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Research Article

Knowledge management of pomelo production system in Northeast Thailand: A case study of the pomelo farmer group in Ban Thaen district

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Abstract: In Thailand pomelo is a fruit tree that has long been grown in the central region particularly in Nakhon Chai Si district, Nakhon Pathom province where soil is relatively fertile and has conditions of sufficient water resources. In contrast, the northeast region has lower soil fertility. Most farmers grow field crops such as rice, cassava and sugarcane instead of fruit trees. However, there is one area in northeast Thailand that is famous for pomelo production in terms of quantity as well as quality for both export and local markets. This area is in Ban Thaen district, Chaiyaphum province. The research objectives of this study is to describe the context of Ban Thaen pomelo farmer group, examine different approaches and understand knowledge management processes of pomelo production. Five key informants groups were selected for the study, consisting of a group leader and group committee members identified for group discussions in order to understand the community context and factors of pomelo production of their group. A total of 17 households were selected for in-depth interviews along with participation observation among some households. Findings show that knowledge management on pomelo production in Ban Thaen is vital for their innovation and practices to increase production volume and quality. This is accomplished through knowledge sharing. Knowledge sharing is possible through existing social spaces in various forms.

Keywords: Knowledge management; Thailand; pomelo production system; farmer group

1. Introduction

The International Board for Plant Genetic Resources (IBPGR) postulated that areas in the region of southern Thailand stretching to northern Malaysia have the highest diversity of pomelo species and are most likely to be the center of pomelo origin. Pomelo is grown in many Asian countries including China, Japan, India, Fiji, Malaysia, Vietnam and Thailand. It is also grown in the Caribbean and the United States (California and Florida). Pomelo distribution is most prominent however, across Thailand, Malaysia and other Southeast Asian countries (Hai, 2014).

In Thailand, pomelo is a commercial fruit produced for both local consumption and the export market. Pomelo is a less perishable fruit and therefore can be kept for a long time for long distant transport. Meanwhile, growing trends of international market have also increased demand, especially in China, Hong Kong, and Cambodia.

Between 2013-2015, the area of pomelo production in Thailand decreased from 179,070 rai (6.25 rai = 1 ha) to 45,640 rai, while production volume increased at an average of 1.3 tons to 2.5 tons per rai. During the same period, fresh export volume of pomelo increased from 11,270 tons to 12,179 tons (Office of Agricultural Economic, 2015). Pomelo is grown in all regions in Thailand. In 2012, 37% of pomelo production area in Thailand was located in the central region, particularly in Nakhon Chai Si district, Nakhon Pathom province (Angyurikul and Taksinavisut, 2007). In the same year, the northern region produced 21.1% (Angyurikul and Phasuk, 2007).

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Pomelo production in Northeast Thailand (NET) has been more limited in terms of area and number of farms because of frequent drought and poor soil fertility. In 2013 the total of pomelo production in the NET region reached no more than 10,000 rai. The NET provinces that produce pomelo are Nakon Ratchasrima, Burirum, Sri Saket, Mukdahan, Ubon Ratchathani, Bueng Kan, Nong Kai, Loei, Udon Thani, Sakon Nakon, Khon Kaen and Chaiyaphum. However, pomelo production area of NET 43% was produce in Ban Thaen district, Chaiyaphum province (Athipanyakul and Chancharat, 2014; Office of Agricultural Economic, 2015).

Field observation and discussion with pomelo farmers of Ban Thaen district indicate that farmer groups are prominent in effectively transforming pomelo production for the region, through a process of developing marketing knowledge and skills from what they learned about pomelo production in the central part of Thailand and transferring it to their communities. Although pomelo production is considered a recently introduced fruit crop, this paper focuses on how farmer groups were able to manage pomelo production for successful marketing and economic viability.

2. Pomelo production in Thailand

Thailand is a large producer of fruit for export. This includes specialty fruits such as longan, durian, mangosteen, lychee, mango, rambutan and pomelo. Thai tropical fruits are divided into two groups. The first group are those that have great potential for both local and export markets. Pomelo is included in this group. The second group is for domestic markets (Vichitrananda and Somsri, 2013). In 2010 Thailand was a major producer of a variety of high quality pomelo to serve consumer demand for both domestic and export markets. However, pomelo export from Thailand constituted only 4% of the total production (Office of Agricultural Economic, 2015), although Athipanyakul and Chancharat (2014) reported that Thailand is a major global producer and exporter of pomelo to China, Hong Kong, Canada, Singapore, Vietnam, Myanmar, Cambodia and the Netherlands. During 2011-2013, volume and value of pomelo exported to China was approximately 6.5 million tons, valued at 98.5 million baht. Exports to Hong Kong amounted to approximately 4.6 million tons, with a value of 36.2 million baht.

The Office of Agricultural Economics (2015) concluded that pomelo cultivation area had increased from 28,898.2 hectares to 32,499.6 hectares during the period 2003-2009, alongside production increases of 7,313 tons to 11,218 tons during 2004-2008. These increases are directly related to increasing international market trends.

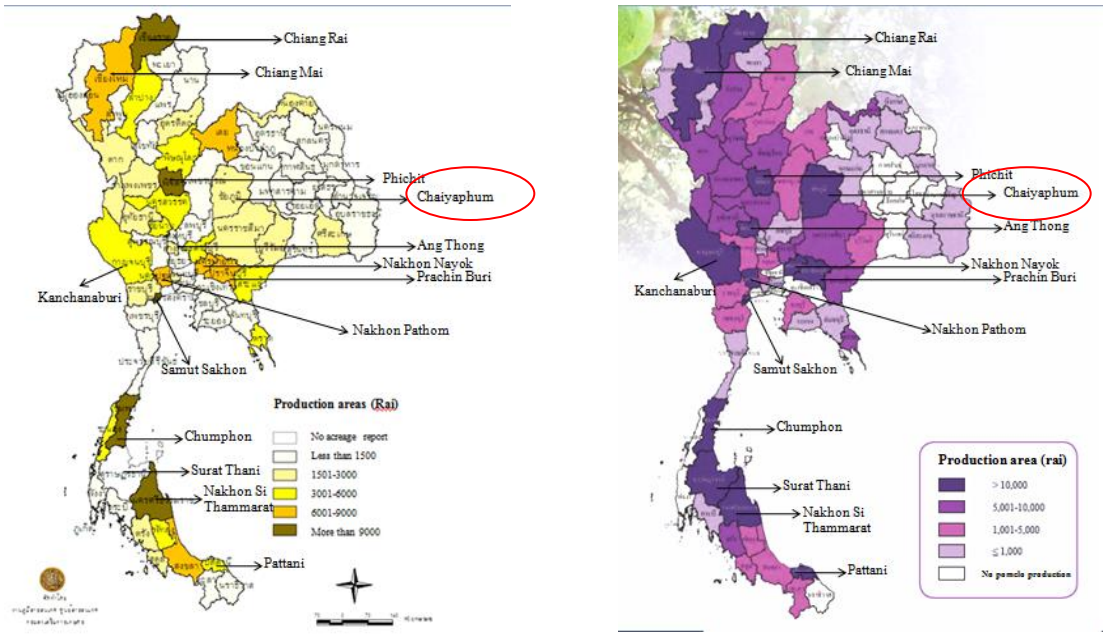
2.1. Thailand pomelo production by regions

During 2000-2007 pomelo production area in the northern region was about 20% of the total production area of the whole country and about 60% of the pomelo growers relied only on pomelo as their major crop (Angyurikul and Phasuk, 2007). The upper northern region is an important pomelo production area of the country particularly in Chiang Rai, Chiang Mai and Lam Pang provinces but most the fruits are for domestic consumption only. Because its quality could not meet export standard such as color, blemish, tastes and physical disorders. On the other hand, pomelo production in the central region of Thailand, Nakhon Pathom, and Samut Songkhram provinces is more suitable for export in terms of variety and quality (Santasup et al., 2008). The production area in this region accounted for 37.2% of total pomelo production area in Thailand. About 60.3 % of these growers depend on pomelo as their major crop (Angyurikul and Taksinavisut, 2007; Santasup et al., 2008).

In 2009 pomelo production area in the southern region accounted to 56.2 % of all pomelo production area in Thailand, the main production area was in Chumphon, Surat Thani, Nakhon Si Thammarat and Songkhla. However, pomelo production in this region is considered as a commercial crop with an average orchard size of 0.8 hectares. About 21% of the growers grew pomelo with others fruit trees as a part for their integrated farming systems (Tantong et al., 2009). Pomelo price

in this region depends heavily on the role of middlemen to specify or negotiate with farmers. In addition, trading among farmers and middlemen was paid fully in cash for the pomelo product. Payment installments were made to farmers by middlemen amounting to 60% of pomelo price, whichl the remaining 40% would be paid 2-3 days later. However, pomelo farmers sold the products separately and thus their bargaining power is weak (Tantong et al., 2009).

In 2013 the total area of pomelo production in the NET region covered twelve provinces, Nakon Ratchasrima, Burirum, Sri Saket, Mukdahan, Ubon Ratchathani, Bueng Kan, Nong Kai, Loei, Udon Thani, Sakon Nakon, Khon Kaen and Chaiyaphum. Pomelo production in this region is relatively small because of frequent drought and poor soil fertility (Athipanyakul and Chancharat, 2014). However, the Office of Agricultural Economics (2013) indicated that during 2003-2013 pomelo production area of the region increased, as shown in Figure 1. However, the large production area in NET amounted to more than 1,600 hectares in Chaiyaphum province.



a. pomelo production area in 2003 b. pomelo production area in 2013

Figure 1. Map indicating comparable pomelo production area spread in Thailand for the periods 2003 and 2013

3. Methods

This research was designed to examine the knowledge management model of pomelo farmer groups in Ban Thaen sub district. Secondary data was collected and analyzed along with primary data, which were collected by group discussion, in-depth interview, and participant observation.

3.1. Research site

Ban Thaen sub district was purposively selected because there is only one pomelo farmer group in the NET region that has successfully been able to manage pomelo production. In 2015 Ban Thaen sub-district had 2,278 households (Ban Thaen Sub-district Administrative Organization, 2015), and more than half of these households were farmers that earned more income from pomelo production than any other agricultural activities (District Agricultural Extension officer interview). According to preliminary field visits (on 22 August 2014, and 26-27 June 2015) pomelo farmer groups

in Ban Thaen district applied knowledge on pomelo production that they obtained by learning from farmers in Nakon Pathom province where pomelo production has been well established.

3.2. Data collection

Secondary data related to pomelo production area were collected from Chaiyaphum Provincial Agricultural Extension Office, Ban Thaen District Agricultural Extension Office, and from pomelo farmer groups. Village characteristics and general information of the pomelo farmer groups were collected from village reports that were supplemented by interviewing group members and an officer of the Cooperative Promotion Department of Chaiyaphum.

Primary field data collections were carried out through group discussions, in-depth interviews and participant observation. “Group discussion” was conducted to collect data on history of pomelo production in Ban Thaen as well as the organization of farmer group management. Purposive sampling techniques were also applied to identify key informants from a set of criteria (Borisutdhi, 2015). Five key informants (KIs) - five members of pomelo farmer group committees were selected based on more than 10-years of experience in growing pomelo (one female and four males). Group discussions were conducted with group leaders and committee members (5 persons) in order to obtain information from sub-topics related to pomelo production management, sale and export, networks and group activities, members’ collaboration and knowledge management on pomelo production. “In-depth interview” was used for data collection at the individual household level. Seventeen out of 47 pomelo farmer households were selected. Sub-topics for in-depth interviews included major issues such as pattern of pomelo plots, irrigation systems, plot maintenance, grading, group activities, sources of knowledge, and skills. “Participant observations” were used in some activities during the household interviews with the farmers, especially in attending regular meeting and the pomelo fair.

4. Results and discussion

4.1. Community characteristics

Ban Thaen sub-district is one of five sub-districts and has a population of 8,445 consisting of 2,278 households (Ban Thaen Sub-district Administrative Organization, 2015). Most of the residents are primarily rice farmers.

Figure 2. Map indicating Ban Thaen district, Chaiyaphum province

4.2. Topography and land use of Ban Thaen district

Ban Thaen district is a plains area with 240 meters elevation above mean sea level located close to a low mountain range. Phu Meng is in the eastern part and Phu Taphao is located along the

northeastern border (Figure 2). Farmers in this village use their land according to land topography, managing land uses as paddy field, sugarcane fields, and pomelo production (see Figure 3).

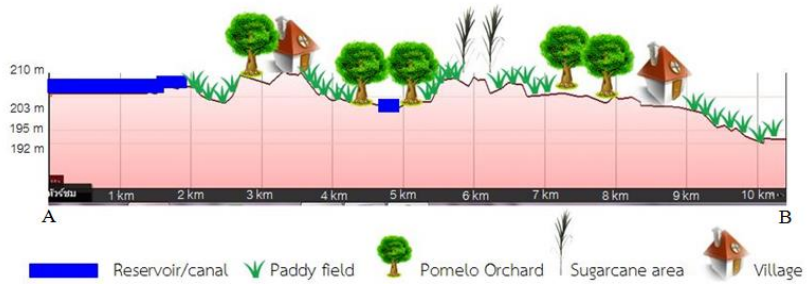


Figure 3. Transect map A (Northeast) – B (Southwest) indicating land use of Ban Thaen district, Chaiyaphum province

This sub-district has an abundance of natural and man-made water resources. Natural water sources included the canal or stream systems that include Nongbuksu, Lam Namchern, Lam Huay Matai, and Lam Nam Prom. Man-made water reservoirs include Nong Khuyai, Nong Bueng, Nongdone, Ban Phet and other connecting elements of the irrigation system. Ban Phet reservoir is in Phu Khaew district, about 2 km from the study area, and is a main water resource for agriculture, especially for pomelo production (Figure 4).

Figure 4. Map indicating Ban Phet reservoir at Ban Phet sub-district, Phu Kheaw district, Chaiyaphum province

Paddy occupies 8,241.4 hectares (58.7% of total agricultural land use area), sugarcane 5,506 hectares (39.3%), rubber 161.7 hectares (1.2%), chili 35.4 hectares (0.3%) and pomelo 75.4 hectares (0.5%) (see Figure 4) (District Agricultural Extension Office, 2014). However, during in-depth interviews with farmers, we discovered that about 50% of the households in this sub-district grow pomelo on their farm land.

From these in-depth interviews, we found that paddy is the major crop. It can be grown twice

a year because of the availability of irrigation systems. Sugarcane and chili are grown as perennial crops while pomelo is a long-term crop. The cropping calendar is shown in Figure 5.

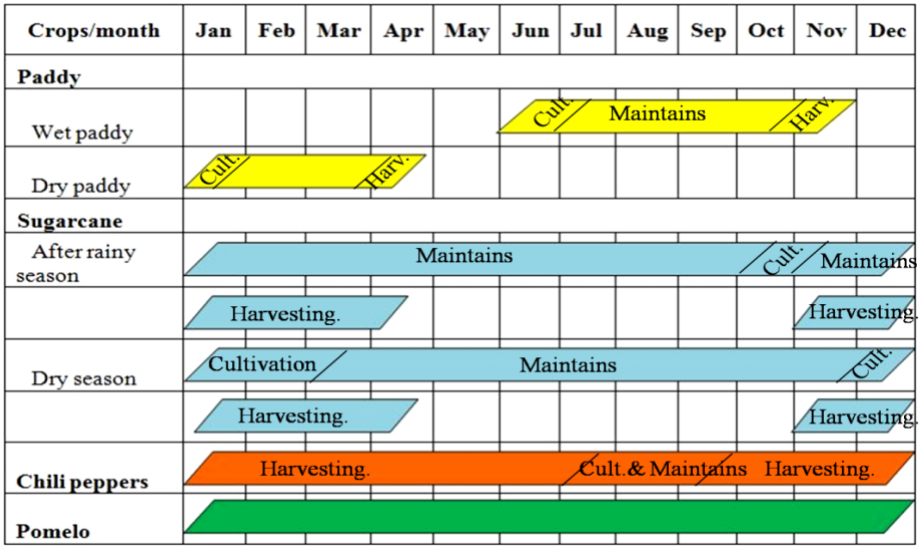


Figure 5. Cropping calendar of farmers in Ban Thaen, Chaiyaphum

4.2. Development of pomelo production system in Ban Thaen

4.2.1 History of pomelo production in Ban Thaen

According to group discussions, pomelo production in Ban Thaen district began by group leaders who noticed that – during experiences helping relatives sell mangoes at Mahanark market in Bangkok in 1987 – mango fruits could not be kept for more than 3 days before rotting. Meanwhile, they also discovered a market product (pomelo) that could last much longer and maintain good quality.

This information believed that irrigation in his home area could enable them to imitate the system of pomelo production as in Nakhon Chai Si (in the central part of Thailand). Thereafter, he tried to get more information about pomelo production from a pomelo trader in Nakon Pathom province and visited pomelo farmers in Nakon Chaisri where pomelo quality is well known in the country. Therefore, he brought pomelo stock of an easier marketing variety (Thongdi) from Nakhon Pathom province to be grown in Ban Thaen district.

4.2.2 Trial and error

- Pomelo plot management

Initially the group leader followed land, water and pomelo tree management according to the practices done by farmers in Nakon Chaisri. After a series of successful harvests, other farmers began to follow his lead, and subsequently a pomelo farmer group was formed.

The group leader imitated patterns of pomelo planting from Nakon Pathom province in 1987, which included a single row planting technique along irrigation water ditches, and three or four farmers (his relatives) followed him. After seven years, the leader and members observed pomelo yellowing and a series of symptom, such as pre-matured fruit falling from the tree. They concluded that this was due to the roots of the pomelo trees that were often over-saturated with water. With this pattern they also observed that the timing of transport of harvested fruits from their plots to

their houses was difficult. Observations from visiting other fruit tree orchards also indicated that the idea of double row planting had also been recommended and put into action. They found out that double row patterns are easier to maintain and support ease of transport of pomelo fruits out of the orchards when compared to the single row. Recently, two pomelo farmers also experimented by designing their pomelo orchards in a big plot without water ditch irrigation. This idea emerged from farmers who used to grow tangerine citrus trees. Each pomelo plot pattern is shown in Figure 6. They learned from each trial of the plot designed through their regular conversations amongst one another through their consistent group meetings, which helped to accumulate more and more knowledge over time. During their regular conversations and group meetings, knowledge related to production technique, marketing, benefits and group management were shared and put into practice. However most of this knowledge took place in tacit form. Therefore, their learning process is still based on trial and error and oral conversations. However, some record keeping (explicit knowledge) were observed.

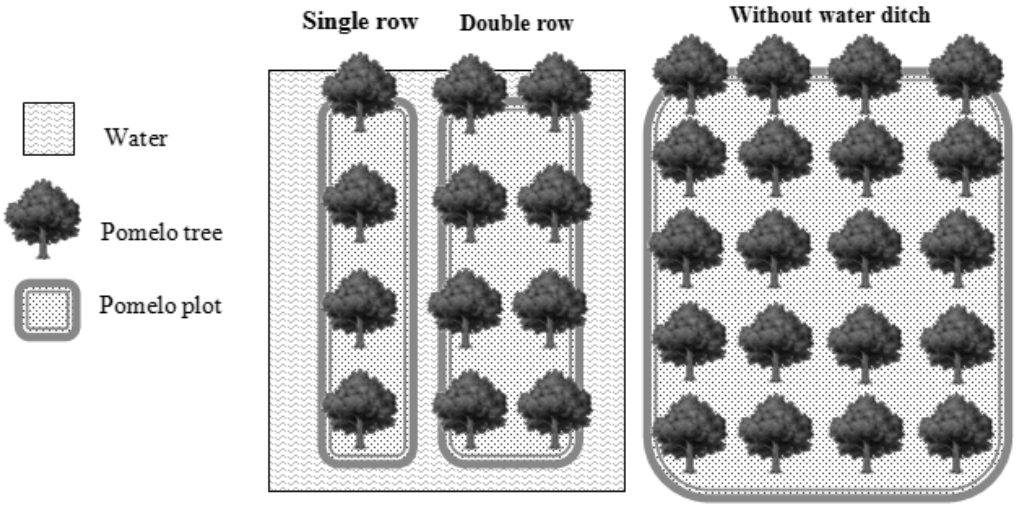


Figure 6. Pomelo plot patterns were developed by pomelo farmer group in Ban Thaen

- Learning on irrigation technique

Initially they irrigated their pomelo plots by small pumps operated by a small boat driven along the irrigation ditch, a practice reproduced from what they learned in Nakhon Chai Si (Figure 7). Over time they discovered that it took a long time to operate this method, which limited their opportunities to perform other household activities. Moreover, they also experienced soil loss using this method from erosion into the irrigation ditch, which in turn also limited the boat's movements. After visiting other pomelo and non-pomelo farms they learned about a sprinkle irrigation system. During different visits, they shared knowledge with the host farmers. They also transferred this knowledge to their members during regular meetings. Then they gradually applied more sprinkle irrigation systems to some of their plots over the past ten years. They expected that all pomelo farmers would begin changing to the sprinkle irrigation system. This system saves time and reduces the complications from soil erosion. Therefore, there are clear transformations of plot design and irrigation system methods from the lessons that farmer groups actively sought from elsewhere. It should also be noted that the transfer of technology and knowledge described in this study are mostly done without extension worker involvement.

- Learning from plot maintenance

When they observed yellow leaves symptom and applied chemical spray they also learned that

such an intervention was not effective. As a result, they stopped using chemical spray but instead introduced a pruning method. When they observed fungus on the pomelo tree stubs because of a lack of sunlight in areas that could not reach the stubs and the plot floor, they began to prune pomelo tree branches to stop the fungus from spreading. They also solved a fruit fly problem by learning from the internet and consulting with local agricultural inputs sellers and resorted to using non-chemical treatment by applying a Methyl Eugenal solution using a plastic bottle for spraying. They were successful in controlling leave borers by observing the timing of the leave borer invasion and spraying chemical controls before its seasonal spreading period. They also learned how to make organic fertilizers from government officers in the department of Agricultural Extension.

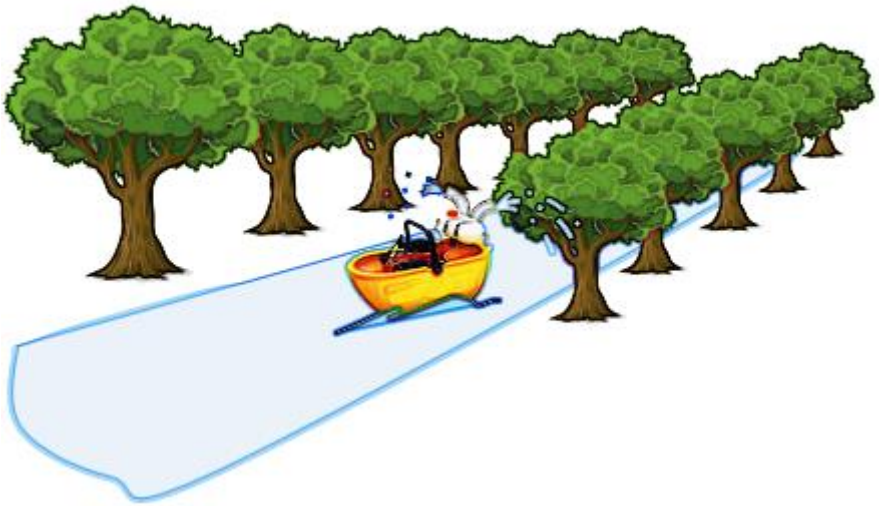


Figure 7. Small pump in a small boat driven along irrigation ditch

From the above information, it can be concluded that this group of farmers have developed various sources of knowledge. Their learning is mostly confined to tacit knowledge through communication amongst themselves through a process of trial and error. Therefore, knowledge sharing in regular meetings of the group is important to their learning. During the meetings, tacit knowledge is exchanged and then applied as practice. On the other hand, living in the same community allowed individual members to easily convene to exchange tacit knowledge through word-of-mouth and other more formal venues like their regular meeting.

4.3. Patterns of knowledge sharing of pomelo farmer group in Ban Thaen

Pomelo production in Ban Thaen first expanded from one pioneer group leader to a network of his relatives and others. They learned from his initial field plot as household laborers and then expanded to their own implementation systems. Other farmers learned to increase their income through pomelo growing by consulting with the group leader or his relatives. Meanwhile, the knowledge was also transferred to other farmers by learning from one another. We have therefore categorized four patterns of knowledge sharing that can be classified visually in Figure 8.

During this process, tacit knowledge is iteratively learned in a cyclical fashion as an “outside-in” process from someone to a receiver and as an “inside-out” process from one who knows to others that have interest in acquiring the information. This could happen in different places in various ways, such as on the way home, at the local temple, or in more formal setting such as the farmer group meetings. The advantage in this rural community is that the social space is conducive for knowledge sharing and problem solving because they live close to each other and communicated in a process of mutual trust. Furthermore, they can easily observe skills and practices amongst one

another because the learning sites (member's farms) are always there. This makes for a situation of fast spreading knowledge of pomelo production in this area. Moreover, we have also shown several instances where group members actively sought knowledge by visiting farms outside their community to learn new techniques and interventions. It is worth noting that some of these farmers also learned from more formal materials such as books, the internet, and seeking out counsel from local agricultural traders. Their cycle of learning can be stated as *tacit knowledge to tacit knowledge* by person to person and person to group or group to person which led to application and recording *(explicit knowledge).* This is in accordance with that of Nonaka and Takeuchi (1995) and Talisayon (2007) on the learning process. However, explicit knowledge practice is limited in this group.

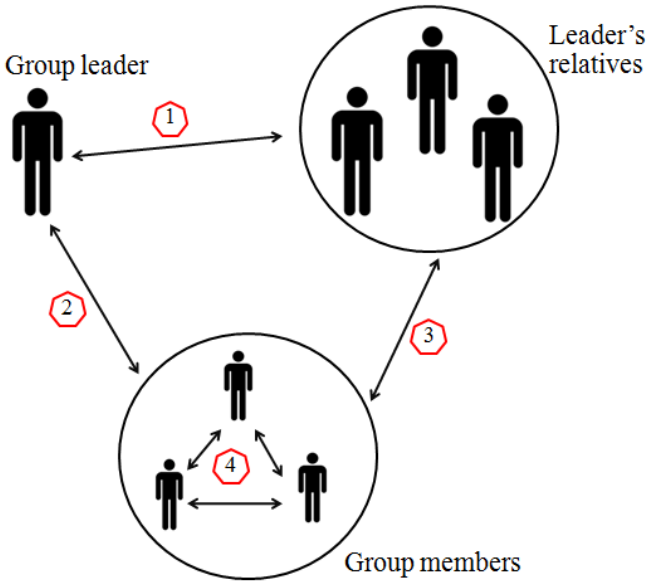


Figure 8. Knowledge sharing patterns of pomelo farmer group

Pattern 1 Relatives learn from the group leader (pioneer as household laborers)
Pattern 2 Others farmers learn from the group leader directly
Pattern 3 Other farmers learn from leader's relatives
Pattern 4 Other farmers learn among themselves and then consult the leader

4.4. Knowledge management model of the pomelo farmer group in term of pomelo production

According to the above findings, knowledge management of this pomelo farmer group can function as a concrete model as shown in Figure 9. Knowledge management of pomelo production of the farmer group is under the concept of knowledge flow of a pattern of both "outside-in" and "inside-out". Knowledge began by flowing from outside the village, which was subsequently applied within the village. Then the old and new knowledge is fused to create new knowledge after application trials and information flows between members of the group within the village. The knowledge flow through sharing within the group whether from person to person or group meeting is possible because of readily available social spaces managed by the group. Even though most of the knowledge is managed within the group, management of the knowledge from outside is also critical.

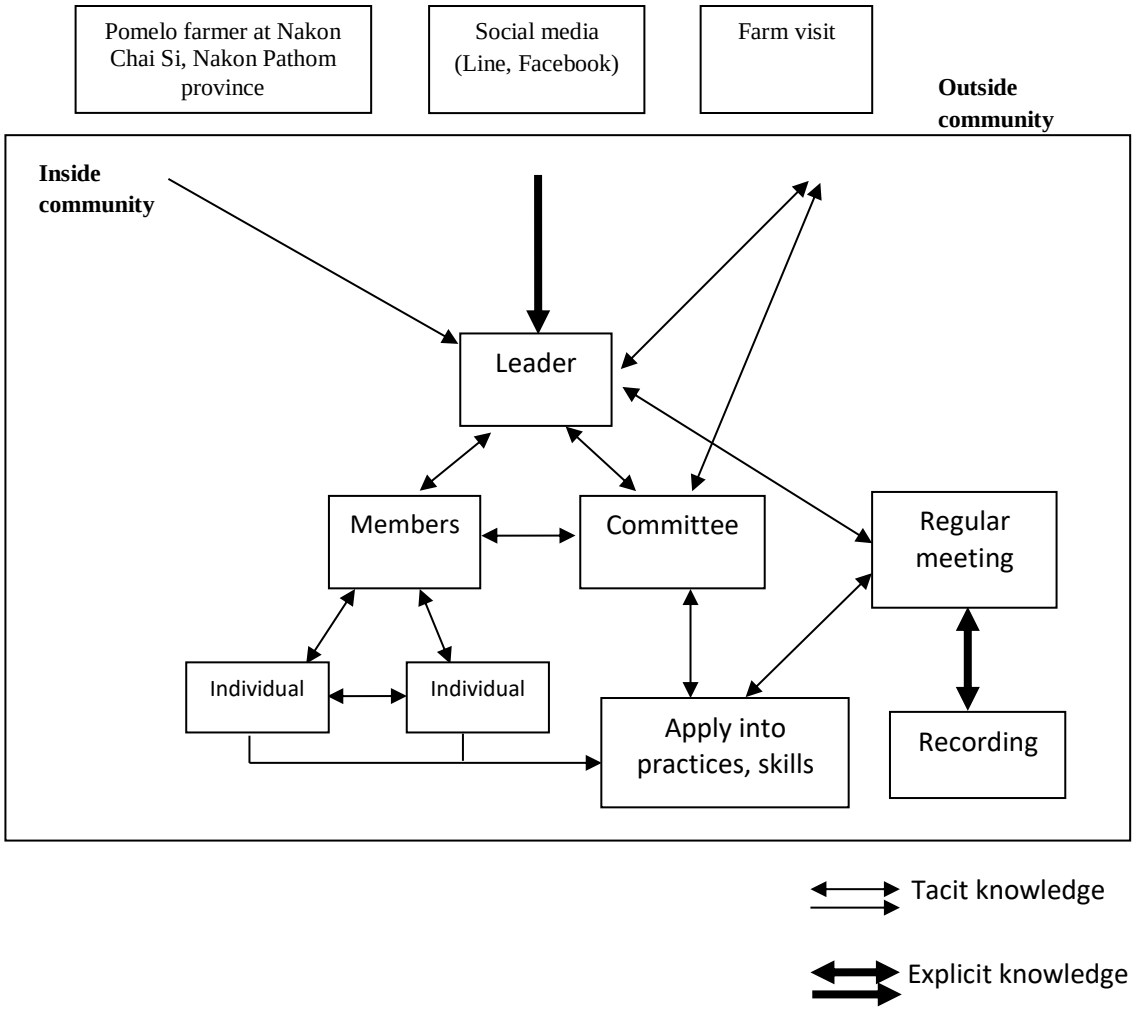


Figure 9. Knowledge management model indicating flow of tacit and explicit knowledge of pomelo farmer

5. Conclusion

Knowledge management on pomelo production by the farmer group in the study site is vital for their innovation and practices to increase production and quality. Over time they have successfully developed a vibrant and economically viable pomelo production system. They are able to produce pomelo fruits for both the local and international market. This is accomplished through knowledge sharing. Knowledge sharing is possible through existing social spaces that take place in various forms such as conversations between individuals, regular group meetings, discussions with other farmers during farm visits within and outside their village. Frequent social interactions across spaces also occurred easily within this community. Tacit knowledge is transferred and applied leading to skills development and a reflexive process for production improvements. However, the transference of tacit knowledge to explicit knowledge is limited except some record keeping efforts that took place among the group. Outside community knowledge is also important at the early stage and was again incorporated later on when the groups believed they needed new ideas to address challenges, such as in their irrigation management systems. Outside knowledge is also critical to shift their way of thinking. As a community organization with various members, they may not realize that their organization is successful because of knowledge management, but as a concept, thinking

in terms of knowledge management helps to better understand how their production systems were able to succeed over time. We have shown that what have they carried out in terms of knowledge management is consistent with other studies expressed by Nonaka et al. (2006) and Nonaka and Takeuchi (1995).

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