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Indigenous Knowledge acquisition and sharing on wild mushroom among local communities in selected districts in Tanzania

Dr A.W Malekani
Department of Informatics and Information Technology, College of Natural and Applied Sciences, Sokoine University of Agriculture, P. O Box 3038, Morogoro, Tanzania
E: Mail: malekani@sua.ac.tz

ABSTRACT

The objective of the study was to assess existing practices of acquiring and sharing indigenous knowledge (IK) related to wild mushroom species among local communities and examine how local communities harvested, processed, preserved and marketed wild mushroom species using existing IK related to such activities. The study also sought to validate the Socialization, Externalization, Combination and Internalization (SECI) model to find out its suitability for managing indigenous knowledge on mushroom. The research employed a mixed research design, using cross-sectional design and a case study design. The study found out that primary sources of mushroom IK are predominantly tacit and local and personal experience. This study found that most of the respondents indicated that personal experience, parents, guardians and family are their key sources of information for edible and non-edible wild mushroom. The study further found that the IK used to distinguish edible and poisonous wild mushroom are experience gained from elders followed by color and appearance, being eaten by wild animals/insects, place of growth and smell. Others include size, production of exudates, taste and using names inherited from elders. The major means of acquiring knowledge related to use of wild mushroom is accompanying relatives during harvesting seasons and through training by elders and direct observations. Over 20 edible dominant wild mushroom collected and used by local communities using IK were identified. It was recommended that existing structures and networks such as farmer groups, and folklore should be fostered by knowledge intermediaries, NGOs, government institutions and village leaders so that they can encourage and motivate active participation of individual farmers and groups to establish links with other communities to enable learning, sharing and creation of new indigenous knowledge especially on use of wild mushroom.

Key words: wild plants; wild mushroom; indigenous knowledge; traditional ecological knowledge; SECI model.

INTRODUCTION

Indigenous Knowledge (IK) is used interchangeably with many terminologies such as Traditional Ecological Knowledge (TEK), Traditional Knowledge (TK), Aboriginal knowledge (AK) and many others. It is knowledge that is tacit, orally communicated, experiential, unique and embedded in the heads, activities and practices of communities with long histories of close interaction with the natural environment across cultures and geographical spaces. IK is largely used by local communities to make decisions (Kalanda-Joshua *et al*., (2011). TEK describes aboriginal, indigenous, or other forms of traditional knowledge regarding sustainability of local resources. TEK refers to "a cumulative body of knowledge, belief, and practice, evolving by accumulation of traditional knowledge related to the environment and handed down through generations through traditional songs, stories and beliefs. It concerns the relationship of living beings (including human) with their traditional groups and with their environment (Olekao, 2017).

According to Olekao (2017), traditional ecological knowledge (TEK) is mainly of a practical nature, particularly in such fields as crop farming, animal husbandry, fisheries, health, horticulture and forestry. It is the basis for local decision-making in livestock keeping, crop farming, hunting and gathering, nutrition and food preparation, resource management, education and health as well as social, economic, and political organization. It is recognized as "the inextricable link between cultural and biological diversity". Traditional knowledge on the other hand is described by *Uprety, et al*., (2012) as the knowledge, innovations and practices of indigenous and local communities around the world which is developed from past experiences gained over centuries and adapted to the local culture and environment. Traditional knowledge is transmitted orally from generation to generation and it is collectively owned by the members of a particular indigenous community taking the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local language, and crop and animal husbandry practices including the development of plant species and animal breeds (Pierotti *et al*., 2000). According to Qwarse *et al*., (2021), local people can identify more plant varieties and animal species than formal science, probably due to the fact that they have had more time to search and find all the plants in their area. This cuts across most societies which their livelihood is dependent upon the natural resource base for survival.

Despite the role played by IK, production in low developed countries is low and studies attribute this to inadequate utilization of IK, inability to adapt to changing circumstances and lack of local innovations (Malekani, 2020). There is a loss in the knowledge and practices concerning mushrooms in particular as observed by Haro-Luna *et al.*, (2019) attributable to social changes in societies. Moreover, farmers do not earn high income because their innovations and discoveries are considered mostly incremental, and because indigenous technologies are applied in isolation (Malekani, 2020). Nonetheless, if properly harnessed, IK can be used to ensure that agricultural developments are viable within the local environment (Malekani, 2020). Traditional ecological knowledge (TEK) in particular, is central to indigenous world views and practices and is one of the most important contributions that indigenous people can bring to conservation management partnerships (Wehi *et al.*, 2014). In Tanzania and the selected districts in particular, there exists scant studies assessing and examining how local communities share and preserve IK related to harvesting, processing and marketing wild mushroom. Nor are there studies examining the applicability of existing Knowledge Management models such as SECI model in harnessing indigenous knowledge and its management on wild mushroom. This study was vital to bridge these gaps.

KNOWLEDGE MANAGEMENT AND THE SECI MODEL

In their study on Knowledge management models and their utility to the effective management and integration of indigenous knowledge with other knowledge systems, Ngulube and Lwoga (2007) assert that one of the strategies that may assist in the management and preservation of indigenous knowledge is the utilization of knowledge management models given the fact that indigenous knowledge is key to the development of sub Saharan Africa and the preservation of its societal memory, and the essence that it is fast disappearing due to a variety of reasons. The authors also posit that knowledge management models may also offer a window of opportunity to manage and integrate indigenous knowledge into other knowledge systems. Despite the fact that knowledge management models tend to focus on business or organizational settings with formal structures, they may be adapted to manage knowledge in local communities. Knowledge management should not be restricted to "closed" business systems with formal structures. It can also be practiced in open systems or in "the wild" as expressed by Hutchins (1995). However, the ways in which communities can access and manage their knowledge assets remains a major challenge to those involved in the preservation and management of indigenous knowledge. The SECI model helps in understanding the modes of knowledge creation and transfer that are used in managing IK in the area of study.

In the present study, the SECI model was one adopted because it provides a holistic approach in the management of both tacit and explicit knowledge (Nonaka & Toyama 2005). It provided guiding framework for explaining the importance of managing IK in both formal and informal settings. KM theorists agree that tacit knowledge can be created, shared and managed through the use of four modes of knowledge conversion such as socialization, externalization, combination and internalization (Mandruleanu 2008; Shannak *et al.* 2012). Nonaka and Toyama (2005) assert that the SECI model is important for the knowledge creation and transfer. The process starts with socialization where knowledge is converted from tacit to tacit. For Adachi (2011), there are two types of socialization modes of knowledge conversion.

One focuses more on physical communication than verbal communication, for example, in traditional apprenticeship apprentices can learn knowledge through sharing as well as hands-on experience. Nonaka calls this process sympathized knowledge. This technical dimension of the socialization mode of knowledge conversion process normally takes place at individual level (Adachi 2011). The second type of the socialization mode of knowledge conversion takes place at team level. The focus is more on the face-to-face repeated knowledge-sharing processes among team members and on the sharing of cognitive knowledge and skills of team members (Adachi 2011).

Externalization takes place when tacit knowledge is converted into explicit knowledge, such as concepts, images and written documents. The advantage is that knowledge can be shared widely (Nonaka & Toyama 2003). According to Adachi (2011), a shared language facilitates the externalization mode of knowledge sharing among the team members and organizational structures. Adachi (2011) calls the knowledge created during an externalization process conceptual knowledge. Combination is when knowledge is collected from inside or outside the organisation and then combined, edited or processed to form more complex and systematic explicit knowledge (Nonaka & Toyama 2003). It is a process of exchanging, sorting, adding, disseminating, sharing and reconfiguring explicit knowledge among the organizational members through documents, meetings, telephone conversations, computerized communication methods and others. This combination knowledge-creation process is called systemic knowledge (Adachi 2011). In terms of databases, ICT's can play an important role in facilitating this mode of conversion and in disseminating the new explicit

knowledge among the members of the organization (Nonaka & Toyama 2003). Lastly, is internalization. In this process, explicit knowledge created and shared throughout an organization is again converted into tacit knowledge. This stage is viewed as praxis because knowledge is applied and used in practical situations and becomes the base for new
routines. The pragmatistic way of learning-by-doing is an effective method to test, modify and embody explicit knowledge as one's own tacit knowledge (Nonaka & Toyama 2003). According to Adachi (2011), knowledge created through an internalization process is called operational knowledge.

THE APPLICATION OF SECI MODEL IN THIS STUDY

Given the nature of the study settings, the study utilized the SECI model mainly the socialization sub-process as explained below.

Socialization

In this model of knowledge transfer, intangible knowledge is socialized either at team or individual level through word of mouth. In addition, learning by doing (known as apprenticeship) or transfer of skills becomes prevalent (Adachi, 2011).

Communication is a fundamental requirement in the socialization process. According to Rogers (2003), communication is one of the four key elements that can be used to determine the rate of the diffusion of an innovation. In this context, the study sought to understand how IK was communicated among the community members of various ages, genders and other social classes, and how the innovation was perceived by the adopters in terms of its relative advantage, simplicity,
compatibility, observability and trialability. During socialization, learning or diffusion of innovations takes place at an informal level through the use of traditional tools and methods like oral tradition, CoPs and apprenticeship. The other critical factors that might influence the adoption include the level of trust, the issue of a language that was used to communicate information about an innovation, and the circumstances under which information was communicated. In this study, findings confirmed that socialization and in-situ preservation strategies were embraced by the community studied. However, the culture of knowledge sharing was declining due to various reasons like lack of commitment and cooperation, challenging weather conditions, lower levels of information skills and lack of resources.

METHODOLOGY

The study was carried out in seven selected districts in Tanzania. The objective of the study was to assess existing practices of acquiring and sharing indigenous knowledge related to wild mushroom species among local communities. The study also sought to validate the Socialization, Externalization, Combination and Internalization (SECI) model to find out its suitability for managing indigenous knowledge on mushroom. The research employed a mixed research design, using cross-sectional design which involves collecting data at one point in time, utilizing a combination of activities, including an extensive literature review, consultations with experts and local communities to provide socio-economic oriented findings (Bryman *et al*., 2008). A case study (small communities involved in mushroom collection in villages) was drawn to enable description of features (indigenous wild mushroom knowledge and management practices) in detail (Bryman *et al*., 2008). The study population included the following two categories of respondents: (i) Local communities – small holder farmers involved in mushroom collection and village leaders; (ii) IK intermediaries (extension officers and forest officers).

A mixed methods approach was used to collect data and to simultaneously address both exploratory and confirmatory questions. Quantitative data were embedded in the qualitative design to enrich the description of the sampled participants (Morse, 1991), and to systematically measure factors considered important for this study such as measurements of the contribution of IK to livelihoods among communities. This approach deployed triangulation to seek convergence across qualitative and quantitative approaches (Tashakkori and Teddlie, 2006). It was used because it is recommended in IK studies as an effective method for collecting different types of data which can be used to confirm the validity and consistency of IK of a certain locality (Kiptot, 2007). Lastly, the study used mixed methods in order to offset the weaknesses of both qualitative and quantitative methods and to draw on the strengths of both (Bryman, 2006).

A four-stage sampling was used to draw a sample for this study. Multi-stage sampling was adopted because the population is scattered over a wide geographical area and a survey was made within a limited time and financial resources. A non-probability, purposive sampling technique was used to select seven districts from the two regions (Ruvuma and Tabora) for the study. These two regions

were selected because they are endowed with expansive miombo woodland (dominant natural vegetation cover) with low soil erosion and with much wild mushroom of different varieties and were therefore seen to be potential to offer relevant data for the study. According to Harkonem *et al.*, (2003), miombo woodlands, covering almost half of Tanzania, have shown to yield the largest variety of wild mushroom species. The most commonly used species were those of the genera *Amanita, Cantharellus, Lactarius, Russula* and *Termitomyces*. *Coprinus cinereus*. The two study regions have also well-established wild mushroom collectors supported by Forest Value Chain (FORVAC) Agency. Other studies have also found that areas with a combination of higher vegetation cover of natural pine and oak forests and lower soil erosion have usually good growth of wild mushroom (Santiago *et al.*, 2016). The documentation of wild mushroom species in communities is important for conservation, transfer of knowledge and information regarding their uses across one generation to another (Qwarse *et al.*, 2021).

Respondents who were interviewed were selected using systematic random sampling. Their names were selected from the village government register of households involved in collecting and selling wild mushroom. Purposive sampling was used to select other categories of respondents in the study, including key informants and participants for focus group discussions (FGD). 152 households were interviewed using questionnaire. In addition, two key informants were interviewed in each village. Between 8 and 12 people participated in one FGD discussions in each village.

RESULTS AND DISCUSSIONS

Respondents were interviewed in seven districts in two regions of Ruvuma and Tabora as indicated in Table 1. **Sources and Access to Indigenous Knowledge on Edible and Poisonous Wild Mushroom**

The respondents mentioned several sources of indigenous knowledge (IK) used for acquisition of knowledge on local species of mushroom. Primary sources of mushroom IK are predominantly tacit and local, which included personal experience, parents/guardian/family, neighbors, friends/relatives, social group gatherings, village meetings, and village leaders and farmer groups. Findings revealed that respondents involved in wild mushroom value chain make little use of formal sources of knowledge such as books, posters, newspapers, seminars and agricultural shows. In terms of frequency of access, the responses again showed the predominance of the parents/guardian/family, neighbor/friends, social groups and village meetings as primary sources of IK they most frequently consulted as reported in Table 2.Primary sources of mushroom IK are predominantly tacit and local and personal

experience. In this study and as shown in Table 2, Most of the respondents indicated that personal experience, parents, guardians and family are their key sources of information. Other sources mentioned include neighbors, friends and relatives, social group gatherings, village meetings, village leaders and farmer groups. As indicated from Table 3, the IK used to distinguish edible and poisonous wild mushroom are experience gained from elders followed by color and appearance, being eaten by wild animals/insects, place of growth and smell. Others include size, production of exudates, taste and using names inherited from elders.

In terms of the type of indigenous knowledge they seek, the majority of participants in FGDs stated that they seek knowledge on edible mushroom species, methods of harvesting, processing, storage, and utilization of wild mushroom species. It is apparent from the findings that the communities lack reliable sources of exogenous knowledge. There is therefore a need to integrate IK into exogenous knowledge to strengthen the local knowledge systems. The major means of acquiring knowledge related to use of wild mushroom is accompanying relatives during harvesting seasons and through training by elders and direct observations. Other studies have also found that traditional (indigenous) knowledge of mushrooms among the local communities is of high accuracy from the western taxonomic and ecological perspective. In terms of classification, local mycological knowledge which includes the use of mushroom as food, medicinal application, recreational objects, beliefs and myths, as well as income generating activity to poor households is well documented in different parts of the world (Tibuhwa, 2013). The information on how to recognize and differentiate between edible and none edible mushroom depends largely on folk taxonomy. Folk taxonomy is the classification of organisms on the basis of cultural tradition which uses vernacular naming system (Tibuhwa, 2013). Local communities can distinguish and name the parts of wild mushroom species in the local language; group them and assign one or two names in their vernacular to the most common, edible or poisonous mushrooms; and pinpoint exactly the habitat and phenology of the species studied (Santiago, 2016). In another study on Knowledge on utilization of wild mushrooms by the local communities in the Selous-Niassa Corridor in Ruvuma Region, Tanzania by Qwarse *et al.*, (2021), it was found that the knowledge about edibility of wild mushroom species was mainly transferred to others by old women whereby those eaten by insects and wild animals or do not form much foam during cooking were considered edible. The dominant wild mushroom collected and used by local communities were

mainly over 20 and are those indicated in Table 4. A total of 32 edible and inedible wild mushroom species belonging to thirteen genera and eleven families were documented from different localities in the Selous-Niassa wildlife corridor in Namtumbo district in a similar study by Qwarse *et al.*, (2021).In this study findings revealed that a majority of local communities in the surveyed areas do not utilize formal sources of knowledge such as books, posters, newspapers, seminars and agricultural. These findings are contrary to what several KM processes that deal with knowledge acquisition suggest. The KM models posit that the acquisition of knowledge involves the importation of substantial amounts of knowledge from internal and external sources of the organization (Bouthillier and Shearer 2002; Earl 2001; Probst, Raub, and Romhardt 2000). However, findings of this study show that local communities rely heavily on local (internal) sources of knowledge to acquire IK, rather than external and formal sources of knowledge.

Local communities rarely use formal sources of knowledge (public and private extension services) and printed materials to acquire IK, instead they prefer local sources of knowledge. These findings are supported by studies conducted in other developing countries, such as Uzbekistan (Wall 2006) where local sources are major sources of agricultural IK unlike formal sources of knowledge. Similar observation was made in Ethiopia (Dixon 2002), Nigeria (Nathaniel-Imeh 2004; Olatokun and Ayanbode 2008), Tanzania (Nathaniels and Mwijage 2000; Lwoga *et al.*, 2010), and Uganda (Akullo *et al.*,2007). These findings are also supported by various authors who contend that face-to-face communication is a major mechanism for acquiring knowledge by organizations and local communities (Earl 2001; Meyer and Boon 2003).

In terms of knowledge on use of wild mushroom, the findings from this study support observation made by Gari (2003), who found that the Gogo people in central Tanzania hold local knowledge of uses of over 40 wild food plants some of which grow only during food shortages (during dry seasons) and how to process and preserve these wild foods. Such knowledge is passed from one generation to another and to children when they accompany parents/relatives during harvesting time. Similar findings were also reported by Somnasang *et al.,* (1998) in north-east Thailand.

THE INTEGRATION OF AGRO-BIODIVERSITY EXOGENOUS AND INDIGENOUS KNOWLEDGE

The study found little identification and integration of indigenous knowledge with exogenous knowledge in the local communities by knowledge providers. Information collected during FGDs indicated that the local communities are involved in participatory research activities in the surveyed areas implying that knowledge is mainly created within the social paradigm rather than the scientific paradigm. Further analysis of individual interviews show that local communities use their own knowledge or combine their knowledge with other indigenous to create new knowledge and better ideas. The research findings confirm what the KM model by Nonaka and Toyama (2005) assert, who state that internal knowledge may be combined with other internal or external knowledge to create new knowledge. These findings also validate the socialization sub-process (that is, transferring tacit to tacit knowledge) of the knowledge creation model of Nonaka and Konno (1998).

Furthermore, these findings show that local communities create new knowledge through socialization processes such as face-to-face interactions, group interactions (that is, social gatherings and farmer groups meetings and village meetings), and cultural roles such as initiation rites during adolescence and direct observation. The socialization process enables local communities to combine their knowledge with that of others to solve problems and to adapt knowledge to their own environment.

VALIDATION OF THE SECI MODEL

The fact that the study found out that primary sources of mushroom IK are predominantly tacit and local and that it is mainly acquired through socialization among local communities, the SECI model becomes a valid one in this study, particularly in the socialization sub-process. During socialization, learning or diffusion of innovations takes place at an informal level through the use of traditional tools and methods like oral tradition, CoPs and apprenticeship. In the socialization process, local communities use their own knowledge or combine their knowledge with other indigenous knowledge to create new knowledge and better ideas.

CONCLUSIONS

This study found out that primary sources of mushroom IK are predominantly tacit and local and that it is mainly acquired through socialization among local communities. During socialization, learning or diffusion of innovations takes place at an informal level through the use of traditional tools and methods like oral tradition, CoPs and apprenticeship. In the socialization process, local communities use their own knowledge or combine their knowledge with other indigenous knowledge to create new knowledge and better ideas. It can therefore, be plausibly concluded that IK is very essential for the survival of local communities residing in rural areas and in certain communities, it is the only hope for their transition from dry season to rain season when there is plenty of food for survival.

RECOMMENDATIONS

In the light of the above discussions and conclusions, it is recommended that village leaders, knowledge intermediaries, private and government institutions should encourage farmer's groups to enhance and strengthen communities of practices (CoPs) which already exist for effective knowledge creation and sharing.

Existing structures and networks such as farmer groups, and folklore should encourage and motivate active participation of individual farmers and groups and should encourage them to establish links with other communities to enable learning, sharing and creation of new indigenous knowledge.

Moreover, village leaders, knowledge intermediaries, private and government institutions should create time and space for communities to share and create new knowledge; and identify IK holders and motivate them to share knowledge through farmer's forums, and other social networks. Story telling should be used more often to share and distribute knowledge during individual and collective interactions such as CoPs.

LIMITATIONS OF THE STUDY AND SUGGESTION FOR FUTURE RESEARCH

Since the study utilized the socialization sub-process in SECI model, future researchers should extend it to other sub-processes in the model to find out how they influence local knowledge on managing wild mushroom.

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LIST OF TABLES USED IN THE TEXT

Table 1: Name of districts involved in the study

District	Frequency	Percent
Madaba	12	7.9
Mbinga	7	4.6
Namtumbo	21	13.8
Sikonge	22	14.5
Songea	34	22.4
Tabora Municipal	39	25.7
Uyui	17	11.2
Total	152	100.0

Table 1 gives the names of districts involved in the study. Seven districts were involved in the survey as indicated in Table 1.

Table 2: Sources of indigenous knowledge on edible and poisonous wild mushroom N= 152

Source	Frequency	Percent
Personal experience	150	98.68
Parents/ guardian/family	148	97.37
Neighbors/Friends/relatives	131	86.18
Women meetings	112	73.70
Wild product gathering	120	73.0
Observation	10	6.6
Social group gatherings	55	36.2
Village leaders	30	20.0
Farmers' groups	19	8.3
Village meetings	31	12.5
Local product exhibitions	6	4.0
Books	2	1.3
Conference/workshops/seminars	4	2.6
Agricultural shows	12	8.0

Source: Field survey, 2022; multiple responses were possible

Table 2 lists the major sources of IK on edible and poisonous mushroom in the surveyed villages in the district.

Table 3: Indigenous Knowledge used to establish edible and poisonous wild mushroom N=152

Ways	Frequency	Percent
Size	10	6.6
Place of growth	52	34.2
Exudates (foam)	29	19.1
Being eaten by insects and other wild animals	70	46.1
Using names	25	16.4
Smell	35	23.0
Taste	30	19.7
Color and appearance	119	78.3
Experience from elders	122	80.3

Source: Field survey, 2022; multiple responses were possible

Table 3 gives main IK used by local communities in establishing edible and poisonous mushroom species.

Table 4: Some dominant wild mushroom species identified by local communities using IK in the surveyed districts, most of which were inherited from elders N= 152

Wild mushroom specie by local names	Frequency	Percent
Kilimbisi	18	11.0
Ulelema	89	58.6
Ukalambi	4	2.6
Mgwida	3	2.0
Kitindi	11	7.2
Kangautowa	13	8.6
Katogwa	27	17.8
Kalungea	18	11.8
Uyungwe	50	32.9
Utowa	24	15.8
Upowa	45	29.6
Unyuwang'ombe	20	13.2
Umpalala	56	36.8
Ulindi	17	11.2
Mbarakata	24	15.8
Kansolele	49	32.2
Usikowa	70	46.1
Unguyugu	60	39.5
Uhinda	98	64.5
Uhima	38	25.0
Mkukwe	44	28.9

Source: Field survey, 2022; multiple responses were possible

Table 4 lists major mushroom species found in the study villages.

LIST OF FIGURE (S) USED

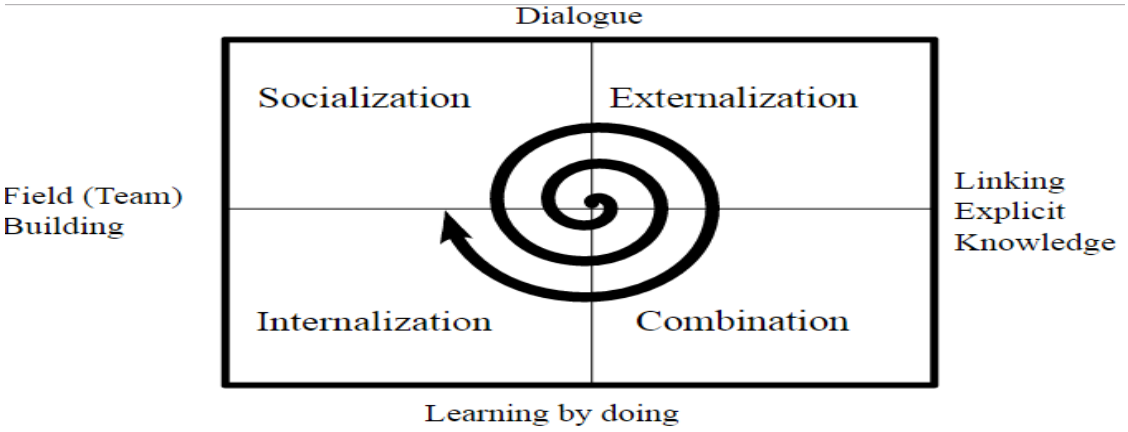

Figure 1: The SECI Model, adapted from Nonaka and Toyama (2005)

This figure indicates the SECI model used in the study to borrow some constructs during data collection.