial location and the destination [10].

Farmer's prior knowledge about the various new techniques of preserving and cultivation of plants (banana) helped to recall the techniques they have inherited from their ancestors and used the knowledge appropriately. Most of the farmers were very positive to impart the knowledge when they were conveyed that this study was for research purpose and for the betterment of the farmers at other location and vice-versa. Cohen & Levinthal; 1990 has correctly pointed out that the absorptive capacity was actually the result of knowledge accumulation process and the ability to innovate [11].

Cummins and Teng; 2003, has remarked that as a relational factor of interest, distance between parties i.e. the source and the destination is very important [12].The geographical distance for transferring knowledge is not a problem. The knowledge acquired from one location can be conveyed to farmers at another location. The multimedia (audio/ video) demo helps the famers at remote site to view and analyse the knowledge used by the farmers at different locations.

The farmers at this sink/ destinations who propose to use such knowledge normally believe and trust the knowledge they get for reference through the website. Inkpen; 2000, has defined trust as that reflects the belief that the words or promise of a partner is reliable and the partner fulfils it [13]. To establish a strong trust between the Initial Location (IL) and sink/destination it is essential to give a feedback from the

farmers who are using the knowledge for their agricultural purpose. We found from the field that most of the farmers were motivated and very enthusiastic if such applications are available within their reach. Davenport and Prusak; 2000, correctly indicated that the reputations of the source is reflected in the perception of the willingness to share knowledge [14].

If farmers from all parts of Kerala express their ideas and help to acquire and transfer the knowledge they possess, then such a system will be a very effective and useful for the farmers and the farming community of the state and this can be extended to other parts of the country and even globally. Hansen; 1999, has indicated that the relationships plays a prominent role in improving the processing capacity of data and this allows effective flow of knowledge [15]. Similarly, in our case a centralized server will help to store and retrieve the information acquired by the farmer. According to Van Wijk et al; 2008, a central location creates a mediating position and allows exchange [16]. The awareness of relevant knowledge from Initial Location can be transferred to sink/ destination and vice versa, if there is a proper connectivity between the various technologies used by the farmers at different locations and controlled by a central location as mentioned by Tsai; 2001[17].

4. THE KNOWLEDGE BASE

The knowledge base is normally updated with new knowledge added either from the farmers or from the expert side. The knowledge obtained from the farmers was TACIT, which requires documentation and proper organization so as to be stored in the Knowledge Base (KB). According to Uzzi; 1996, the empirical studies have indicated that tacit knowledge can more easily be transferred between organizations within a network than to new organization [18]. Normally the tacit knowledge of the farmers is more or less the same in a particular location, for example: it is same within the same Small Agricultural Groups (SAG) of the state of Kerala. Galbrith; 1990, suggested that if the distance between the organization are high, then slower and less effective will be the technology/knowledge transfer[19]. But if the distance between the farmers (SAG) is increased then the transfer of knowledge becomes less effective. Consider an example; the Knowledge used for protecting banana plant from heat in Ernakulum district of Kerala was not the same in Kasaragod district of Kerala, but the Multimedia (audio/video) demonstration makes it very effective to convey the actual knowledge.

If the Initial Location and the sink/destination can understand and disseminate the same knowledge, then we can assume that the knowledge transferred is effective and useful. Now VFPCK and CPCRI and other government bodies concerned with agriculture are trying to give training so as to unify the knowledge used by farmers across the state of Kerala.

5. INTERMEDIARIES

They are the third party actually involved in the process of technology/ transfer of knowledge and assumes the role of facilitator between Initial Location and the sink/destination. The type of intermediaries depends on various factors, like the services provided, researchers, the area of cultivation, consultants and so on. Moreover the intermediaries range from individuals to consultants and cater different areas of specialization according to Landry et al; 2013[20].

In this research, the VFPCK officials, scientists and the researcher himself act as the intermediary for the knowledge acquisition. The intermediary include both government and non-government agencies, science and technology parks, research centers, science and technology departments and so on which helps to transfer the acquired knowledge from the farmers. Gilsing et al; 2011, points out that many private and public organizations are involved in the liaison work for the knowledge transfer [21].

The knowledge abstracted from the farmers are gathered and effectively communicated to the knowledge base. Thus the role of intermediaries is very important for bridging the gap between the Initial Location and the sink/destination..

6. KNOWLEDGE TRANSFERRING PROCESS

Knowledge transferring process is 'epistemological'. Knowledge attained from the farmers regarding the farming techniques or the diseases of plants can be transferred using various channels or mechanisms which are effective and efficient. For example: mobile apps, websites etc. can be used to capture a picture and upload to the server. Therefore, different types of technology and knowledge as indicted by Szulanski; 1996, were required to transfer a knowledge from the Initial Location to sink [22]. Even different types of technologies (Multimedia) can be integrated to such a system. The nature of the knowledge is very important from the farmer's perspective.

The traditional knowledge acquired according to Howells; 1996, can be either tacit (which can be expressed and transferable) or explicit (which can be documented and thus easier to get transferred). When we discuss about technology transfer, it is not only a physical artifact but also the knowledge gained by any individual and how well it can be used [23]. Polanyi; 1962, expressed that tacit knowledge is non-verbalized, intuitive and unarticulated and very difficult to formalize and communicate [24]. Tacit knowledge obtained from farmers is difficult to encode and transfer. This to a great extent depends on the farmer's characteristics and their policies of farming in that region of abstraction. Such knowledge is very difficult to replicate as well. But in explicit knowledge, the farmers have made a note of the knowledge available by attending the seminars and conferences and they have proper documentation of such knowledge. Nonka; 1994, articulated that these two types of knowledge are mutually dependant on each other and together they reinforce the quality of knowledge transferred [25]. The tacit knowledge which the farmer expresses helps to determine and interpret explicit knowledge.

7. PROPOSED MODEL FOR KNOWLEDGE TRANSFER

In this section the detailed description of the proposed model is given.

7.1. Model Architecture

Many models are proposed by various researches to express an overview about knowledge transfer models. Davenport & Prusak, Cummings & Teny argues that tacit knowledge; experience of personals and skill of individuals represent a kind of knowledge with high degree of viscosity whereas knowledge from documents were thin [26]. Normally the knowledge transfer is from an Initial Location (IL) to sink (destination), by using various technologies. In this study, the knowledge transfer is possible from sink/destination to Initial Location as well. For example: Knowledge transfer from one farm land to another farm land at a distant place and vice- versa.

The figure1: below indicates the model for agricultural knowledge transfer. The arrows indicate the flow of knowledge transfer from one part to another. The knowledge is transferred using different channel and different media (Multimedia).

The design is done based on the feedback from the farmers / agricultural scientists/ experts and so on.

7.2. Initial Location and sink/destination

Malik; 2002, explains about a 'broadcasting model', where there is a sender, recipient and the message [27]. Similarly knowledge transfer originates from the Initial Location and imparting of knowledge to the sink/destination is done in our study. In this model as shown in the figure above, the arrow is bidirectional;

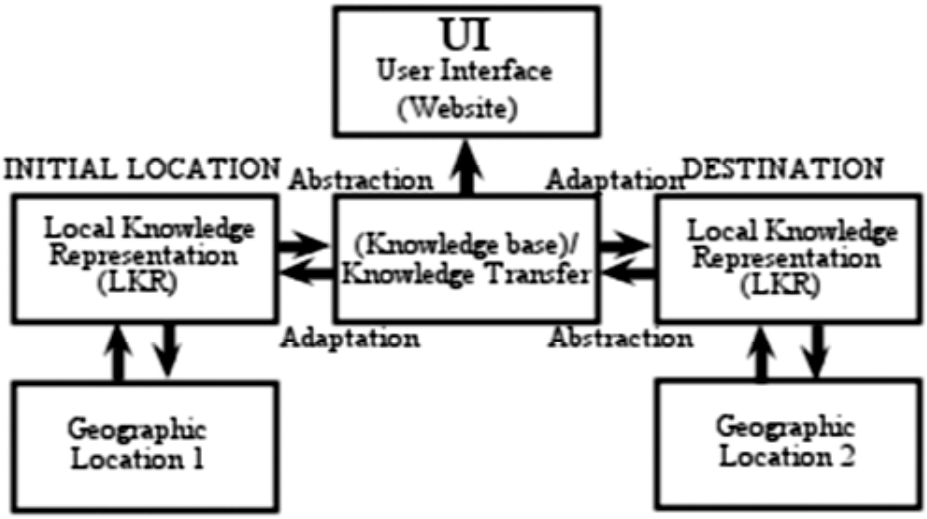

Figure 1: Agriculture Knowledge Transfer Model (AKTM)

one knowledge can be transferred from Initial Location to sink/destination and vice-versa. Currently there is no proper intermediary to transfer the traditional /tacit knowledge of one farmer to other part of state. Liyanage; 2009, has proposed a model with two main actors, the source which shares the knowledge and the receiver which acquires it [28].

Kumar and Ganesh; 2009, has pointed out that when technology/knowledge is transferred, their properties and characteristics will also be transferred [29]. The knowledge or experience of the farmer from one site is transferred into other site. This is normally done with the help of audio/image/video clippings (Multimedia) of the location/ process from where the knowledge is acquired.

The knowledge is transferred from the Initial Location to the destination with the help of the intermediaries. The audio/video files are stored in the database of the website developed. Farmers at the destination can browse the website and get the new knowledge. Chi, Tailan; 1994, has pointed out that such exchange structure between firms involve a lot of cost problems [30]. The genuinely captured audio/ video /image is retained and transferred to the website without any tampering of the data with the help of various intermediaries where cost is involved. Hargadon and Sutton; 1997, has correctly indicated that the intermediaries are agents which are involved in the process of knowledge / technology exchange [31].

Some of the data are collected by using the questionnaire, direct interviews with the farmers. The tacit /experienced knowledge is thus collected and transferred from one farmer site to another. Liyanage et al;2009, proposed that there are different modes like the social, external and internal aspects which influence the knowledge transfer [32].To a great extent the success of such process depends on the degree of implementing successfully the knowledge acquired from the remote site as mentioned by Cummings and Teng; 2003[33].

7.3. Phases of Knowledge Transfer

The knowledge transfer phase depends to a great extent on time as mentioned by Szulanski; 2000[34]. Depending on the need and the initiation, transfer of knowledge normally takes place.

The main phases in the design of the knowledge transfer model include:

(i) Initial phase: in this phase the initial set up for acquiring the knowledge from the farmers, experts and identifying the various transfer methodologies, should be identified. In our case researcher identified farmers from Annamanada, a panchayath in Thrissur district of Kerala. For example: The

farmer was identified and with their permission, the knowledge was acquired on (Multimedia-audio/ video files) how to cut the Banana from a tall Banana Plant.

(ii) Local knowledge representation: the knowledge acquired from the farmers has to be represented locally. This is normally attained from the Geographical location-1. This knowledge can be tacit or explicit knowledge, or it can be both.

(iii) Abstraction: in this process, the essential ideas of a technology are extracted and stored in the knowledge base. This knowledge is transferred to the destination and in the adaptation phase, ideas are implemented adapting to the environment in the destination. For example: a video cam/mobile phone was used to record the knowledge about how to cut the banana bunch from a tall banana plant. Here a plastic strip was used to hold the banana in position by tying it to an arecanut/coconut tree. While cutting the banana bunch, the strip was used to pull the banana bunch close to the ground and using a knife the stem connecting the bunch fruit was cut. Now the knowledge about how to cut the banana from a tall banana plant is demonstrated and the knowledge is gathered. This knowledge is abstracted about how the banana bunch can be lowered and then cut. Thus such abstracted knowledge can be transferred to a new location. Similarly, audio/video on how to protect the banana saplings from severe heat was recorded (video) from Banana Research Station Kannara. They used the coconut leaves for providing the necessary shade as well as the necessary heat to the saplings. Thus protecting the saplings. This process was recorded and stored in the knowledge base. Abstracted knowledge can be used in the destination location.

(iv) Transfer: once the Knowledge is acquired, it was shown and discussed with the farmers and stored in the Knowledge Base (KB). Much care was taken to avoid any problems through proper planning. The main problem was with communicating with the farmers and to explain the banana bunch cutting process in a simple manner. Then it was stored in the database and transferred to the destination.

(v) Adaptation: in the adaptation process, only the necessary knowledge from the knowledge base is extracted as per the requirement of the farmer at the destination/sink. All the knowledge abstracted may not be used in the sink/destination due to the difference in the geographical conditions, climatic conditions; types of soil used and so on. Here the ideas are implemented adapting to the environment at the destination. For example: the banana bunch cutting process at the sink/destination can use bamboo/wood log for supporting and pulling the banana bunch down. Similarly, in the case of protecting the banana saplings at the sink/destination, they were using the adapted knowledge i.e. the requirement of the limited sunlight for the saplings. For this they can use the plastic net sheets. So this adapted knowledge is used at the destination.

(vi) Integration and Retrieval: Once the Knowledge acquired is shown to the farmers at the sink/ destination, and if they understands the knowledge and able to perform the task based on the audio/ video (multimedia) files stored in the knowledge base, then the assumption is made that the knowledge transfer is successful and proper integration and retrieval of the knowledge took place.

But if the receiving end farmer, have problem in identifying the Knowledge (audio/video files), then the knowledge transfer becomes a failure. The image/knowledge acquired from one location is hoisted on the website (http://indianrupeeservices.in/agri/index.php) as shown in figure 2.1-2.2 and the farmers can have a view of the knowledge transferred. If the video file is able to express the knowledge acquired then the process can be said to be effective.

Since the video and audio descriptions are available it is easy for the farmers at sink/destination to implement the knowledge acquired. The success of such knowledge transferred from one location to another mainly depends on the content and context of the knowledge abstracted from the initial location and how it

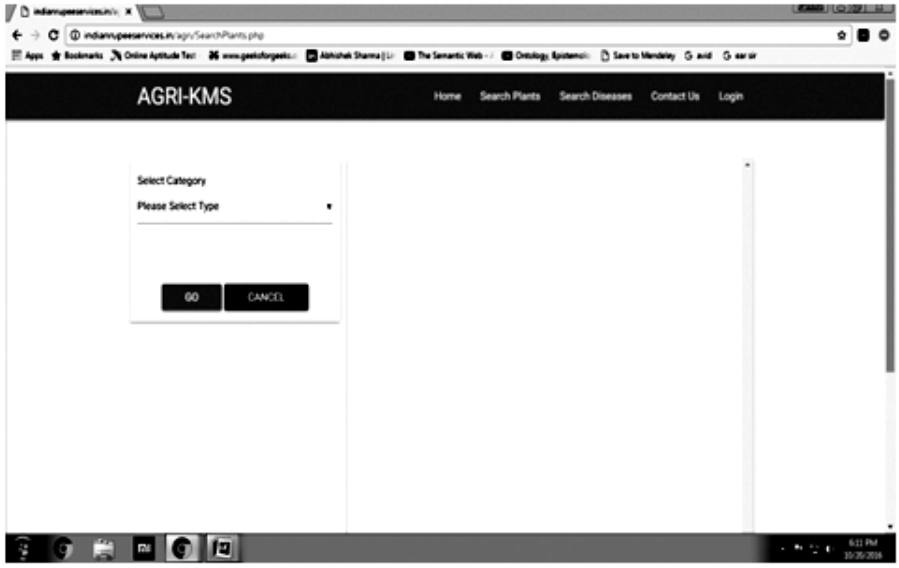

Figure 2: Knowledge management website-home page

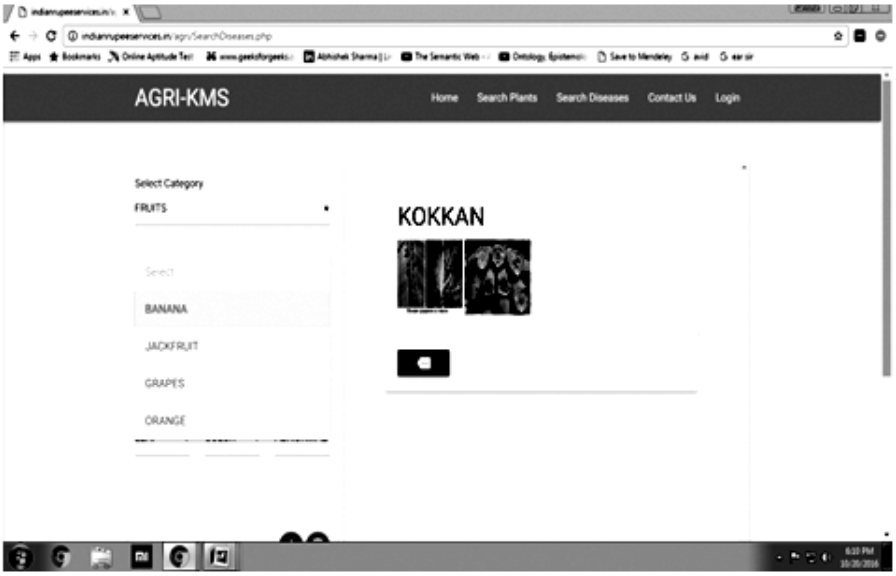

Figure 3: Knowledge management website-knowledge acquiring page

is adapted in the sink/destination. Aryote;1999; Ferdows; 2006, Kingsley; 1996, has pointed out that the best approach for such knowledge exchange can be done by transfer of manuals, documents, seminars, workshops and so on [35] [36] [37].

8. DISCUSSION AND CONCLUSION

There are a lot of positive and negative aspects of Agricultural Knowledge Transfer. The use of technology, modern tools (Multimedia-audio/video capture), educational institute – industry relationship, VFPCK, CPCRI, Agri-clinics and research centers opens a wider scope for the farmers to transfer knowledge from any remote location. Thus the farmers of one location are benefitted by using the knowledge and technology used at other parts of the state and vice-versa. There are lots of factors like technology, technological skills, geographical location, cultural and social factors and so on which influence the knowledge of the farmers at particular site.

The analysis of the various journals and the field experience obtained by interacting and collecting the multimedia data (audio/video) from the farmers, helped to consolidate the knowledge.

REFERENCES

[1] Argote, Linda, Bill McEvily, and Ray Reagans. "Managing knowledge in organizations: An integrative framework and review of emerging themes." Management science 49.4 (2003): 571-582.

[2] Bozeman, Barry. "Technology transfer and public policy: a review of research and theory." Research policy 29.4 (2000): 627-655.

[3] Argote, Linda, and Paul Ingram. "Knowledge transfer: A basis for competitive advantage in firms." Organizational behavior and human decision processes82.1 (2000): 150-169.

[4] Reisman, Arnold. "Transfer of technologies: a cross-disciplinary taxonomy." Omega 33.3 (2005): 189-202.

[5] Chesbrough, Henry William. Open innovation: The new imperative for creating and profiting from technology. Harvard Business Press, 2006.

[6] Amesse, Fernand, and Patrick Cohendet. "Technology transfer revisited from the perspective of the knowledge-based economy." Research policy 30.9 (2001): 1459-1478.

[7] Autio, Erkko, and Tomi Laamanen. "Measurement and evaluation of technology transfer: review of technology transfer mechanisms and indicators." International Journal of Technology Management 10.7-8 (1995): 643-664.

[8] Crossan, Mary M., Henry W. Lane, and Roderick E. White. "An organizational learning framework: From intuition to institution." Academy of management review 24.3 (1999): 522-537.

[9] Dougherty, Deborah, and Cynthia Hardy. "Sustained product innovation in large, mature organizations: Overcoming innovation-to-organization problems." Academy of Management Journal 39.5 (1996): 1120-1153.

[10] Amesse, Fernand, and Patrick Cohendet. "Technology transfer revisited from the perspective of the knowledge-based economy." Research policy 30.9 (2001): 1459-1478.

[11] Cohen, Wesley M., and Daniel A. Levinthal. "Absorptive capacity: A new perspective on learning and innovation." Administrative science quarterly(1990): 128-152.

[12] Cummings, Jeffrey L., and Bing-Sheng Teng. "Transferring R&D knowledge: the key factors affecting knowledge transfer success." Journal of Engineering and technology management 20.1 (2003): 39-68.

[13] Inkpen, Andrew C. "Learning through joint ventures: a framework of knowledge acquisition." Journal of management studies 37.7 (2000): 1019-1044.

[14] Davenport, Thomas H., and Laurence Prusak. Working knowledge: How organizations manage what they know. Harvard Business Press, 1998.

[15] Hansen, Morten T. "The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits." Administrative science quarterly 44.1 (1999): 82-111.

[16] Van Wijk, Raymond, Justin JP Jansen, and Marjorie A. Lyles. "Inter and intra organizational knowledge transfer: a meta analytic review and assessment of its antecedents and consequences." Journal of Management Studies 45.4 (2008): 830-853.

[17] Tsai, Wenpin. "Knowledge transfer in intraorganizational networks: Effects of network position and absorptive capacity on business unit innovation and performance." Academy of management journal 44.5 (2001): 996-1004.

[18] Uzzi, Brian. "The sources and consequences of embeddedness for the economic performance of organizations: The network effect." American sociological review (1996): 674-698.

[19] Galbraith, Craig S. "Transferring core manufacturing technologies in high-technology firms." California Management Review 32.4 (1990): 56-70.

[20] Landry, Réjean, et al. "Technology transfer organizations: Services and business models." Technovation 33.12 (2013): 431-449.

[21] Gilsing, Victor, et al. "Differences in technology transfer between science-based and development-based industries: Transfer mechanisms and barriers." Technovation 31.12 (2011): 638-647.

[22] Szulanski, Gabriel. "Exploring internal stickiness: Impediments to the transfer of best practice within the firm." Strategic management journal17.S2 (1996): 27-43.

[23] Howells, Jeremy. "Tacit knowledge." Technology analysis & strategic management 8.2 (1996): 91-106.

[24] Polanyi, Michael. "Personal Knowledge: Toward a Post-Critical Theology." (1962).

[25] Nonaka, Ikujiro. "A dynamic theory of organizational knowledge creation." Organization science 5.1 (1994): 14-37.

[26] Davenport, Thomas H., and Laurence Prusak. Working knowledge: How organizations manage what they know. Harvard Business Press, 1998.

[27] Malik, Khaleel. “Aiding the technology manager: a conceptual model for intra-firm technology transfer.” Technovation 22.7 (2002): 427-436.

[28] Liyanage, Champika, et al. “Knowledge communication and translation-a knowledge transfer model.” Journal of Knowledge management 13.3 (2009): 118-131.

[29] Ajith Kumar, J., and L. S. Ganesh. “Research on knowledge transfer in organizations: a morphology.” Journal of knowledge management 13.4 (2009): 161-174.

[30] Chi, Tailan. “Trading in strategic resources: Necessary conditions, transaction cost problems, and choice of exchange structure.” Strategic management journal 15.4 (1994): 271-290.

[31] Hargadon, Andrew, and Robert I. Sutton. “Technology brokering and innovation in a product development firm.” Administrative science quarterly(1997): 716-749.

[32] Liyanage, Champika, et al. “Knowledge communication and translation-a knowledge transfer model.” Journal of Knowledge management 13.3 (2009): 118-131.

[33] Cummings, Jeffrey L., and Bing-Sheng Teng. “Transferring R&D knowledge: the key factors affecting knowledge transfer success.” Journal of Engineering and technology management 20.1 (2003): 39-68.

[34] Szulanski, Gabriel. “The process of knowledge transfer: A diachronic analysis of stickiness.” Organizational behavior and human decision processes 82.1 (2000): 9-27.

[35] Argote, L. “Organizational learning: Creating, retaining, and transferring knowledgeKluwer.” Dordrecht, Netherlands (1999).

[36] Ferdows, Kasra. “POM Forum: Transfer of Changing Production Know How.” Production and Operations Management 15.1 (2006): 1-9.

[37] Kingsley, Gordon, Barrt Bozeman, and Karen Coker. “Technology transfer and absorption: an ‘R & D value-mapping’ approach to evaluation.” Research Policy 25.6 (1996): 967-995.