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Knowledge Sharing of Farmers' Adaptation Strategies on Climate Stresses in Benguet, Philippines

ABSTRACT

This study analyzed the knowledge sharing of adaptation strategies to climate stresses among selected upland farmers in Benguet, Philippines. Mixed method research design was employed, and survey questionnaire and in-depth interviews were used in gathering responses. Fifty-three farmers served as survey respondents in the study while selected individuals from the agriculture sector served as key informants. The four climate stresses identified were: frost, strong typhoons, drought and hail. All of the adaptation strategies for the four climate stresses were categorized based on water management, nutrient management, and pest and diseases management for specific crops. Descriptive statistics and UCINET software were used to analyze knowledge sharing flow. Results showed that knowledge sharing dynamics of farmers were limited to the people they know and trust, and dependent on expected reciprocal exchanges. The results reveal the need for strategies to enhance knowledge dissemination in dispersed, upland areas, given the restricted knowledge sharing behaviour revealed in these findings.

Keywords: *knowledge sharing, adaptation strategies, climate stresses*

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INTRODUCTION

There is a growing interest in the need to understand knowledge acquisition and sharing among farmers as they grapple with new technological improvement, complex farm systems and more problematic environmental stresses. Upland agricultural farmers are vulnerable to various climatic stresses. *Fadina and Barjolle* (*2018*) explained that adaptation to climate change is a process that needs farmers to perceive that the climate has changed and then identify what appropriate adaptations to be implemented. Adaptation strategies among farmers are needed to address the impacts of the situation. *Tabbo* (*2016*) observed that farmers maximize their utility when they decide to choose one strategy as the best and another as the worst to adapt against the negative effect of climate change. The adaptation strategies shared among farmers within the family or within the community is described as knowledge sharing. It is a process of exchanging knowledge (skills, experience and understanding) (*Tsui 2016*) among farmers. It occurs when people are genuinely interested in helping one another, learn new processes and develop new capacities for action.

In terms of organization, knowledge sharing is basically the act of making knowledge available to others within an organization. Knowledge sharing is the process by which knowledge held by an individual is converted into a form that can be understood, absorbed, and used by other individuals. It also implies that the sender does not relinquish ownership of the knowledge but instead results to a joint ownership of the knowledge between the sender and the recipient (*Ipe 2003*) There were also instances where some researchers use the word knowledge sharing and knowledge transfer interchangeably (*Gangeswari et al. 2016*). However, *Hendricks* (*1999*) explained knowledge sharing that requires "relationship between at least two parties - one that possesses the knowledge and the other that acquires the knowledge." Compared with knowledge transfer, *Wang and Noe* (*2010*) primarily describe it as a movement of the knowledge between larger entities within organizations, department, divisions. Four factors influence knowledge sharing between individuals in the organizations. These are: the nature of knowledge, motivation to share, opportunities to share, and culture of the work environment.

The nature of the knowledge has something to do with knowledge sharing. The tacit knowledge refer to as the know-how that is acquired through personal experiences is not easily codifiable and cannot be communicated or used without the individual who is the "knower." On the other hand, explicit knowledge can be easily codified, stored, and transferred across time and space

independent of the individuals. It is easier to disseminate and communicate. This kind of knowledge has a natural advantage over tacit knowledge in terms of its ability to be shared, it is relatively easily transferred across individual and settings (*Hendricks 1999*).

The value of knowledge has influenced the nature of knowledge either it be explicit or tacit. One factor that influence knowledge sharing is when individuals perceive the knowledge they possess as a valuable commodity, which leads to a process of contemplating about the knowledge to share, when to share and who to share it with (*Andrews and Delahaye 2000*). In addition, people share knowledge based on a strong personal motivation. The motivational factors to share knowledge are influenced by internal and external factors. Internal factors are perceived factors attached to the knowledge and the reciprocity that result from sharing while external factors include relationship with the recipient and rewards for sharing (*Andrews and Delahaye 2000*). This statement was supported with *Jambo et a.l.* (*2019*) study that explained it will be effortless for the farmers to difuse information if they feel connected with the other farmers.

Another factor is the presence of opportunities to share. These can either be formal and informal in nature. The formal opportunities are referred to as training programs, structured work teams, and technology-based system that facilitate the sharing of knowledge. On the other hand, informal opportunities are referred to as personal relationships and social networks that facilitate learning and the sharing of knowledge.

Lastly, culture and the environment influence knowledge sharing. Knowledge sharing recognizes the personal nature of people's knowledge gained from experience (*Awad and Hassan 2004*). This experience is usually based on one's culture. *Macionis* (*2005*) defined culture as the values, belief, behavior, and material objects that together form people's way of life. Culture is reflected on the values, norms and practices of the organization, where values are manifested in norms that in turn, shape specific practices. In the study of *Harvey* (*2018*), it was also observed that farmers also faced problems on the issue of climate change or climate stresses that affects their produce. The experience they had can build support for mitigation and adaptation measures while the events remain fresh in people's minds (*Spence et al. 2011*).

While there were studies about the climate stresses experienced by farmers in Benguet and their adaptation practices (*Calora et al. 2011 and Ngoyahon et al. 2011*), there were no studies regarding knowledge sharing of adaptation practices. In Benguet, the vegetable and cut flower farming employs more than half of its population (*Reyes, et al. 2017*). As a major vegetable producer, it is important that farmers are constantly updated with knowledge and skills on how to adapt to climate stresses given that the major source of income come from vegetable production. It is along this line that the study sought to discuss the adaptation strategies to climate stresses and understand the knowledge sharing practices of farmers.

Hence, this study analyzed the dynamics of knowledge sharing of adaptation strategies among upland vegetable farmers in Atok, Benguet, Philippines. It specifically aimed to: describe the socio-demographic characteristics of the respondents; enumerate the stresses experienced and the adaptation strategies used; and analyze the knowledge sharing flow of adaptation strategies among respondents and their motivations and opportunities in sharing their adaptation strategies.

MATERIALS AND METHODS

The study was conducted in Atok, Benguet, Philippines. It is geographically situated in the central portion of Benguet Province. It is 50 km north of Baguio City and 360 km north of Manila. It is bordered on the west by Kapangan, on the south by Tublay, on the north by Kibugan-Buiguias, and on the east by Kabayan and. Bokod (**Figure 1**). It has a total land area of 21,912.1863 ha. It has an elevation of 2,400 m above sea level. Its terrain is mountainous with slopes ranging from 40-60°. All the municipalities of Benguet are vegetable producers. Atok has eight barangays comprising of Abiang, Calikling, Catubo, Naguey, Paoay, Pasdong, Poblacion, and Topdac.

Atok is considered as one of the leading producers of vegetables and cutflowers in the country (*Reyes et al. 2017*). Two organizations who are into vegetable production were included respondents. The specific vegetables, which the respondents produced are carrots, chinese cabbage, potatoes and cabbage.

The study employed mixed methods research to analyze the knowledge sharing of adaptation strategies to climate stresses among upland farmers. *Schoonenboom and Johnson* (*2017*) defined mixed methods research design as a type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches in all aspects of the scientific process. This combination ensures that the objectives are achieved with depth of understanding and

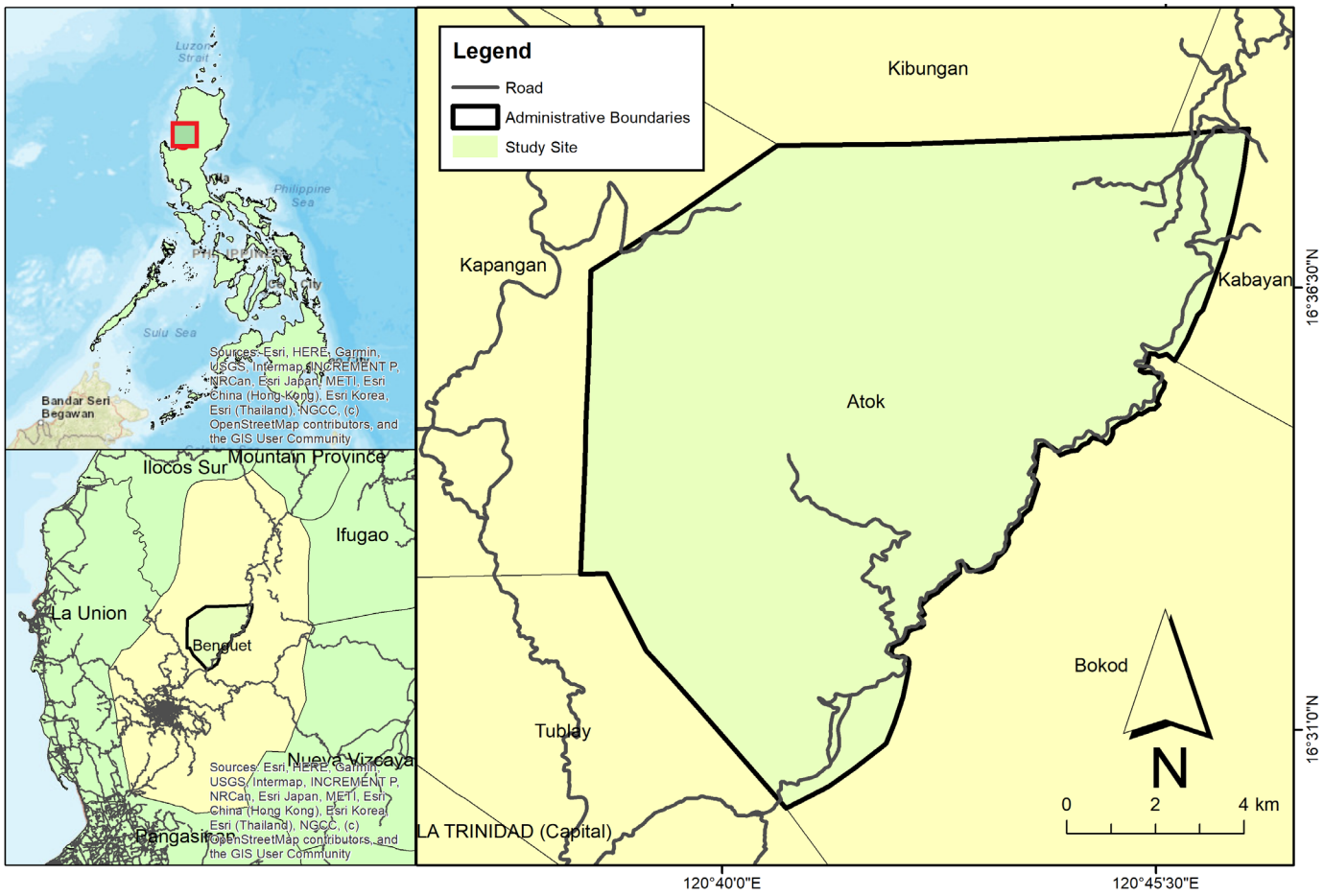


Figure 1. Location Map of Barangay Atok.

corroboration. Triangulation is one of the advantages of this research design over the other. The confirmation of the data obtained from the various methods used, validated the results of the study. *Malina et al.* (*2011*) added that this kind of research create a stronger research outcome than either method individually. Thus, having these characteristics can explicitly explain the dynamics in the knowledge sharing process.

This study used various data gathering techniques such as survey questionnaire, GPS reading and key informant interview. Fifty-three farmers who are members of the Liang-Bonglo Farmer's Association and Namegpegan-Akiki Farmer's Association served as respondents of the survey questionnaire where GPS was likewise used to determine exact location of households. The survey questionnaire contains information about socio-demogrpahic profile, intensity of climate change experiences, adaptation strategies done by farmers on specific crops, knowledge sharing ties, description of motivation of farmers in knowledge sharing, and opportunities to share. Likert scale was used to determine their level of motivation to share information. The Municipal Agriculture Officer (MAO) of Atok and the Kankanaey anthropologist served as key informants. Specific questions for MAO to explain further the climate change adapation strategies of the farmers as well as knowledge sharing issues common to farmers while the anthropologist explained the culture of the people in Atok. The data were analyzed using descriptive statstics and UCINET social network analysis (SNA). The SNA was used to map out the knowledge flows from one person to another and identify the type of knowledge shared. *Krebs* (2000) defined SNA as the mapping and measuring of relationships and flows between people, groups, organizations, computers, or other information/ knowledge processing entities. Social network analysis was further studied by *Freemen* (*2011*) and observed that it has developed over the past five decades as an essential part of developments in social theory, empirical research, and formal mathematics and statistics.

The distance obtained using the GPS helped in analyzing how far or how near one farmer to another and not just mere dependence on visual flow of knowledge. The results of the interview were used to strenghten the explanation. The study was conducted from April 2014 January 2015. Prior to the conduct of the study, the survey

questionnaire was pretested to ten randomly selected farmers. Cronbach alpha was also computed to determine the internal validity of statements.

RESULTS AND DISCUSSION

Socio-demographic characteristics

The 53 respondents were members of the two farmer organizations, namely Liang-Bonglo (23) and Namegpegan-Akiki (30) in Paoay, Atok, Benguet whose primary commodity are vegetables. Majority were male and between 22-45 years old. Almost half of the respondents from Liang-Bonglo were able to study in the college level, while nearly half of the Namegpegan Akiki respondents only reached highschool. Majority came from the Kankanaey tribe and affiliated with the United Church of Christ in the Philippines. Kankanaey is the dominant ethnic group in Benguet, which is home to various ethnolinguistic groups collectively referred to as Igorots.

Climate Stresses

Participants experienced climate stresses such as drought, extreme changes in temperature, hail, and frost. Farmers experienced these climate stresses with a rating from "often increase" to "sometimes decrease" (**Tables 1 and 2**). The extreme changes in temperature affected

Table 1. Liang-Bonglo respondents' observation on the climate stresses in their community.

Climate Stresses	Increase		Decrease	
	Mean Rating	*Adjectival Rating	Mean Rating	*Adjectival Rating
Temperature				
• Hot day, cool night	3.83	Often	3.00	Sometimes
• Hot day and warm night	3.90	Often	3.00	Sometimes
• Cold day and cool night	3.94	Often	3.00	Sometimes
Typhoons				
• Frequency	3.81	Often	3.50	Sometimes
• Strength	3.75	Often	3.33	Sometimes
Rainfall				
• Intensity	3.79	Often	3.20	Sometimes
• Amount	3.71	Often	3.25	Sometimes
• Timing	3.57	Often	3.13	Sometimes
Drought	3.78	Often	2.86	Sometimes
Wind				
• Strength	3.75	Often	3.22	Sometimes
Frost	2.67	Sometimes	2.63	Sometimes
Hail	1.00	Never	1.00	Never

*Always – 4.21- 5.00; Often – 3.41- 4.20; Sometimes – 2.61-3.40; Rarely – 1.81-2.60; Never – 1.00- 1.80

Table 2. Namegpegan-Akiki respondents' observation on the climate stresses in their community.

Climate Stresses	Increase		Decrease	
	Mean Rating	*Adjectival Rating	Mean Rating	*Adjectival Rating
Temperature				
• Hot day, cool night	2.8	Sometimes	1.80	Rarely
• Hot day and warm night	2.9	Sometimes	2.30	Rarely
• Cold day and cool night	3.14	Sometimes	2.18	Rarely
Typhoons				
• Frequency	2.75	Sometimes	1.80	Rarely
• Strength	2.43	Rarely	2.33	Rarely
Rainfall				
• Intensity	3.36	Sometimes	2.13	Rarely
• Amount	2.40	Rarely	1.86	Rarely
• Timing	3.70	Often	2.50	Rarely
Drought	2.33	Rarely	2.38	Rarely
Wind				
• Strength	1.53	Rarely	2.45	Rarely
Frost	3.00	Sometimes	1.82	Rarely
Hail	2.00	Rarely	2.00	Rarely

*Always – 4.21- 5.00; Often – 3.41- 4.20; Sometimes – 2.61-3.40; Rarely – 1.81-2.60; Never – 1.00- 1.80

the water supply for vegetables. Hail and frost were also factors that affect the profitability of vegetables. To address these problems, the people practice adaptation strategies to ensure a good harvest.

Adaptation strategies based on the climate stresses

The adaptation strategies used by farmers depend on the climate stresses experiencd. The categories of the adaptation strategies were based on nutrient management, water management, and pest and diseases management. Under pest and disease management they used chemical pesticides, insecticides and fungicides. In terms of nutrient management, farmers used synthetic, chemical and organic fertilizer. Respondents were heavy users of chemicals to their produce. This was further explained by the MAO that chemical companies can easily access the site because they are being provided with motorcycles as their means of transportation. For water management, the practices were frequent watering during drought as well as not maximizing the land area especially if it is far from the water source. On the other hand, farmers did not maximize their farm lots during droughts especially if the farms were far from the water source due to inadequate supply of water. Intention of not utilizing the entire land is practical due to lack of water supply during drought. In addition, farmers changed the variety of seed depending on the season (**Table 3**).

Thomas et al. (*2020*) avered that farmers tend to listen more to information or practices that are not production related of considered as "hard-earned knowledge". In this case, an example would be about adaptation practices related to the perceived rapidly changing environmental conditions, which affects everybody and thus, is deemed to be discussed collectively. This is corroborated by *Magala et al.* (*2019*) who found that information about climate change is shared among coffee farmers.

Table 3. Adaptation strategies to different climate stresses.

Climate Stresses	Adaptation Stresses
Drought	Pest Management - Spraying of insecticides, pesticides, fungicides Water management - Frequent watering of crops - Land area is not maximized esp. if it is located far from the source of irrigation - Plant drought resistant variety - Watering of plant during afternoon when there is no sunlight Nutrient management - Application of chemical, synthetic and organic fertilizer
Strong typhoon	Pest Management - Spraying of insecticides, pesticides, fungicides Water management - Make a canal in the garden especially in lower elevation before the occurrence of typhoon Nutrient management - Application of chemical, synthetic, and organic fertilizer - Applying fertilizer using side dressing Other Practices - Replanting of crops Seedlings are placed in their house basement (silong) for protection
Frost	Pest Management - Spraying of insecticides, pesticides, fungicides Water management - Watering of vegetables before sunlight Nutrient management - Spraying of foliar fertilizer Other Practices Harvest mature crops
Hail	Pest Management - Spraying of insecticides and pesticides for mature crops Nutrient management - Application of fertilizer Other Practice - Mature vegetables can be harvested

Akkinagbe and Orohibe (2014) also reviewed various adaptation strategies to climate change in Africa and results revealed that farmers also used crop adaptation strategies such as planting of drought resistant varieties of crops, crop diversification, change in cropping pattern and calendar mixed cropping, improved irrigation efficiency, adopting soil conservation measures that conserve soil moisture, planting of trees planting and agroforestry.

Influences of Knowledge Sharing

The statements were formulated to reflect the research findings of *Andrews and Delahaye* (*2002*) categorized as motivation to share and the opportunities to share (**Table 4**).

Motivation to share

Under this category, eight statements were related to motivation such as reciprocity, knowledge as power, relationship with the recipient, and rewards for sharing information/knowledge. Using the five-point Likert-scale, the respondents were able to determine their motivation in sharing what the respondents know (**Table 4**). **Reciprocity**. This statement refers to farmers' mutual give and take of knowledge/information. It had a mean rating of 3.74 for Liang-Bonglo and 3.57 for Namegpegan-Akiki respondents, which means that the respondents were highly motivated to share information to a person if he will also share what he knows to him. This statement may reflect the intention of the farmers when they share their knowledge on adaptation strategies to climate stresses. *Thomas et al.* (*2020*) averred that while farmers tend to hold on to experienced based farming practices, information related to new events that affect farmers such as those related to adaptation practices to changing weather conditions are discussed more freely since these are things that affect farmers in a geographical areas and are therefore better discussed collectively. This is supported by the findings of *Nguyen et al.* (*2020*) where farmer respondents emphasize the need to collectively address and share information about mitigation and adaptaion to climate change. This phenomenon can be explained by the fact there is an increasing pressure to respond to these environmental stresses and less information reaching them about what really works in their respective contextual circumstances. As the MAO explains that farmers believe that they are also scientist who have been tilling their lands for so long. The respondents

Table 4. Respondent's motivation to share their knowledge on climate change adaptation strategies.

Statement	Liang-Bonglo		Namegpegan-Akiki	
	Mean Rating	***Adjectival Rating**	**Mean Rating**	***Adjectival Rating**
1. I share the knowledge on climate change adaptation strategies because I want my fellow farmers to reciprocate on what I did to him.	3.74	High motivation	3.57	Neutral
2. I share the knowledge on climate change adaptation strategies on vegetable production because I want them to be educated.	3.51	High motivation	3.27	Neutral
3. I share the knowledge on climate change adaptation strategies on vegetable production because I want to be known.	2.30	Low motivation	1.63	Very low motivation
4. I share the knowledge on climate change adaptation strategies on vegetable production because I want to feel I am an expert.	2.09	Low motivation	1.77	Very low motivation
5. I share the knowledge on climate change adaptation strategies on vegetable production because I am waiting to receive a reward.	2.00	Low motivation	1.37	Very low motivation
6. I share knowledge on climate change adaptation strategies on vegetable production because I am waiting to be paid for that.	1.87	Low motivation	1.53	Very low motivation
7. I share knowledge on vegetable farming because I know the person who I shared it with.	3.35	Neutral	3.47	High motivation
8. I share knowledge on climate change adaptation strategies on vegetable production because I want to have a good relationship with others.	3.61	High motivation	3.40	Neutral

*Very high motivation - 4.21-5.00; High motivation- 3.41-4.2; Neutral – 2.61-3.40; Low motivation – 1.81- 2.60; Very low motivation – 1.00- 1.80

already exprimented what to do if there will be changes in the environment that affects the farms.

Knowledge as power. Statements (2 and 4) explained that if you have knowledge, it seems that you know so many things. This can be a source of power. Educating farmers is also a way of empowering them. In Statement 2, Liang-Bonglo farmers rated it as 3.51 highly motivated while those from Namegpegan-Akiki rated it as 3.27, which is neutral. Looking into the perspective of education, being educated means you will have a wider perspective on the things around you. Thus, it can help them in deciding what is best. However, the farmer respondents from Namegpegan-Akiki rated this statement as neutral. This can be attributed to the educational attainment of majority of the respondents.

All respondents from the two organizations had the same perspective on statement 4. The respondents are not motivated if they will be called "experts" when they share the knowledge. Liang-Bonglo respondents rated it as 2.09 (low motivation) while those from Namegpegan-Akiki rated it as 1.77 (very low motivation). Contradictory to some side comments gathered during the survey interview, respondents said that they were "scientists". The respondents know what they were doing and they know what to do with their farms. However, an anthropologist revealed that most of Kankanaeys are known for their humility. These people do not want to brag about what they have or what they know.

Relationship with recipient. Two statements (7 and 8) in the questionnaire refer to the person they prefer to share their knowledge with that will end up to have a good relationship with the recipient. Statement 7 had a mean rating of 3.35 from Liang-Bonglo respondents. This suggests that they almost had high motivation (3.41-4.2) to share their knowledge to the person they know while Namegpegan-Akiki farmers rated it as 3.47, which means that they were highly motivated to share their knowledge to provide who they know. Sharing it with the person one knows will establish a good relationship between them as explained in Statement 8. However, the mean ratings of the respondents from the two organizations were quite different. Liang-Bonglo farmers were highly motivated to share their knowledge with the persons who they know having a mean rating of 3.61 more than the respondents from Namegpegan-Akiki who had a neutral mean rating of 3.40 only. Findings show that farmers share knowledge with people that they know. Peer-to-peer knowledge sharing had been documented by various authors such as *Ying et al.* (*2015*) and *Franzel et al.* (*2018*) where farmers share knowledge with their peers.

Reward for sharing. Three statements (3, 5, and 6)refer to the reason that they share their knowledge based on reward. The motive of some people was to gain a reward in return for sharing. Statement 3 refers to a reward that if one shares his knowledge, he will become known and this received a mean rating of 2.30 from the Liang- Bonglo and 1.63 from the Namegepegan-Akiki respondents.

Statement 5 refers to sharing knowledge in exchange for a reward. Both respondents from Liang-Bonglo and Namegepegan-Akiki rated it as 2.0 and 1.37, respectively. These ratings on the statements indicate a low and very low motivation from the farmers of Liang-Bonglo and Namegpegan-Akiki, respectively.

Similarly, statement 6 refers to expecting a reward by paying him if he shares the knowledge. It also received a 1.87 and 1.53 with an adjectival rating of low motivation and very low motivation from Liang-Bonglo and Namegepegan-Akiki respondents, respectively.

In general, the farmer respondents from Liang-Bonglo were more motivated to share with others their knowledge on climate change adaptation strategies than those from Namegpegan-Akiki (**Table 4**).

The motivation to share the knowledge was based on the reciprocity of action and relationship with the recipients who can be explained by the Social Exchange Theory (*Hall 2001*). A person is motivated to do a favor to another person if he will get something in return. This explains why both respondents from Liang-Bonglo and Namegpegan-Akiki were motivated to share knowledge because they expected that whatever good they do to others; they will get something in return. Likewise, the familiarity of the person who they share their knowledge with also contributed to their motivation to share what they know. Their relationships were built on trust, which influenced their knowledge sharing practices.

Opportunities to share

Respondents share their knowledge with others more often through the informal venues than the formal ones. This emphasizes the interpersonal value of knowledge exchange among farmers as highlighted in the study of *Wood et al.* (*2014*). Both utilized small talks and a few used SMS. Small talks usually happened during occasions such as funeral, weddings, birthdays, as well as after church service on Sundays (**Table 5**). *Kibiten* (*2008*) also mentioned that though Kankana-eys are mostly dispersed, they had their own way of bringing them back together in the form of clan reunions to preserve traditions.

These spaces of interaction are crucial for knowledge exchange to happen. In other contexts, facilitated group discussions are important spaces of interaction (*Thomas et al.* 2020) and these informal gatherings are considered less intimidating when discussing farm related problems and information as compared to visits from technical experts. The MAO of Atok mentioned during the key informant interview that farmers had no time to regularly chat with their neighbors because they are in their farms all day. Farmers in the lowland have venues in exchanging information, which they call "tambayan" or their place of hangout and their favorite "huntahan" or meeting place for conversation. It is for this matter that *Gwandu et al.* (*2013*) recommended the setting up of learning centers where farmers can share knowledge among their peers.

Four of the Liang-Bonglo respondents made use of all formal venues or opportunities in sharing their knowledge. This could be attributed to the position of the president of the organization who happens to be the current chairman of the Municipal Agricultural and Fisheries Council (MAFC). On the other hand, only one respondent from Namegpegan made use of a knowledge sharing through a formal venue.

Knowledge Sharing among Farmers

In the applied SNA, one arrow-head (unidirectional) means that sharing of knowledge is one way while two arrow heads mean that there is interaction among respondents. The dynamics of knowledge sharing of the two farmer organizations are explained. The respondent/ farmer represents the node while the groupings refer to as component.

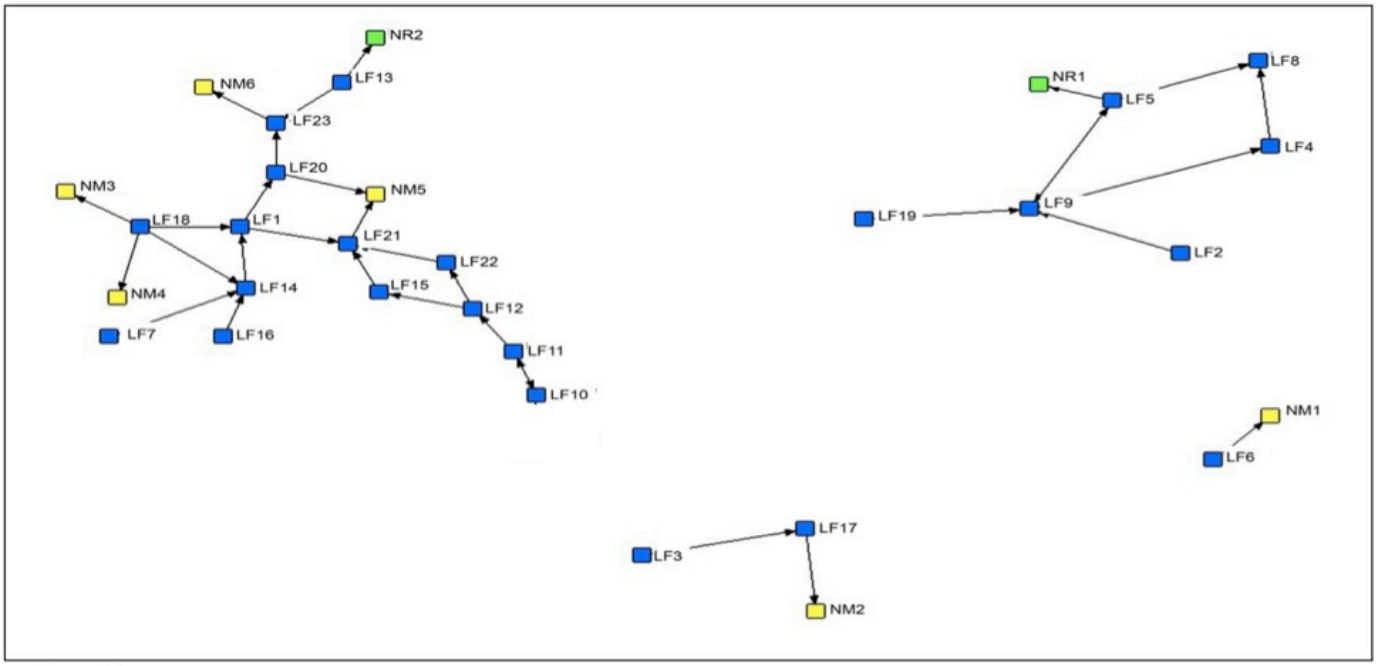
Liang-Bonglo Farmer's Association. The knowledge sharing showed that four components could be analyzed as weak (**Figure 1a**). It has 28 components or nodes but did not show that all components have interactions with the other components that resulted to unidirectional flow of knowledge.

The network could be characterized as a clan-oriented network. This is similar to the findings of *Kiptot et al.* (*2006*) where farmers shared information with their kins. The respondents considered their relative as the person with whom they shared what they know on climate change adaptation strategies. The relative might be a member of the organizations and sharing does not depend whether the houses were far from one another

Table 5. Respondents' opportunities to share their knowledge on climate change adaptation strategies.

Opportunities to Share	Liang-Bonglo		Namegpegan-Akiki	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
Formal				
Training/seminar	2	50	0	0
Fora	1	17	1	100
Organization				
Meeting	1	17	0	0
Total	4*	100	1	100
Frequency				
Every other month	1	17	0	0
Once a year	2	50	1	100
Quarterly	1	17	0	0
Total	4	100	1	100
In-formal				
Small-talk	20	87	25	74
SMS	3	13	9	16
Total	23	100	34	100
Frequency				
Monthly	2	6	0	0
Every other month	2	6	0	0
Everyday	8	24	6	15
Every Sunday (after church service)	10	29	9	22
Occasional (Weddings, birthday, wake/funeral)	12	35	20	50
Anytime	0	0	5	13
Total	34*	100	40*	100

*Very high motivation - 4.21-5.00; High motivation- 3.41-4.2; Neutral – 2.61-3.40; Low motivation – 1.81- 2.60; Very low motivation – 1.00- 1.80



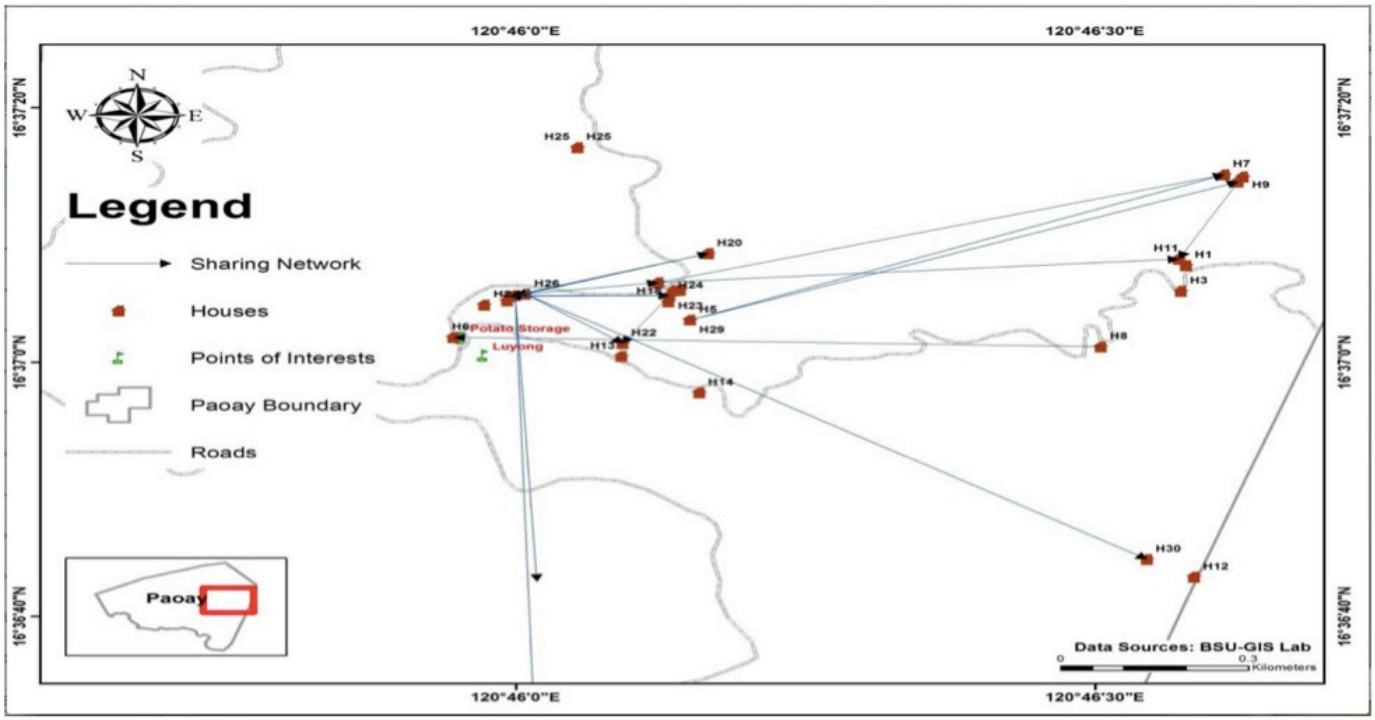
Legend:

LF- Member of LBFA
NM- Not a member of LBFA
NR- Member of LBFA but not a respondent

Number of nodes: 36
Number of ties: 32

Reciprocity: 1

Figure 2. Knowledge-sharing ties of Liang-Bonglo respondents.



Knowledge Sharing Ties (Distance in meters)							
H8-H6	990	H17-H7	910	H26 - H15	200	H29-H7	890
H9 -H10	10	H20-H19	310	H26-H22	190	H29-H10	900
H10-H11	210	H20-H15	320	H26-H20	300	H15-NR8	960
H15-H23	240	H24 - H22	140	H26-H17	210	H15-NR19	690
H17-H11	800	H24 - H19	250	H26-H30	1,150		

Figure 3. Knowledge-sharing ties of Liang-Bonglo farmers using Global Positioning Satellite.

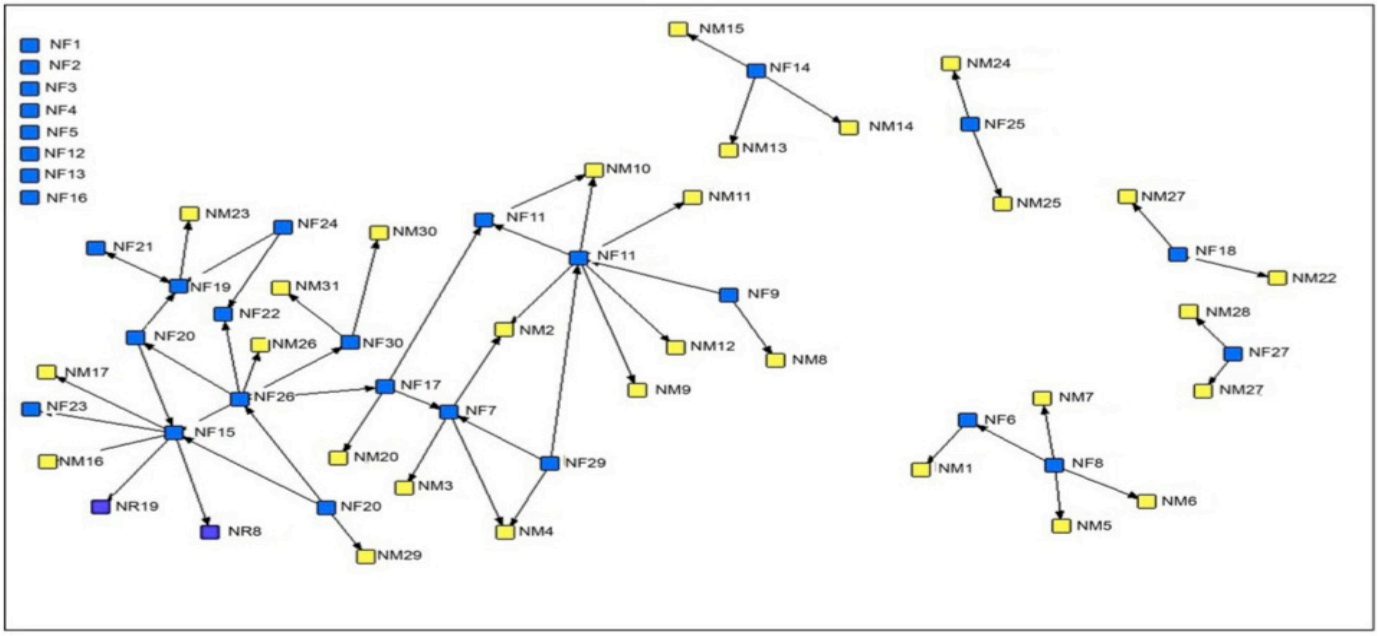
about 200 m on hilly landscape or near from each other (150 m) (**Figure 3**).

The knowledge seeking ties can also be likened to the "sink and faucet" phenomenon observed in Rice Cyber Villages where farmers receive information from the source or faucet but does not reciprocate the interaction (*Ramirez and Velasco 2015*). A probable explanation could be that famers consider the source an authority and therefore they cannot reciprocate appropriately. The good thing though, is that since the source of information are considered experts, the information is shared to other farmers as well. The topics, which the respondents shared with their co-farmers and relatives include the following: appropriate variety of seeds during rainy season, planting of crops like carrots and potatoes for dry season and cabbage and Chinese cabbage during rainy season, proper planting distance of crops, planting of different varieties of lettuce such as romane and iceberg, and refrain from planting- during rainy season to avoid damage of crops.

Namegpegan-Akiki farmers. Sixty-one nodes or individuals were in this network and 55 ties in this organization (**Figure 4**). However, eight members of the farmer organizations can be considered as isolates. The network had six components. Components one to five showed that members of the organization shared knowledge to farmer-relatives who are not members of the organization. The sixth component showed that the arrowheads of nodes were directed towards those who were not members. There was a dominant node with the highest out degree of five. This person considered the persons whom he shared his knowledge to as his neighbors, brother and friend. The farthest distance between two members of the organization is 1,150 m and yet farmers were able to share their knowledge because of personal relationships (**Figure 5**). This showed that distance is not a major issue in terms of knowledge sharing.

The number of nodes and ties of non-members were higher than the nodes of the members. This network could be characterized as weak. This explains that sharing of knowledge among farmer respondents is more of blood ties rather than as membership to an organization.

The topics, which the respondents shared with their co-farmers and relatives included: change of seed variety that is appropriate for rainy season and dry season, adjust cropping schedule, formulation of fertilizer, increase dosage of insecticide during rainy season, application of chicken dung to the soil, use of Trojan insecticide was effective for eliminating insect pests, as well as application of lime to the soil to avoid clubroot.



Legend:

NF- Member of Namaegpegan Akiki Farmer's Association (NAFA)

NM- Not a member of NAFA

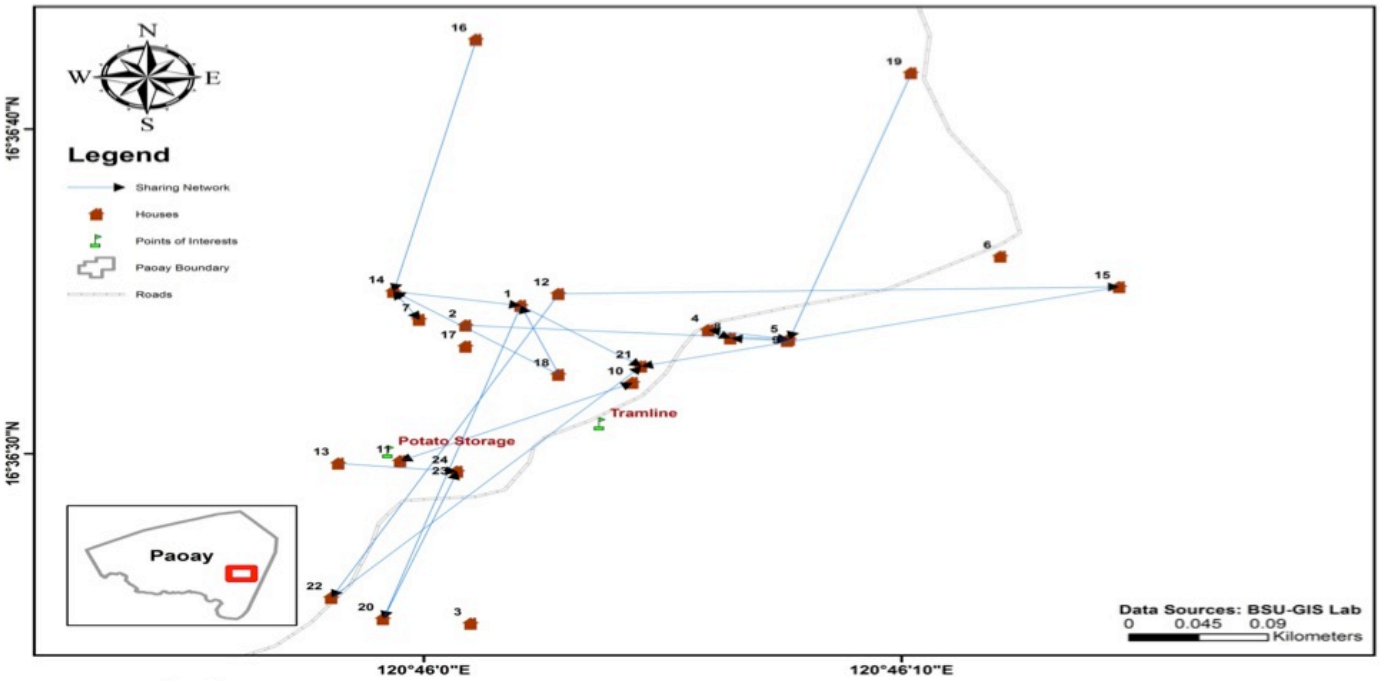
NR- Non respondent but member of Liang-Bonglo Farmer's Association

Number of nodes: 61

Number of ties: 55

Reciprocity: 1

Figure 4. Knowledge-sharing ties of Namegpegan-Akiki farmers.



Legend:

Knowledge Sharing Ties (Distances in meters)

H1- H21	90	H9-H4	50	H14-H7	30	H20-H23	150
H1- H20	310	H9-H5	0	H14-H1	80	H22-H21	290
H4 - H8	20	H10-H11	160	H15-H21	310	H2-H9	200
H4-H9	50	H11-H10	160	H16-H14	240	H3-H17	260
H5 - H8	40	H12-H22	320	H18-H14	130		
H5-H9	0	H12-H15	350	H18-H1	70		
H7-H14	30	H13-H23	70	H19-H9	260		

Figure 5. Knowledge-sharing ties of Namegpegan-Akiki farmers using Global Positioning Satellite.

Further, the results exemplified communication network among respondents as explained in the Social Network Theory (*Krebs 2000*). The unidirectional flow of information supported that the there was no reciprocity happening in the network. Referring to the previous topic on motivation which the respondents said they were motivated if they share knowledge to others if others will also do the same for them. This knowledge sharing flow can easily explain the dynamics of the network. This means that majority of the respondents' action to others were not reciprocated. Likewise, the clustering of respondents showed that the interactions were concentrated only on the cluster and not on the entire network. These clusters were one family. The relationships were built on trust that explained why the respondents shared the knowledge only to the persons they know, their relatives in particular. This has been explained earlier in the motivation part.

In addition, sharing does not matter whether the respondents are not members of the same organization. The main criteria in identifying the person to whom farmers share knowledge is personal but not organizational affinity. This is similar to the findings of *Kiptot et al.* (*2006*) where farmers share knowledge along kinship ties. This is further strengthened the explanation by an anthropologist interviewed that culture had contributed on who they share their knowledge with being closely knit and clannish individuals. *De Guzman* (*2020*) found that farmers prefer to deal mostly with traders sharing the same ethnicity. Thus, the network size of farmers actually become smaller and focused on those with the same ethinicty as they stay longer in the business, making her conclude that kinship defines the networks of farmers in Benguet vegetable trading.

CONCLUSIONS AND RECOMMENDATIONS

The adaptation strategies used by farmers included changing the vegetables to plant for specific months, adjusting the cropping schedule for specific vegetables, improving nutrient and pest management practices.

Farmers were motivated to share knowledge with people whom they are affiliated with, either by blood or through friendship. Farmer's motivations to share were anchored on the evaluation of reciprocal benefits related to information that can be obtained as a result of

knowledge sharing.

The social network analysis (SNA) conducted clearly showed that distance or difficulty in accessing other households is not the barrier in knowledge sharing. Moreover, the SNA analysis revealed that knowledge sharing is not based on organizational affiliation. Farmers shared knowledge mostly among kins and friends whom they can trust and occur during events such as family gatherings. Given that farmers are very busy, the potential for knowledge sharing beyond personal affinity is nil.

The clan-centered knowledge sharing among farmers indicated that the farmer association has nothing to do with the sharing of knowledge among its members. This is problematic given that knowledge sharing is key to improvement of practices, whether in agricultural production or adoption of adaptation strategies. With the results of the study, the following recommendations for farmers and other government institution were posed.

Create venue for knowledge sharing

Since their farmer's association meetings take place every quarter for Liang-Bonglo farmers and twice a year for those in Namegpegan-Akiki, it would be beneficial for each of them to schedule the meetings every month. The frequency of meetings could lead to an exchange of information and ideas where everybody can participate. This can also strengthen friendship among the members, as respondents shared information only to the people they are affiliated with.

Resource persons who are experts in the field can be invited to give short lectures on the proper application of chemicals and feritilizers to plant which can can be done during one of their scheduled meetings. Each association has different problems only specific to their location. Having an expert can assist farmers know if they were doing a sound agricultural practice. Thus, monthly meetings will also serve as a venue for the staff of MAO to have frequent interaction to the farmers which is one of their problems.

Collaborate with agricultural institutions

In promoting knowledge exchange, it is important that other stakeholders are tapped. Academic institutions can help farmers by allowing their student practicumers to conduct their projects in their area. Some projects could be the mapping of farms and other landmarks and the sources of water needed by the residents and the farm. Academic institutions also have their own laboratory where soil testing can be done to determine soil ph.

Capacity building. Since this is a vegetable farming hub, the local government should consider the farmers' welfare as a top priority. These include allotment of funds for LGUs to conduct visit and training programs. It is necessary to educate farmers on the use of pesticides and its effects on their health and the environment given the tendency to increase dosage and frequency of use during the rainy season.

Given that farmers do share knowledge, albeit limited circles in this case, it is important to encourage farmer to farmer exchanges by identifying farmer leaders who can take the lead in promoting farmer exchanges.

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