Knowledge Management in Smallholding Organic Farm for Sustainable Food Security

Oranut Naowakate* and Patcharin Sirasoonthorn

Social Development Program, Department of Sociology and Anthropology, Faculty of Social Sciences, Naresuan University
No. 99 Moo 9, Ta Pho Sub-district, Muang District, Phitsanulok 65000, Thailand
*Corresponding author. E-mail address: oranutn63@nu.ac.th
Received: 8 December 2021; Revised: 24 March 2022; Accepted: 7 April 2022

Abstract

This article aims to investigate existing knowledge management with specific context from three smallholding organic farms on high ground in Phitsanulok province. The theoretical framework focuses on sustainability of food security where qualitative grounded theory research methodology was adopted. The information in the past twelve years was gathered from related farm documents, depth-interview, and participatory observation. These farms have been operated by entrepreneurs who have vitalized the concepts of environmental conservation into their small and medium size business with organic agriculture. The data were analyzed using content analysis and data saturation. The study finds crucial root causes of problems including limitations from an adoption set of the generalization knowledge and mismatch to its Agro-ecosystem landscape and four key biophysical constraints: soil, water, slope, and local climates, which oppose their knowledge management for the farm characteristics. They are missing out the integration of specific site physical, social context and local agricultural culture. The farmer experiences and entrepreneurs' technical knowledge in Agro-ecological systems that were crucial to create sustainable food security are not correspondence. Up until they elevate the farms through group shared ideas and experiences to adopt participatory guarantee system and set up a standardization of production system by recontextualizing on key biophysical in agricultural production and revive knowledge management for the best practice of specific farming conditions which becomes a key drive mechanism to possible success.

Keywords: Knowledge Management, Smallholding Organic Farm, Food Security, Sustainability

Introduction

Background and Importance

The main food producer is the Smallholding Organic Farms (SOF) rather than large farms (Horrigan et al., 2002) and share 50 to 70 percent in global food supply (Raungpaka & Savetpanuvong, 2017). However, the food insecurity worldwide still an unsolved issue (International Fund for Agricultural Development (IFAD), 2013), including in the SOFs in Phitsanulok. To understand the situation the research brought in information from applying Constructing Grounded Theory (CGT) (Charmaz, 2014) to a pilot study in small and medium size businesses of Kayakiri Farm, Rainforest Farm and Wana Thara Resort by taking Lessons Learned (LL) in 2021 to find the set of Knowledge Management (KM). The results raised three main issues oppose to sustainable food security.

First, this research contradicts the straightness that are not able to explain issues related to human complicatedness linked in the social dimension, culture, economy, and natural environment (Sutrisna & Barrett, 2007). In which, the knowledge generalization appears when a set of popular studies that often sided with the positivism paradigm and presented panacea research with the same principles as physical science that being straight and systematic appearance. Therefore, this study focused on knowledge specific, internal, and the key biophysics.

Next, local practice and scientific data is crucial in agriculture. Traditionally, the fundamentals of agriculture to lead quality produce is the collective skills generated from the repeated routine practices in agricultural plots with a particular purpose. Secchi (1999) proposed that knowledge is the increasing experience over the period that a person spends in practice. In this case, it is to find knowledge that arises based on the local cultivation and

farmer skills individually and to focus on farmer thinking system that apply general technical knowledge through forms of well-suited specific context integration.

Last, a key drive mechanism is a linkage tool. The farms share diverse characteristics but similar root causes of practical experience. It is the restrictions caused by education background, timing, poverty, or livelihood. As a result, existing skills and experiences are not passing on and disappearing from farmers. Boonyakit & Prasopsukchokchai (2004) mentioned the disappearance or an ambiguity of the knowledge sector was common because of personal lack of analyzing ability, creativity of the thinking system, bridging the gap of the depth-knowledge between individual and group. Therefore, it is another important part to localize the agricultural custom and culture to connect and harmonize farmers from individuals, community, and a group of higher standards.

The SOFs are food producer and provider in the household and community. It is important to improve their KM following to the diversity of farm characteristics and context practicality to help sustain food security. In which, in finding its Knowledge Management System (KMS) should be more specific design and based on factors within to form the linkage between biophysical site constraint, skills, and local agricultural culture. Where farmers can be adopted, practiced, and sustained according to their local needs. Thus, this research is in regard that the existing vital information may not be systematically collected, organized, and it is playing a great barrier to sustainable food security.

Research Questions

What are the key principles of agricultural production that lead to the practical knowledge and practice? Are the local sources: KM, genuine practices, and drive mechanisms already existing? How to integrate the specific context with general technical knowledge for sustainable food security?

Research Objectives

There is to synthesize the knowledge related to the key biophysical principles of agricultural production, to find the existing KMS that lead to the placement of conceptual and practical mechanism which correspond to the specific context, and to present a series of relationships between specific context, local agricultural culture and a drive mechanism that prime to sustainable food security management in SOFs.

Review of Related Literature

The investigation was carried on those disagreements and directly with farmers to uncover the specific context knowledge and linkages. In believing the individualistic with their explicit and tacit knowledge as a value asset to the sustainability and security under the context of environment and its surroundings to rectify with actions that congruence with the ongoing changing circumstances e.g., drought, climate change and so on.

It begins with contextualizing the knowledge definition as an important step in KM as a foundation of the ideas and practices placement from entrepreneurs and farmers. Many scholars have a consistent opinion that LL is part of the learning organization of KM (Senge, 1990) for example, Davenport & Prusak (1998), and Zack (1999) this focuses on the potential of learning, knowledge, and resources that contribute to sustainability. Identifying knowledge is a concept that has been widely used in businesses and industries: automotive, metal, software, as well as military organizations in the States. It is always practiced as a process, interaction (Weber et al., 2001) or an intelligent system (Aha & Weber, 2000). The value of knowledge in each organization is therefore a concrete asset, strategic valuable resource, and key management because it is a flexible process to implement

both short or long-term and critical conditions (the U.S. Military as cited in Weber et al., 2001). Besides, it can be adopted, conveyed, exchanged, and transferred (Goh, 2002).

Next, the local cultivation customs and cultures that are hidden or disregarded may fill in the overall working structure. Recognizing the sustainable agricultural focused concepts on a holistic thinking system through its actor as the following, the importance of thinking system, perspectives on the recontextualization of the farm location, and the emphasis on the structure of ecological agriculture specifically to organic eco-logicalness. Similar to the social development concept of Sirasoonthorn (2013): The survival of individuals, groups, communities and societies in the world of globalization requires many elements, including individual potential. Due to both the knowledge of changes and the ability to think are for analyzing, adapting, indagating, and the potential to solve encountering problems.

The form of holistic farming thinking system is an integration of both social sciences and sciences. As agriculture is classified an applied science to refer a thinking system aimed at describing physical phenomena and the environment with empirical evidence. Resulting from systematic notetaking and data analysis (Warren et al., 2008). As for KM, there is often a connection in the production system based on four key biophysical constraints management: pedological (soil), hydrological (water), topographical (terrain), and climatological (climate or temperature) (Brown et al., 2011). Then how to sequentially prioritize and systemize these four area-base managements with the SOF social context.

Leading to the correct practice is four area-base managements (1) soil maintenance is essential to internal inputs and the practices that are concentrated in ecological principles such as regenerative agriculture often use the succession theory concept. Also, in permaculture with the concept of design the spaces by considering the theory of plant hierarchical arrangement or the staggering theory (Mollison, 1988), (2) Water in agriculture is often understood to physical accessible water sources but Lake (2011) drought concept is as a phenomenon that affects ecosystems caused by more than one of human activities. Besides, Whitmore (2000) defined the drought as a more complex than means of water absence that occurred from the quantity, seasons, duration, and frequency of rainfall but including the different responsiveness of plant cultivar and animals. So, missing interpretation and management of droughts that may not correlate with the possibility of prolonging the period of local cultivation to build capacity for higher potential of both individual and physiographical purposes, (3) Farmers should look at the relationship of landscapes with people, such as designing habitats to suit the conditions of the area (Mollison, 1988). These illustrate what is caused by mistakes and losses due to communication deficiencies, including the process of giving meaning to the knowledge of both publicly conscientious entrepreneurs and farmers of faith; self-reliance and actions are so serious that they form knowledge through rich experience, (4) The microclimate study is a result of linking the relationship between the main biological limitation management (Brown et al., 2011) soil, water and area that derive the proper ecological and climate management. The farmers must realize a transformational management process occurs on the soil and then results in energy mobility and radiation (Foken, 2008), types of cultivation plants with water content (Brown et al., 2011) or radiating shade (Zweifel et al., 2007), a combination of plants to maintain soil surface moisture (Schindler et al., 2007). These are important for managing activities within the plot to create a suitable climate for cultivation in specific areas.

Next, to connect people and knowledge by participatory science. In Warner (2008) shows practical concept of how to extend agricultural knowledge and practices through diverse actors. These were the farmer networking activities stimulated through a group of similar thinking systems, an acceptance of standards through its framework

and then applying such standards to become a new local agricultural culture. This culture sums up ideas, beliefs, and practices then it is integrated into livelihood, social context, and farm production processes. Therefore, combining those skills with local agricultural culture that is already practiced but adjust the usage to suit the community. This is when participatory active learning becomes an important mechanism for the farms to run more effectively. Thus, all are concatenated and cannot be divided but to contextualize and systemize before deploying into practices.

Hence, this information is supporting the study to trace for the flow linkage factors and existing KM thoroughly from the main four areas of farming key production with its context to defy the key conceptual framework and recontextualize the connection between SOFs and the possibility to sustain food security KM that responses to the specific.

Conceptual Framework

The researchers wanted to open an argument that each development area has a unique ecosystem and social context. Especially a specific Organic Agro-ecosystem which is associated with the implementation of activities subject to organic farming. Ecological organic agriculture requires the restoration of diverse Agro-ecology to create a new area, where recontextualization is needed (Melo, 2013). The area should be classified as a new ecosystem (Wu, 2013) with the collaboration of social systems to become a managed society to create sustainable food security. To aim towards sustainability goals by the lens of the three principles of Sustainable Pillars in accordance with sustainability goals to the sub-dimension of the Sustainable Development Goals in Clause 2 (SDGs 2.3, 2.4).

Research Methodology, Methods, and Tools

Research Methodology

This research chose the CGT (Charmaz, 2014) with Creswell & Poth (2018) proposing a research design concept of supporting the procedures for analyzing, classifying, coding, as well as leaving the flexible distances between researchers and the data. This approach is widely known, such as in Wuelser & Pohl (2016) adopts creative approaches to form theoretical frameworks based on empirical data from inductive methods and the uses of abductive analysis. Then focusing on assembling the creation of a new set of knowledge. CGT collects novelty information from social actors, which is sage. This is focusing on set of query data that related to local farmer skills and experiences, and organic agricultural cultures in contemporary circumstances. This is the CGT to find the process of empowering local knowledge through the in-vivo from the entrepreneurs and farmers.

Research Methods

The commencement of the study used GT method to raise the research queries from theoretically selected SOFs in a specific area. Charmaz (2006) and Sirasoonthorn (2015) proposed that research under the GT theoretical framework should not be too rigid, but appear as a broad concept, also make it clear that it is unrestricted or narrowing any possibilities until the useful information cannot be found. Researchers should explain what is being studied, while also examining the interactions that always occur between researchers and field data. Then processed further investigation through documentary research from farm diaries, including interviews and observation. By conducting the method and defining the types of documents that covered both recorded and related literary synthesis to understand the local agricultural culture.

Research Tool

Using LL as a research tool to reach for local knowledge and After-Action Review (AAR) technique that simplified four phases; planning, preparation, actual conduct, and personal opinion as human assessment method (Dodge et al., 2021) to review experience (DeGrosky, 2005) and explore what happened and learned in activity or project (Prusak, 1999) for seeing structured and logical flow (Dodge et al., 2021) of the local agricultural culture, working framework, thinking system, management process and drive mechanism.

Data Collection

Considering the above research design, this research is crucial to detail the agricultural practices through main in- depth investigation. The methods are documentary research, in-depth interview, and participatory observation 2 units of analysis: entrepreneur and farmer. Data collection procedure in the first part is 12 years history from diaries and digital evidence data, up to the present (2008-2020). Although it was not completed, the non-existent records also indicate the degree of achievement. The second part was carried on in-depth interview taken from verbal, phrases, sentences, and non-verbal communication. Then arrange the contents according to the process of GT, consisting of the following five KM codes. Each of the stages were analyzed with the GT analysis method as the following: in-vivo coding, line-by-line coding, focus coding, and theorizing.

Theoretical Sampling

The target farms are Kayakiri Farm, Rainforest Farm and Wana Thara Resort in Wangthong District, Phisanulok Province. They were theoretically selected by specific characteristics as members of Participatory Guarantee System (PGS) or locally focused quality assurance system from IFOAM by Songkwae Organic (SKO). The entrepreneur or the owner and local aka farmer or farm labor in the farms with various background of family, financial, and education. None of them hold any agricultural degree but self-taught and taken private course. The farms located on high ground with the slope percentage between 5 and 35, height between 150 and 500 meters above the sea level and consisting areas of 1.98 to 19.8 acres. They have farm diary, project reports, audio tapes or images from both successful and unsuccessful operation. These records included sign of changes from design concepts and guidelines for managing organic landscape structure and functions in their agricultural ecosystem.

Coding

The initial coding is based on the interaction of specific geographical features in 4 key biophysical constraints management: soil, water, topography, and climate. Consequently, LL from entrepreneurs and farmers appeared: skills, experience, knowledge, and local agricultural culture. This is the weight of social science research studies, especially in the development of sustainable organic agricultural systems. In addition to conducting research in the future to observe problems caused by local features and to connect those local ideas into the KMSs. Where the tie of micro-operation is relevant social actors. Then focus on KM process (KMP) from farmers under the concept of agricultural ecological system approach. In the form of interconnected, successive, and flexible. Then shadowed a consecutive axial coding and 5 steps: (1) Identification knowledge and resource, (2) Capturing thinking system and biophysical knowledge management process, (3) Organizing local framework and drive mechanism, (4) Sharing LL of an area specific context, (5) Using a KM summary with suggestion.

Analytical Process

The research analytical process started from the prior finding and sets of queries while going through each of the coding. The researchers used content analysis to take LL in accordance with the KM procedures to interpret and translate the important elements of the knowledge, including sets of truth involved in managing the four keys

according to the conceptual framework. The main coding of the transcription process uses the SOF result assessment tool from its AAR that provides information and checks for gentrification to create tools in the identifying elements of knowledge and synthesize them as a specific context knowledge system.

Research Results

Even though they are in the same location, similar site physical, and sharing organic farming and environmental conservation concept but the results are varied. However, in practices, their existence of theoretical and practical local knowledge is matched and mismatched to their context to lead sustainable food security KMS. Rainforest Farm and Wana Thara Resort use key knowledge from many general sources and sage through private courses and farm visits. Their technical knowledge of key biophysical are dependent on the tacit knowledge from their farm labor daily life and experiences. When later adopted PGS standards and use it to defy their practices. Meanwhile Kayakiri Farm has been adopting some sage and aimed at ecological restoration on degraded land. The results to be described concludingly by using the axial codes in KM main categories as the following:

1. Identifying: The identification of farmer specific context knowledge on key biophysical constraints of organic agricultural production. Following the collected data and information. The farm KM on main production system is vague and scattered upon their sage knowledge but mostly are untied to their physical constraints.

1.1 Pedological or Soil Management, there are three mismatched key points. First, being organic with little inputs from within. Which obviously links to the minimal production costs and organicity. Second, plant design to pre-acknowledge the number of processed inputs, to match following data: household consumption, local market demand, number of fresh produce and processing, and network crop planning. The ideas of plant design are to generate stable income and regular produce that range from daily, seasonal, and trends.

1.2 Water Management, missing four water-related issues. First, water sources and access on high ground are associated with the cost determined and investment limitation on the matters with pedological structure. Second, the standard of PGS limited the use of natural sources. Third, the landscape is not conducive to manipulation by a general model of irrigation management. Fourth, moisture maintenance at the soil surface to prevent the deep permeability beneath the surface for evaporation. Last, the understanding of information gathering through seasons, especially the precipitation during monsoon to make possible drought resistant preparations.

1.3 Slope Management. They lack designs to conform with terrain. First, the design of organic land use. Second, the buffering plants, object of protection, and segment organization to prevent soil damage from gullies, leaching, light, and wind direction. Third, no combination of existing context with concepts, such as permaculture and terrace agriculture. Fourth, making use of the slope to reduce costs of irrigation. Last, by creating land evenness increases costs.

1.4 Temperature Management. The farmers concerned and accepted as an uncontrollable factor. They lack scientific arrangements of watering systems such as plant species to increase or decrease local and micro level temperature. This is related to other three management above, especially creating space for vegetation and using internal inputs to enhance microorganisms that help manage moisture at the top and beneath the soil surface level.

In conclusion, the farmer general technical knowledge without an insight the site physical that deployed through the existing operations over the years has caused many conflicts and numbed the farmer practices which led to undesired results. It is very clear that identifying knowledge is a valuable resource existing in four keys of

biophysical management. Also, the relationship of physical composition to four area-appropriate management methods are needed.

2. Capturing: The information pointed out that systemic thinking and KMP on key biophysical are treated as manuscripts causing no dynamic thinking process to adapt themselves to the changing circumstances.

Following their key biophysical management. It showed no systemic connection between contextualized knowledge and farming management: First, soil quality problems stemmed from their land use history and causes of environmental degradation. Second, water sources in organic agriculture and the definition of area drought of mixed deciduous forests where trees have seasonal leaves fall in the dry season. Third, geographical characteristics of the slope problems remain unsolved. Fourth, the climate at micro level is less concerned. Last, missing systemic knowledge management between key production and amongst the social actors to improve thinking processes that will lead to a paradigm shift for the management of problem solving encountered by specific farming. Therefore, the issue is separated into two, subject to visible physical and people: the key biophysical constraints, and knowledge management.

3. Organizing: The information should rearrange from the smallest unit at the base of society and in successive ways. Therefore, the operational framework should be through the local drive mechanism.

The farms formed their own administration which are very vary through their own nature of business. Wana Thara Resort and Rainforest Farm are in tourism but different in service and detail. Where Wana Thara is related to nature and health care and Rainforest Farm has added on organic living courses and learning center into their business. In contrast, Kayakiri Farm runs a small integrated farming. Through the past 12 years, these farms faced the irregularity of safety food supply, in both household and to sell. As the result, they organized the setup of PGS to help regulate the organic farming and increase organic farming producer in a hope of regular safety food supply into the community.

The study found a drive mechanism of PGS standards that formed through the SKO to help farms develop the same goal and generate internal KMS and KMP of shared knowledge in detail to strengthen the organic production system in the realm of organic eco-concepts. The group-activated approach pushes both levels to move forward by ensuring the jointed farmers with an integrated practice and theory to reach sustainable food security, also encouraging farms to move into a larger framework, such as setting higher goals from self-sufficiency in accordance with FAO standards.

4. Sharing: an applicable LL and KM in a specific context framework for accessibility and acceptance.

During the 12 long years, the key actors shared their knowledges through friendship, trust, and informal meetings. However, the shared ideas, concepts and practices of each farm KM that passed on to each other were not obligatory. Only in the last 2 years was more evitable to changes when they added another tier of duty and reforming farming relationship through an organization with specific purpose. They formed SKO group and new set of practices using the LL from each farm that shared during meetings and gatherings to correct their operation. Through this process the systems were organized with mutual PGS standards. Additionally, the LL increases new farm KM. The regular meetings bring upon new ideas and create dynamic changes through PGS regulation based that inserted new thinking system to both the owners and farmers on the farms. This is when the farm able to regulate a more continual food supply and improve the quality of fresh produces and environment.

5. Using: the sum up of the new system and process from a re-contextualization creates a new context then employs its KM it to further concepts of specific development.

The three farms have followed those mutual setup standards that play as an individual farm purpose to reach organicity and group goal of being more recognize, consumer trust and easy to adapt to other similar setups and networks. The standards were practically rigid and flexible to all farm and its farm labors. By being a member in PGS form of relationship, they are helping each other, resourcing each other on different kinds of supplies and products. Also, to help solving problems through regular meetings, farm visits and shared experiences through both formal and informal communication.

Discussions and Conclusions

First to discuss is if there are the existing of knowledge and principles of agricultural production. It is based on the definition of agroecological and organic agriculture. The knowledge existed but not defy as four key biophysical constraints. This knowledge involved in three areas of importance. First, the environment is given priority to soil essence using as little external inputs as possible through the following concerns: biodiversity, mixed vegetation, technological application, crop planning and resistance development. Second, an economy that focuses on low equity but increases the value of its products. Finally, society is a drive tool that emerges as a framework that contributes to co-operation and strong social network. The combination of context specific on the integration of skills, group's experience and standard requirements has appeared to be a local agricultural culture and better to match the international standard. However, the benchmark is the incubation of a culture of participation in the thinking system of social principals, entrepreneurs, and farmers.

The three farms fulfillment of theoretical knowledge that characterized the holistic thinking system from the group discovery which brought up the main code to complement the missing part of the common thinking frame. The results reflect the importance of connecting farmer and networking individual with similar goals, the confidence in the potential farmers to organize knowledge and operation for higher goals as an individual to community level and the latter at society level becomes more possible.

Next, the insight investigation is the acquisition of farmer knowledge and their thinking system before structuring the framework with the KM that can be adapted to specific context and change. It is to connect individual and group with multi-role and rapidly changing through the mechanism of work in the SOFs with the characteristics of a holistic way of thinking. First, farmer knowledge presents similar key points and often misses the following: systematic note taking, specific context, quantitative detail in both minimal and maximal, and activities of production cost. One of the hardest points is a collaboration based on "*Kreng-jai*" (being considerate) in the family, kinship, and friendship systems. All this is made up of important elements including the work base of ideas, beliefs, process, techniques, and LL from their experiences. The KM system of each SOF is different but aims to create a way of self-reliance in ever-changing conditions.

Although they are in similar locations and resources but there are the differences in physical factors, sizes, the type of existing plants found in both native vegetables for consumption and marketing and the use of inputs from internal and external resources. However, the operational model of each farm is similar as they are small and medium-sized businesses, health and well-being orientated and with the concept of environmental conservation by using an organic agriculture approach.

Likewise, the process of thinking is the sum of the critical analysis of entrepreneurs and farmers. That uses a process of synthesis of knowledge to draw conclusions to create an understanding of inconsistencies in a wide range of evidence and contradictions of scientific systems. This will connect farmers and entrepreneurs to the

KMPs through various channels of communication to correct the working process. The overlap is the Agro-ecological process of an area. Scientific knowledge also has theoretical limitations and must be filled with a set of knowledge that comes from the foundation of farmer minds, their ability to access government agency databases, the commitment to access the area and the flexibility to make non-stop operational modifications to gain deeper understanding of the work processes. The enlightenment of self-systemized and self-re-taught LL. It is the lead to techniques and drive mechanisms for the ongoing dynamic KMP. Therefore, LL, and KM are used as intellectual ideas for sustainability and should be based on the prior and after process of thinking and the functioning of each unit in the Agro-ecosystem in accordance with the creation of important behaviors of entrepreneurs and farmers in specific contexts. In this study the farms benefited LL and KM through participating in the SKO.

Lastly, the integration of organic ecosystems as an intermediary of idea, knowledge, social context, skills, and experience to combine with edification and assembly to establish processes and production standards. It contributes to awareness of taking LL in the past to highlight behaviors that have effects and to change a particular social trait. In other words, LL allows searching ideas or identifying the person's view of society. It is to extend the specific context understanding in detail for creating new structure, systems, and processes for the desired results. In line with the desired effects, the possibility of behavior manipulation and unstable practical domination of individuals in the production cycle. Following the specific process and system to make the correction, modification, or adjustment on the lessons through the dynamic and endless learning process. This can be done at group routine meetings, discussions, exchanges, and mutual agreements that bring up the systematic creation of common standards.

In addition, the individual complexity changes cause firmness in the composition of the framework to create a clearer system and have been found to support the sustainability of SOF with limited specificity. In other words, the drive of farms are prime examples of sustainable development based on networking in the manner of intellectual friendship. The assemblies are built on a network of groups of entrepreneurs and farmers with similar ideas. At the same time, it recognizes the wide range of differences in both the farm physical characteristics and thinking systems of the related social actors. Therefore, the creation of a collaborative process under clear standards of operation plays an important part. Besides, it could connect with a bigger network and has an ability to raise higher and broader development goals. (Figure 1)

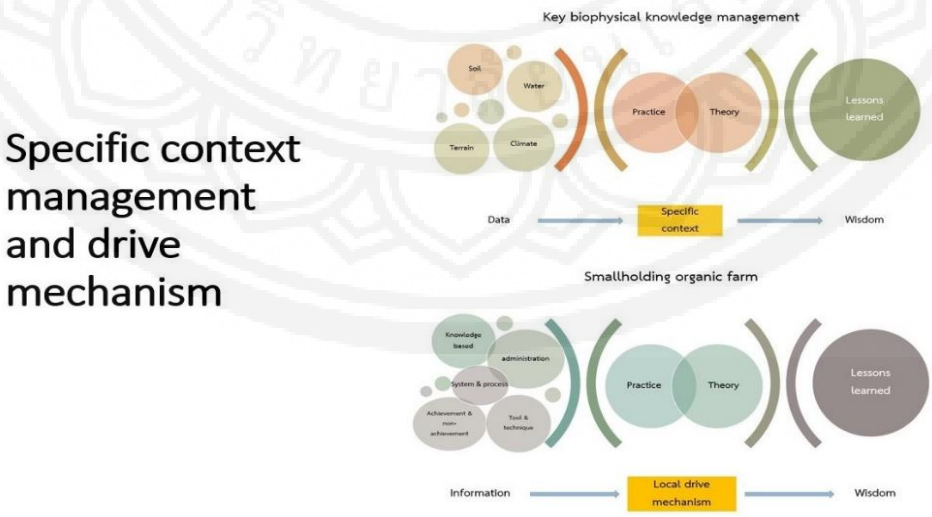

Figure 1 The Combination of Site Physical and Social Actors According to Context.

To close of this discussion, it is cleared that applying set of general technical knowledge not covering the thinking system linkage that related to contexts. This is the procurement of applying farmer knowledge generated from experiences into the practices until it becomes a skill. In which, it is unconsciously procedural, with flexibility and a continuous appearance. Therefore, it differs from the natural sequence of elemental work that usually focuses on before and after or a straight-line relationship that cannot be bypassed. It is from local agricultural culture transfer, farm observation, recollection and organizing information systems, and the development of systemic thinking processes in the manner of an adaptation to daily life and beyond.

The conclusions including the farm's activities and structural relationships overview to reflect the possible KMS and KMP for sustainable food security through these five linkages in a consecutive way by a summary as follows:

1. Local Agricultural Culture. The attitude, perspective, and life goal are influenced by having a two-tier status: family and community member. The local agricultural culture is an understanding of the preparation, a judgment on the selection and production method and system. This includes the harvest, storage, consumption, and distribution. In addition, the ability to access the cultural data of local agriculture led to the creation of a practical organic farm organizing process among them to blend into the theoretical parts to create knowledge, perception, and skills. It amends and re-adjust the attitudes of entrepreneurs and farmers. This makes it possible to new KMS with a more consistent approach into the society needs direction, but it is also subject to a local culture that is still acceptable and has little impact on the routine activities in day-to-day life.

2. Systemic Thinking. The knowledge of the entrepreneurs to run the farm was based on thinking system and was adapted to move in the direction of environment and sustainability. It is from explicit knowledge obtained from informed knowledge according to its conditions and the tacit knowledge derived from the experiences, skills, and abilities of farmers. Thinking systems and management processes are caused by internal and external observation that rely on the succession of prior and after. It will help to emphasize the matter of observing and context understanding from within. An encouragement to adapt or being experimental, learning by mistake, the ability to search and use the information to manage the creation of a farming system and play a part of new changing agent creation. However, in a systematic group, instead of the individualistic untune. This is helping to drive the process from the labor, farm, up to the network. Where the targets are always empowered by sharing and elevating to opportune a higher and wider degree.

3. Working Framework. In the process of defining and regulating the PGS standards. It plays an important part in raising expectations and expertise or moving the lever point of farming management concepts that focus solely on benefits such as self-responsibility, community, network, and society. As a result, the framework is flexible and unrestricted. The development is based on the arrangement of information obtained from documents, notes and words of smallholding farms and brings the integration of knowledge that is available to experience in the specific context of the farms.

4. Driven Mechanism. The systemic thinking process raises development awareness and continual firm action with clear goals. A social process where all the farms work together, both from the farm within and network. It plays an important part in enhancing the motive and strengthening the mechanism. In a systematic manner, the structure of work is characterized by elasticity and informal but flowing. As well as creating standards or requirements that guide the farm level and to web network collaboration to make communication within the organization is concrete and farmers of all educational backgrounds can understand and practices based on consistent theories, in the same direction in the form of PGS certification.

5. Lessons and Goals. The ability to draw knowledge from all work experiences from farms to use among a group and network of organic farms in a similar environment creates a learning process from lessons that connect the memories and experiences. Although there are remote organic areas, but it is possible to recognize the connection. In terms of the connection of promotion and production systems, it is more convenient with core control systems that contain specification of standards, monitoring, and mutual network acceptance. This is an access to all exchanging of inputs, knowledge, experience, and all kinds of producing resources and processed products, i.e., fresh produce, preserved food, a variety of readymade foods with nutritional concerns, as well as access to truly chemical-free food sources to achieve sustainable food security and safety.

Consequently, the study suggests using KMS to guide SOFs for sustainable food security from understanding its new context. Through the process of CGT and a module based on the use of foundation theory, concepts of social development and the findings to explain the KMS called Organizing Specific Chain of Framework represented by the Furling Rib Cage Diagram that imitates the function of the rib cage. (Figure 2)

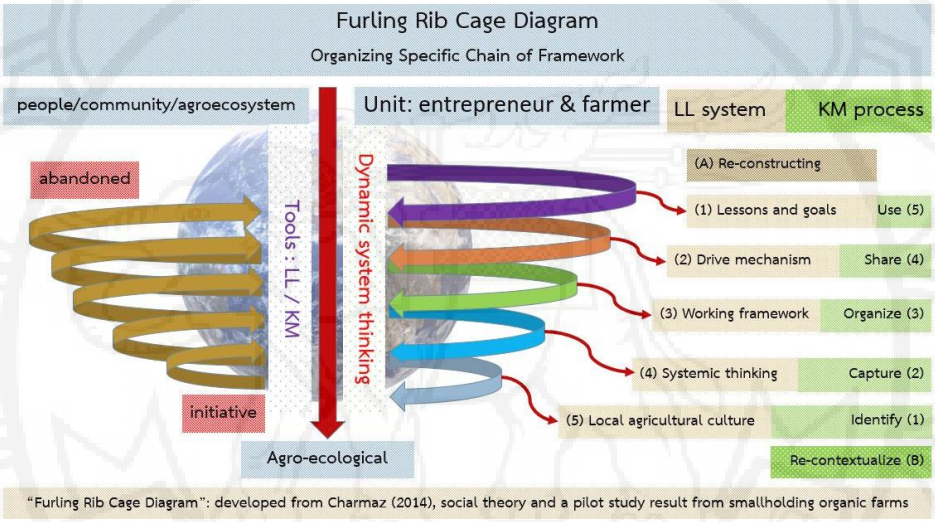

Figure 2 Organizing Specific Chain of Framework.

As explained here. First, (A) to avoid knowledge generalization by recontextualization, Second, to uncover and merge local practices and systemize into scientific methods. The key is to understand the first part of the normal blackout cycle process exist in all realms for retrieving the original knowledge and practice by initiating the abandoned, or the AAR of its LL. Third, the second part (B) of the application is to bridge the gaps. In it, the creation of a thinking system and dynamic thought by assembling the detachment from suitable tool that matches its context. Fourth, to enhance the process of learning from transcribing systems and using local agricultural culture to create an empowering technique by semi-influenced group processes or a systematic creative group-activated approach. This is to create a power of intonation with an international acceptance, or local practices but global standards. Meanwhile, it is under a loose structure that is ready to be reconducted on the attitude and shared needs of the new local organic farming culture. Therefore, the New Local Organic Agricultural Culture appears, using LL and adding KMS to gain knowledge from emerging organic Agro-ecosystems to respond to the relentless changes of ecosystems that are difficult to control. Lastly, to achieve KM for sustainability, it occurs in new structures that lead to changes in outcomes. Although it is still under an unfavorable economy and must adapt to changes conditions.

References

Aha, D. W., & Weber, R. (2000). *Intelligent Lessons Learned Systems: Papers from the AAAI Workshop (Technical Report WS-00-03)*. Menlo Park, California: AAAI Press.

Boonyakit, B., & Prasopsukchokchai, B. (2004). *Knowledge Management from Theory to Practice*. Bangkok: Thailand Productivity Institute (FTPI).

Brown, I., Poggio, L., Gimona, A., & Castellazzi, M. (2011). Climate Change, Drought Risk and Land Capability for Agriculture: Implications for Land Use in Scotland. *Regional Environmental Change*, *11*(3), 503-518. http://doi.org/10.1007/s10113-010-0163-z

Charmaz, K. (2006). *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. Thousand Oaks, California: Sage Publications. Retrieved from http://www.sxf.uevora.pt/wp-content/uploads/2013/03/Charmaz_2006.pdf

Charmaz, K. (2014). *Constructing Grounded Theory* (2nd ed.). London: Sage Publications. Retrieved from https://uk.sagepub.com/en-gb/eur/constructing-grounded-theory/book235960#preview

Creswell, J. W., & Poth, C. N. (2018) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (4th ed.). Thousand Oaks: SAGE Publications.

Davenport, T. H., & Prusak, L. (1998). *Working Knowledge: How Organizations Manage What They Know*. Massachusetts, USA.: Harvard Business Press.

DeGrosky, M. T. (2005). Improving After Action Review (AAR) Practice. In B. W. Butler, & M. E. Alexander (Eds.), *Eighth International Wildland Firefighter Safety Summit: Human Factors-10 Years Later, April 26-28, 2005, Missoula, MT*. Hot Springs, South Dakota: The International Association of Wildland Fire. Retrieved from https://www.nwcg.gov/sites/default/files/wfldp/docs/improving-aar-practice.pdf

Dodge, J., Khanna, R., Irvine, J., Lam, K.-H., Mai, T., Lin, Z., ... Fern, A. (2021). After-Action Review for AI (AAR/AI). *ACM Transactions on Interactive Intelligent Systems (TiiS)*, *11*(3-4), 1-35. https://doi.org/10.1145/3453173

Foken, T. (2008). The Energy Balance Closure Problem: An Overview. *Ecological Applications*, *18*(6), 1351-1367. http://doi.org/10.1890/06-0922.1

Goh, S. C. (2002). Managing Effective Knowledge Transfer: An Integrative Framework and some Practice Implications. *Journal of Knowledge Management*, *6*(1), 23-30. https://doi.org/10.1108/13673270210417664

Horrigan, L., Lawrence, R. S., & Walker, P. (2002). How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture. *Environmental Health Perspectives*, *110*(5), 445-456. http://doi.org/10.1289/ehp.02110445

International Fund for Agricultural Development (IFAD). (2013). *Smallholders, Food Security, and the Environment*. Rome, Italy: International Fund for Agricultural Development. Retrieved from https://www.ifad.org/documents/38714170/39135645/smallholders_report.pdf/133e8903-0204-4e7d-a780-bca847933f2e

Lake, P. S. (2011). *Drought and Aquatic Ecosystems: Effects and Responses*. New York: Wiley-Blackwell Publishing. http://doi.org/10.1002/9781444341812

Melo, F. (2013). The Future of Biodiversity in Tropical Agricultural Landscapes: Ecological Restoration and the Importance of the Matrix. In *Ecological Restoration and Sustainable Agricultural Landscapes, Proceedings of a Symposium held during the III Iberoamerican and Caribbean Conference on Ecological Restoration, Bogotá, Colombia, July 30, 2013* (pp. 12-16). Retrieved from http://elti.fesprojects.net/Proceedings/2013_agrilandscapes.pdf

Mollison, B. C. (1988). *Permaculture: A Designer's Manual*. Tyalgum, Australia: Tagari Publications.

Prusak, L. (1999). Action Review of Knowledge Management: Report and Recommendations. *World Bank*. Retrieved from http://web.worldbank.org/archive/website01006/WEB/IMAGES/ACTIONRE.DOC

Raungpaka, V., & Savetpanuvong, P. (2017). Information Orientation of Small-Scale Farmers' Community Enterprises in Northern Thailand. *Kasetsart Journal of Social Sciences*, *38*(3), 196-203. https://doi.org/10.1016/j.kjss.2016.08.018

Schindler, F. V., Mercer, E. J., & Rice, J. A. (2007). Chemical Characteristics of Glomalin-Related Soil Protein (GRSP) Extracted from Soils of Varying Organic Matter Content. *Soil Biology and Biochemistry*, *39*(1), 320-329. https://doi.org/10.1016/j.soilbio.2006.08.017

Secchi, P. (Ed.). (1999). *Proceedings of Alerts and Lessons Learned: An Effective Way to Prevent Failures and Problems (Technical Report WPP-167)*. Noordwijk, The Netherlands: ESTEC.

Senge, P. M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday/Currency.

Sirasoonthorn, P. (2013). *Concept, Theory, and Technique for Social Development Practice*. Bangkok: Chulalongkorn University Press.

Sirasoonthorn, P. (2015). *Knowledge, Power and Health: From Theory to Practice*. Bangkok: Chulalongkorn University Press.

Sutrisna, M., & Barrett, P. (2007). Applying Rich Picture Diagrams to Model Case Studies of Construction Projects. *Engineering, Construction and Architectural Management*, *14*(2), 164-179. https://doi.org/10.1108/09699980710731281

Warner, K. D. (2008). Agroecology as Participatory Science: Emerging Alternatives to Technology Transfer Extension Practice. *Science, Technology, & Human Values*, *33*(6), 754-777. http://doi.org/10.1177/0162243907309851

Warren, D. L., Glor, R. E., & Turelli, M. (2008). Environmental Niche Equivalency Versus Conservatism: Quantitative Approaches to Niche Evolution. *Evolution: International Journal of Organic Evolution*, *62*(11), 2868-2883. http://doi.org/10.1111/j.1558-5646.2008.00482.x

Weber, R., Aha, D. W., & Becerra-Fernandez, I. (2001). Intelligent Lessons Learned Systems. *Expert Systems with Applications*, *20*(1), 17-34. https://doi.org/10.1016/S0957-4174(00)00046-4

Whitmore, J. S. (2000). Drought Management on Farmland. In V. P. Singh (Ed.), *Water Science and Technology Library, Volume 35*. Dordrecht, The Netherlands: Kluwer Academic Publishers. Retrieved from https://link.springer.com/book/10.1007/978-94-015-9562-9#toc

Wu, J. (2013). Landscape Sustainability Science: Ecosystem Services and Human Well-being in Changing Landscapes. *Landscape Ecology*, *28*(6), 999-1023. http://doi.org/10.1007/s10980-013-9894-9

Wuelser, G., & Pohl, C. (2016). How Researchers Frame Scientific Contributions to Sustainable Development: A Typology Based on Grounded Theory. *Sustainability Science*, *11*(5), 789-800. http://doi.org/10.1007/s11625-016-0363-7

Zack, M. H. (1999). Developing a Knowledge Strategy. *California Management Review*, *41*(3), 125-145. https://doi.org/10.2307/41166000

Zweifel, R., Steppe, K., & Sterck, F. J. (2007). Stomatal Regulation by Microclimate and Tree Water Relations: Interpreting Ecophysiological Field Data with a Hydraulic Plant Model. *Journal of Experimental Botany*, *58*(8), 2113-2131. https://doi.org/10.1093/jxb/erm050