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Abstract

The study was undertaken to describe the characteristics of the model farmers and analyze the process in which model farmers learn and share rice growing skills and knowledge in rural communities and its contributory factors. The participatory method was employed in the study to gather information from various perspectives, such as from stakeholders, on learning and sharing knowledge about rice production. The study found that knowledge, attitude, practice, communication and networking skills are important characteristics of model farmers for ensuring the effectiveness of learning and sharing rice growing skills and knowledge in rural communities, especially in Cambodia. Hence, informal discussions during gatherings such as wedding and funeral ceremonies, in the rice fields, at agricultural supply stores in the village or commune or district, and field days held in rural communities are effective means for learning and sharing rice growing skills and knowledge among model farmers and other farmers. Family members, close friends, and agricultural supply owners in the village, commune or district are active in learning and sharing rice growing knowledge. The communication and networking skills of model farmers and other farmers should be further studied to fully understand the effectiveness of communication and networking skills in the exchange of rice growing knowledge in rural communities.

Key Words: Knowledge, Attitude, Practice, Network and Communication, Participatory, and Model Farmer.

1. INTRODUCTION

Cambodia has been recognized as an agricultural country in the Southeast Asian region. According to the Ministry of Agriculture, Fishery and Forestry, it has around six million hectares of total land area allocated to agriculture. Around 85 percent of the people are living in rural areas with farming as the main source of livelihood.

To reduce poverty in the country, the Royal Government of Cambodia (RGC) designed its

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Rectangular Strategy with the agricultural sector as one of its priority sectors (RGC 2004). Furthermore, the agriculture sector is one of the major sectors which contribute to economic development in the country, especially through rice and rubber production and the fishery.

While the agricultural sector is prioritized as one of the sectors for developing the country, various issues need to be addressed, such as inadequate water supply, a poor irrigation system, low rice yields, land erosion, changing farming practices, and inputs such as pesticide, herbicide, and fertilizer used in farming (RGC 2008). Furthermore, the majority of rice farmers in rural areas in Cambodia still adhere to their traditional rice farming techniques (Cai et al. 2008). Nowadays, a large percentage of the people in the rural area in Cambodia depend on rice production as their main source of income.

Recently, Cambodia re-entered the world market as a rice exporting nation, following a 30-year hiatus caused by war, political isolation, and a decimated agricultural sector. A resurgence of rice cultivation is occurring all across the nation's vast lowlands, as the rural population expands and as previously abandoned or exhausted farmland is brought back into production. Public statements by government ministers in the previous year indicate that Cambodia wants to double rice production by 2015 to approximately 15 million tons (which is 9.5 million tons of milled rice) and export 8 million tons (5 million tons of milled rice) (USDA 2010). However, the provision of agricultural extension service from the government to the farmer is limited. The majority of agricultural extension services operating at the provincial level do so with a small number of staff (1,905 in 2011) (IFPRI 2014) and are located in agricultural offices at the district level where they do not receive an annual budget to conduct agricultural extension service to farmers. However, through development partners, both local and international agents and organizations, some farmers have received some agricultural knowledge and skills. These include the Royal Government of Cambodia, especially the Ministry of Agriculture, Forestry and Fisheries (MAFF), and development partnerships, especially through the Cambodia Agricultural Value Chain Program (CAVAC) funded by Australian Agency for International Development (AusAID) and Australian Centre for International Agricultural Research (ACIAR) to accelerate the growth in value of agricultural production and smallholder incomes in selected provinces (Kampong Thom, Takeo and Kampot). The goal is improved productivity of rice-based farming systems through: (1) Funding and managing priority research activities and programs that address constraints in selected value chains; (2) Implementing a farmer extension program among participating water users and agribusiness groups; (3) Enhancing the capacity of extension providers to transfer improved technologies and information to farmers; (4) Developing and implementing a partnership program linking researchers, extensionists, farmers and agribusiness; and (5) Assisting in sustaining the operational capacity of the Cambodian Agricultural Research and Development Institute (CARDI). In order to achieve its goals, model farmers are one of the catalysts who are playing a crucial role by inspiring and sharing model farmer knowledge provided by the MAFF through the Department of Agriculture, international non-governmental organizations, and local non-governmental organizations

(NGOs). According to Kamarudin et al. (2015) knowledge sharing is an essential practice to improve farmers and other stakeholders' capacity in increasing productivity.

Hence, this study describes the characteristics of the model farmers and analyzes the process by which they learn and share rice growing skills and knowledge in rural communities and its contributory factors.

The results of the study will enable policymakers and development practitioners to determine the effectiveness and efficiency of the model rice farmer in learning and sharing rice growing knowledge with their fellow farmers in the communities. It will also pinpoint some of the obstacles to the learning and sharing of the model rice farmers which will allow policymakers and development practitioners to make decisions or modifications to the model. Furthermore, the results of the study will contribute to the environmental question, such as management and use of water and land resources by the model rice farmers. For example, model rice farmers who have good knowledge, learning and sharing attitudes, and are practical, are able to use and manage natural resources properly. Their knowledge and skills contribute to not only rice production but also to how to use natural resources sustainably through comprehensive learning and training informed by modern agricultural techniques. Furthermore, model rice farmers inspire a lot of rice farmers in communities to change traditional rice cultivation practices and adopt modern rice planting techniques. Thus, the model rice farmer is one of the key actors that protect the environment and actively contribute to development in rural areas.

However, this study focuses only on the informal learning and sharing of model rice farmer with their fellow rice farmers and among rice farmers within or outside communities in lowland areas of Cambodia. Furthermore, the study had methodological constraints as well as limitations on the results. It employed only simple research data collection tools such as key informant interviews, group interviews, and participatory observation. The results of the study also represent only those areas or locations with similar characteristics with the study sites.

1.1 A brief history of Cambodian agricultural extension

The Ministry of Agriculture established an extension unit in 1957 with the aim of transferring effective agricultural technologies of rice, vegetable and livestock to the rural farmers. Different techniques and methods were transferred and disseminated by using mass media communication such as radio and TV in order to improve production in the rural communities. During the Khmer Rouge regime (from 1975 to 1979), agricultural extension services were abandoned. After 1979, technical departments of the Ministry of Agriculture were resumed at target research stations and agriculture development centers. The committee of development extension was established in 1980 in order to produce extension tools and materials such as scripts for radio and TV programs, booklets, and posters for distribution to farmers. Through support from the Australian Catholic Relief (ACR), 17 government extension officers were trained in Australia. The program also funded

agricultural extension officers to work in 12 provinces (Kandal, Takeo, Prey Veng, Svay Rieng, Pursat, Kampong Cham, Siem Reap, Kampong Thom, Banteay Meanchey, Kampong Chang and Kampong Speu). The Partnership for Development in Kampuchea (PADEK), Coopération Internationale Pour Le Développement et la Solidarité (CIDSE), also known as Development and Partnership in Action (DPA), Church World Service (CWS), and World Vision and Church World Service/Lutheran World Service (CWS/LWS) also provided agricultural extension services to rural communities in Cambodia. From 1995, the MAFF established the Department of Agriculture Extension (DAE) (formerly called the Department of Techniques, Economics and Extension) to implement agriculture extension activities. This department was renamed as the DAE in 2000. Its mandate is to lead and coordinate extension and technology transfer activities in Cambodia through collaboration with technical departments and institutions, provincial department of agriculture, service providers, field agents, and local authorities. The main activities include: 1) facilitating and organizing extension and technical training; 2) farming system and technology development; 3) farmer organization development; 4) mass media and the broadcasting of agricultural technology; and 5) assisting and promoting household food security and income generation (Mak 2013).

For implementation of agricultural extension in Cambodia, several key departments, institutes, universities, and NGOs provide various agricultural extension activities. The DAE is represented at the national level and works on policy guidance and development, program development, quality assurance, program control, and providing technical support to the provincial departments and district offices. The DAE has the mandate to manage extension programs and to coordinate and to facilitate the agricultural extension programs in the country (Mak 2013).

The Provincial Departments of Agriculture (PDAs) provide support to the district extension staff. They coordinate and manage the delivery of extension systems to ensure all extension workers are operating effectively and services are efficiently carried out. The key duties of the PDAs include the following: (1) providing guideline for provincial extension planning; (2) advising and facilitating technical support for the District Agricultural Offices (DAOs); and (3) organizing the training on effective and efficient agricultural technology to the DAOs, which continues to extend knowledge and skills to farmers, farmer groups and other communities (value chain actors) in communities (Mak 2013).

According to the guidelines of agricultural extension from the MAFF, DAOs are mandated to continue the training for technology transfer programs with villagers. The DAOs also engage in coordination and integration of agricultural development planning at commune and village levels. The district agricultural teams are managed by and responsible to the District Agriculture Chiefs. Based on the national framework of agricultural extension, volunteer commune extension workers and village extension workers were recruited to assist the DAO staff in implementing an extension program at the local level (Mak 2013).

Subject Matter Specialists (SMS) departments/institutions provide technical training such as production, technology research and development, regulation support, human resources development, and technical backstopping to the provincial and district extension programs. The SMS departments/institutes consist of the technical department of the MAFF, research institutes such as CARDI, and universities/colleges like the Royal University of Agriculture (RUA) (Mak 2013).

Field extension agents include local and international non-governmental organizations (OI/NGOs), projects, and private extension. The agents from OI/NGOs such as the Centre d'Etudessur le DéveloppementAgricole du Cambodge (CEDAC) and the Centre for Livestock and Agriculture Development (CelAgrid) offer extension services in districts, communes and villages. The projects include the Agricultural Quality Improvement Project (AQIP) and the Cambodia-Australia Agricultural Extension Project (CAAEP), which are funded by the Australian Agency for International Development (AusAID). Private extension service firms such as British-American Tobacco Cambodia (BAT), Angkor Kasekam Rongroeng and Bandanh Kaksekar offer extension and technology transfer (Mak 2013).

The subjects in agriculture extension include rice production, home gardens, fruit/trees, livestock, and fish culture. CARDI, AQIP, and Australian Centre for International Agricultural Research (ACIAR) provide the knowledge and skills for rice production while home gardens are taught by the Department of Agronomy and Agricultural Land Improvement (DAALI), International Development Enterprises (IDE), CARDI, ACIAR, and individuals. Technology and skills on fruit/trees are offered by individuals, RUA, CARDI, and DAE. Individuals, DAE, the Centre for Livestock and Agriculture Development (CelAgrid), and the Departments of Animal Health and Production (DAHP) provide the training about livestock to the model farmers. Finally, Catholic Relief Services (CRS) and the Department of Fishery (DOF) engage in the training of fish culture (Mak 2013) (Appendix A).

1.2 Agricultural practice and the Khmer socialization process

From a historical perspective, rice growing knowledge has existed for a long time in Cambodia and has evolved and been transferred from generation to generation until the present. The knowledge of rice production was transferred in different forms. In the traditional or informal form in Khmer society, especially in rural communities, the grandparents or parents handed down this knowledge to their sons or daughters by engaging them at a very young age in agricultural activities such as taking care of animals, collecting cow manure or garbage surrounding the house to make organic fertilizer for growing rice, involving them in transplanting, watering, and clearing grass in the rice field, applying insecticides or pesticides, harvesting rice, and transporting and storing after harvesting. For heavy tasks such as land preparation, children become involved at around 18 years of age because this work requires physical strength. Through this socialization process, the next generation observes and learns every stage of agricultural production through direct involvement, right up to the present day.

Furthermore, another form of learning and sharing knowledge is through the extended family

structure in Cambodian society. The relatives and family members, such as brothers or sisters, uncles or aunts, cousins, close friends, and neighbors usually gather during special occasions, such as wedding ceremonies, funerals, house blessings and Buddhist rituals, where they share news about their daily lives, which includes agricultural activities and problems, especially in the rural communities in Cambodia.

During break time and before or after meetings in the villages, communes or districts, the discussion involves sharing or exchanging concerns and agricultural production. Farmers from different villages and communes meet and talk to each other about rice variety used, fertilizer, pesticide and herbicide use, appropriateness and effectiveness of agricultural tools, and selling prices of rice before the start of the meeting.

Buddhist practitioners, especially elderly people in rural areas, usually attend the Buddhist gatherings or meetings (*Thgnai Soeul* in Khmer) every week (four times per month). Some elders normally share or exchange recent news about their families and rice cultivation activities during these occasions.

Farmers are also able to exchange good agricultural practices and knowledge in some provinces during the Farmer of the Year Program, which is supported by international organizations, especially USAID's Cambodia Harvest Program and the German Development Cooperation (GIZ), local organizations such as the Cambodia Natural Agriculture Development (CNAD), the Cambodian Organic Agriculture Association (COAA), Angkor Green and other companies. The Provincial Department of Agriculture plays an important role as host institution, while the Department of Culture and Fine Arts conducts significant activities related to agricultural education. The Farmer of the Year Program organizes agricultural competitions and focuses on small-scale farmers' achievements which overcome the challenge of knowledge dissemination and thus are beneficial for farmers' capacity for innovation in rural areas (AGFEST 2014).

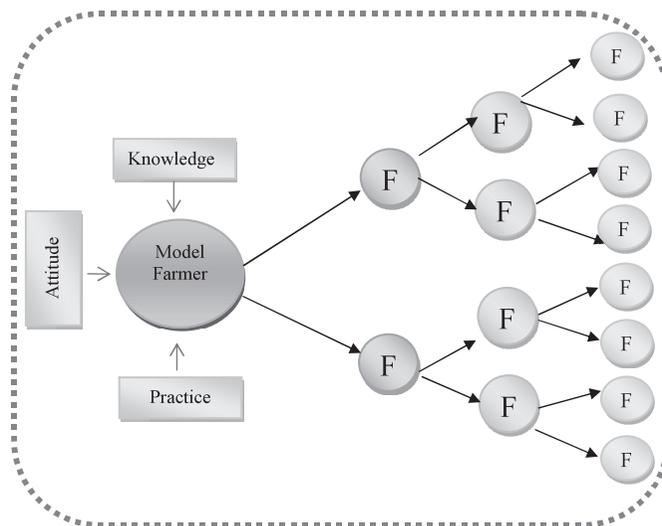
Hence, exchange of informal agricultural knowledge of Khmer farmers usually occurs in the family, among kin and other networks, in informal gatherings, and at special events which have been means for transferring agricultural knowledge and skills up until the present.

2. Conceptual framework of the study

This study was guided by the following research framework to answer the problems and fulfill the study objectives. A farmer who graduates from the Farmer Field School (FFS) training program is considered a model farmer. The FFS was developed by The Food and Agriculture Organization of the United Nations (FAO) in 1998. It defines as a school without walls, where farmers learn through observation and experimentation in their own fields. This allows them to improve their management skills and become knowledge experts on their own farms (Groeneweg et al. 2006).

The characteristics of a model farmer are described and measured using the KAP model (knowledge, attitude and practice). Knowledge refers to rice growing knowledge, particularly land preparation, seed selection, water management, fertilizer application, use of chemicals (herbicide, insecticide, and pesticide), and the rice market (rice price). Attitude refers to feelings towards rice growing and their habits in managing rice cultivation. Practice refers to the actual implementation of rice growing before and after being given additional rice growing techniques or skills by agricultural extension or through sharing among the model farmers and other farmers (the adoption of agricultural innovation). Sharing of knowledge and skills between the model farmers and other farmers in the communities was guided by the diffusion theory, especially the process of diffusion theory. This theory is also called the diffusion of innovation theory. The diffusion theory concerns the spread of innovation, ideas, and technology through a culture or cultures. The theory states that there are many qualities in different people that cause them to accept or not accept an innovation. There are also many qualities of innovation that can cause people to readily accept or resist them. There are five stages in the process of adopting or accepting an innovation. The first stage is knowledge, in which an individual becomes aware of an innovation but has no information about it. Next is persuasion, in which the individual becomes actively interested in seeking knowledge about innovation. The third stage, decision, is where the individual weighs the advantages and disadvantages of the innovation and decides to adopt it or not. After decision comes implementation, in which the individual actively adopts and use the innovation. Confirmation is the final stage. After adopting the innovation, the individual makes a final decision about whether or not to continue using it based on his own personal experience with it (Wisegeek 2014; Figure 1).

Figure 1 Research framework of the study



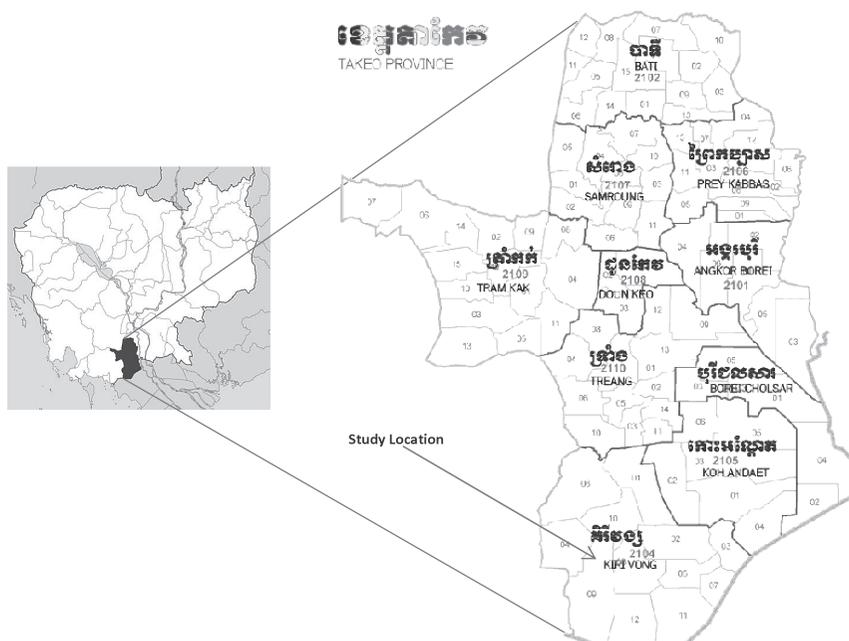
Source: Wisegeek, 2014

3. Research Methodology

3.1 Study location

KiriVong District, approximately 121 kilometers from Phnom Penh or 43 kilometers south of Takeo provincial town through National Road 2, shares a boundary with Vietnam (Figure 2). Agricultural land in the district includes dry rice land (9,522.00 ha), wet rice land (23,348.00 ha), and upland rice areas (*Srei Leu in Khmer*) (634.00 ha). Actual intensive rice cultivation areas are 6,247.00 ha. Average yield is 4.1 tons/ha (intensive rice cultivation), 3.3 tons/ha (dry rice cultivation), 2.1 tons/ha (wet rice cultivation) and 2.5 tons/ha (upland rice cultivation) (NCDD 2010). The total population in the district is 118, 225 people, or 24,351 families. Agriculture is the primary occupation in 91.40% of families, with 87.7% engaged in rice farming (NCDD 2010).

Figure 2 Location of the study site in KiriVong District, Takeo Province, Cambodia



Source: <http://cambodiakow.blogspot.jp/>

The participatory method was employed in the study to gather information about how local farmers learn and share knowledge about rice production from various perspectives, such as from districts, communes, and villages.

Four communes (Ream Andaeuk, KoukPrech, Kampeaeng, and Angk Prasat) out of 12 in KiriVong district in Takeo province were selected to conduct the study entitled “The Learning and Sharing Rice Growing Knowledge of Model Farmers in Cambodia.” Purposive and random sampling methods were

employed to establish the sample size of the study.

Fourteen model farmers in the study sites were selected and participated in key informant interviews (KIIs) to understand the individual's perception and opinion on the exchange of effective agricultural knowledge between model farmers and their fellow farmers and among farmers in the villages. Three farmer groups in the study sites and one commune council group were selected and participated in focus group discussions (FGDs) to collect an overall view of the characteristics of the model farmers, the process of learning and sharing knowledge in the village, and the strengths and weaknesses in the process of exchanging skills and knowledge in agricultural production.

4. Results

4.1 Number of model farmers

Through the support of the various district agricultural officers, commune councils, and village heads in Kirivong district, 80 farmers from four main communes of the district, such as Angk Prasat, Ream Andaeuk, Kouk Prech, and Kam Peaeng Commune were identified as model farmers (Table 1). They had learned agricultural knowledge and skills, particularly skills and techniques for rice growing, animal raising, and vegetable growing. This knowledge and these skills were shared with other farmers in their respective villages and communes. In order to select the model farmers, some characteristics were defined by the agricultural officers from the Kirivong district.

Table 1 Number of model farmers in Kirivong district, Takeo province, Cambodia

Model Farmer	Communes				Total
	Kam Peaeng	Kouk Prech	Ream Andaeuk	Angk Prasat	
Male	16	19	20	17	72
Female	4	1	0	3	8
Total	20	20	20	20	80

Source: Agricultural Office of Kirivong district, 2013

4.2 Challenges of the selection process for model farmers

In order to select farmers to be trained to become model farmers, the top-down approach was used in the process of choosing candidates from the villages. Selection of the model farmers was made through the commune council and village chief based on the advice of the district agricultural offices. Some criteria, such as having a rice field next to the irrigation canal, producing rice at least twice annually, and good rice management, were given to the commune council and the village chief in order to identify the model farmers. Based on the advice and guidelines, each village chief selected some

farmers and sent those names to the commune, after which the commune sent the final list of those farmers to the agricultural office at the district. These farmers were then invited to join agricultural training programs which were conducted by the agricultural extension agents with support from the Department of Agriculture, Forestry and Fishery and the MAFF. Furthermore, some agricultural training programs were supported by development partners and some international and local NGOs.

Although there were some guidelines for selecting the model farmers, it was revealed that the process of selecting model farmers was led by the village chief, who had the right to choose the farmers. This selection process limited the participation of the villagers and farmers in the communities, as reported by some farmers:

“I do not know about the model farmer but I know that some villagers grow good rice and get more yield and their family is better off now.”

Farmer from Ream Andaeuk village and Ream Andaeuk
Commune, Kirivong district, Takeo province
Interviewed June 13, 2013

Furthermore, the commune head from Ream Andaeuk described the process of selecting the model farmer at the commune level:

The selection of the model farmers was through a meeting with all village heads, first vice village head, second vice village head, as well as the participation of those village heads who do not have model farmers. Through the meeting, the list of model farmers (20 families) was identified by the village leaders. Hence, the commune did not identify these model farmers but the village leaders identified them and sent the list to us.”

Commune Head from Ream Andaeuk village and Ream Andaeuk
Commune, Kirivong district, Takeo province
Interviewed June 12, 2013

In addition, the selected model farmers were given not only agricultural knowledge and skills, but also some agricultural inputs such as rice seed, vegetable seed or fertilizer for their participation as model farmers. This encouraged some village chiefs to select only those farmers with whom they had strong relationships and regular communication or contact. These actions created discord in the villages, especially among farmers. For example, those farmers who had no connection with the village chief or village chief's network did not inquire about new agricultural knowledge that was given by the district agricultural officers. Finally, an expectation of the model could not be achieved because other farmers in the villages were not able to learn or adopt the new agricultural technology and their rice

production did not increase or improve at all.

Moreover, because of political alliance in the local community, especially the village, some farmers who belonged to different political affiliations were not allowed to join or were ignored when choosing the model farmers. In the village, the chief was able to identify or classify village members because there was a small number of families in each settlement. On the other hand, some farmers did not want to learn new agricultural techniques and methods and were also not willing to share with or seek out those with new agricultural knowledge.

Overall, the selection process was not clear and the village chief had excessive authority to select the model farmers. Hence, the process of choosing the model farmer must ensure equal participation, free from political influence, and the role of the village chief as facilitator in the selection process should be clarified.

4.3 Characteristics for selection as a model farmer

From the different views expressed in the individual (KIIs) and group opinions (FGDs), a model farmer should have the following characteristics: knowledge, attitude, practice, network, and communication skill. The model farmer should also have good knowledge of agricultural technology and the willingness to share with other farmers who ask for assistance in order to deal with existing problems. If the model farmer has a broad network and good communication skills, learning and sharing will occur simultaneously between the model farmers and other farmers in the village. For example, because of the close relationship among them, other farmers come to ask support, advice or assistance from the model farmer in order to deal with problems in rice production or agricultural production. Through strong networking among farmers and model farmers, rice marketing and securing good rice seeds will work more effectively and efficiently.

However, according to the deputy of the agricultural office of Kirivong district, the model farmer should have the following characteristics:

If we talk about the model farmer, it means this: first, it refers to knowledge. Second, it refers to the practice of the model farmer. It means that we have to look at rice farming activities from seeding to harvesting and also follow up on rice production activities. Third, it refers to sharing and dissemination with other farmers. Some farmers have good knowledge of rice production but dissemination and sharing do not work effectively because they have poor communication skills.

The deputy of agricultural office of Kirivong district, Takeo province

Interviewed October 10, 2013

According to the commune chief of Ream Andaeuk, the characteristics of a good model farmer are: “Before selecting the model farmers, the commune should set some guidelines. First, farmers should

have a large rice field. Second, farmers should be chosen who can harvest rice three times a year due to the availability of water. Third, farmers must have interest and want to learn new technology.”

The commune Head from Ream Andaeuk
Commune, Kirivong district, Takeo province
Interviewed June 12, 2013

Likewise, some village heads expressed their opinion about the characteristics of the model farmer, as presented by one of the village heads from Kam Peaeng village in Kam Peaeng commune: “The model farmer should have other characteristics, such as having good water resources and accessibility to roads. Also, a model farmer should have rice farming skills.”

The Village head from Kam Peaeng Commune,
Kirivong district, Takeo province
Interviewed June 12, 2013

Meanwhile, other village heads from Svay Thom village mentioned that the characteristics of a model farmer: “The farmer should be young and have good education, be engaged in rice growing, and have good management in rice growing.”

The village head from Svay thom village, Angk Prasat Commune,
Kirivong district, Takeo province
Interviewed June 1, 2013

The village head from Ream Andaeuk commune shared his idea about the characteristics of a model farmer from his village: “The model farmer should have four main characteristics: 1) Know how to select good seed; 2) Know how to apply fertilizer effectively; 3) Prepare the rice field well; and 4) take good care of the rice field.”

The village Head from Ream Andaeuk
Commune, Kirivong district, Takeo province
Interviewed June 12, 2013

Overall, the understanding of the characteristics of model farmers was not consistent and varied among the village heads and the district agricultural officers. Meanwhile, the commune heads had similar ideas about the characteristics of the model farmer. Furthermore, the characteristics of a

model farmer varied from one village head to another. Hence, proper guidelines should be considered in the selection of the model farmers.

To ensure the effectiveness of agricultural knowledge sharing at the village in Cambodia, the characteristics of the model farmer should include knowledge, attitude, practice, networking, and communication skills. If the model farmer has only good knowledge, has a friendly attitude, and has good practices, knowledge sharing will not work effectively. This is because other farmers will not come to ask him or her because they do not have good connections or relationships with each other. On the other hand, those farmers who have problems usually approach their closest network members, like relatives and close friends with whom they talk or discuss matters more frequently. In addition, if the model farmer's communication skill is poor or limited, this may pose a problem because it will be difficult for him to explain the knowledge and skills regarding agriculture and other farmers will not acquire this information. Lastly, the fellow farmers will give up the new technology and adhere to their traditional practices. Thus, the five main characteristics of selecting model farmers should be considered in choosing the candidates who will ensure that the knowledge and skills taught to them will be adopted by other villagers in the rural communities.

4.4 With whom, where and how do knowledge learning and sharing occur?

Information from the FGDs and the KIIs were the main sources used to analyze rice growing knowledge learning and sharing between model and other farmers. Based on the four FGDs conducted in the study sites (inside and outside the village, neighbors in the village, and rice field neighbors), new rice growing knowledge from the model farmers was defined. Rice growing knowledge learning and sharing often occurs among relatives or kin inside and outside the village.

The common locations of knowledge learning and sharing between model farmers and farmers were wedding ceremonies, funerals, agricultural supply houses or stores, along roads when farmers meet each other, meeting at the commune or village, and in the rice fields, especially when farmers go to inspect their fields. However, the most common place for rice knowledge learning and sharing was at special occasions like wedding ceremonies and funerals.

Rice growing knowledge sharing between the model farmers and other farmers occurred in an informal way. In Cambodian society, especially in rural areas, people always support their relatives, friends, and neighbors with time and money during special events such as weddings or funerals, particularly within their family. During these events, many people from both inside and outside the village meet and exchange concerns or good news regarding rice technology, issues of rice production, rice marketing, and other daily life concerns. Knowledge learning and sharing for the majority of the farmers occurs during meetings, when they meet each other in the rice fields when they go to inspect them, when farmers meet each other at the agricultural supply store, or along the road in the village.

4.5 The knowledge learning and sharing process

In the selected villages, agricultural extension agents, model farmers, agricultural suppliers, NGOs, farmers, and private companies were involved in the diffusion of new agricultural technologies, such as new rice seeds, new fertilizers, new chemicals, rice marketing and others. According to the results of the KIIs and the FGDs, the farmers changed from traditional rice growing (long rice growing duration or six months) to short rice growing (around 90 days growing duration or *srove nam kong boung or ea air houk brammouy or ea air peitsebbram* in Khmer language) at Preah Bat Choan Chum and Phnum Den commune, close to southern Vietnam. Some farmers from these two communes adopted the new three-month growing technique from farmers in Vietnam. For example:

I learned the new rice growing method from my relative in Vietnam, first of all because it provides more yield and I can grow two or three crops per year. I started to grow it and I had higher yield and I have continued to grow it up to now.

Farmer from Kbal Damrei village in Kouk Prech
commune, Kirivong district, Takeo province

Interviewed June 24, 2013

Some farmers changed their rice growing practice through inspiration from the successful rice growing of other farmers in the village, especially model farmers. Good practices and high yield among model farmers gained a lot of interest and attention from other farmers inside and outside the villages or even from other districts. Hence, some farmers approached the model farmers in the village or commune to learn new rice techniques such as land preparation, seed selection, water management, fertilizer application, and pesticide and herbicide management. The model farmer from Angk Prasat commune testified that:

Some farmers from my village and from other villages come to ask me about my rice growing practices, like land preparation, irrigation management, and fertilizer and pesticide application. Sometimes they come to my rice field directly because they want to see it. In addition, I also share with them how to select rice seeds and how to store them for the next planting season. For those farmers who are far away, they sometimes call me and ask my advice about insecticide problems and what kind of chemical should be used to deal with it. I give them some instructions according to my experiences and what I have learned from agricultural training. Sometimes, they inform me about the results of what I advised them.

Model farmer from Angk Prasat commune,
Kirivong district, Takeo province

Interviewed June 22, 2013

The farmer who planted the three-month rice also testified that:

A model farmer told me to grow the three-month rice and the technique of growing this rice I learned from other farmers. I also asked Mr. Di Sam Poeun, who participated in the agricultural training. I asked him about chemicals for improving rice production and the application of insecticide and herbicide and so on. I also learned from other farmers, which allowed us to exchange and learn from each other our experiences of growing this rice seed. We discussed the reasons for losing profits in the rice business or insecticide or irrigation management and so on.

Farmer from Ream Andaeuk village, Ream Andaeuk
commune Kirivong district, Takeo province
Interviewed May 28, 2013

On the other hand, farmers often learned from agricultural suppliers who gave some instruction about how to use fertilizer, irrigate rice fields, and apply insecticide, herbicide or pesticide in rice growing. This was revealed in the key informant interview among farmers:

I always go to the agricultural store in my village to buy fertilizer, herbicide, and insecticide because they give me instructions in applying chemicals or fertilizer. Sometimes I have problems with rice growth so I go and discuss it with them and they help me to identify some effective chemicals to deal with the problem.

Farmer from Ream Andaeuk village, Ream Andaeuk
Commune. Kirivong district, Takeo province
Interviewed May 29, 2013

4.6 Learning and sharing agricultural knowledge

In the informal learning and sharing of the model farmers and among farmers from the selected study sites, major considerations relating to rice production were: fertilizer selection for application in rice growing; choosing chemicals and learning how to use them; rice seed selection; and land preparation for the rice field. However, application of chemicals in rice cultivation at all stages was often shared between the model farmers and among farmers in the selected study communities. This was revealed in the KIIs. For example, a farmer reported that:

“I do not have enough knowledge and skills in rice production but I can do it without having any concern. I also share my rice growing knowledge with my neighbor farmer, especially for choosing and applying both chemicals and fertilizers.”

Farmer from Ream Andaeuk village, Ream

Ream Andaeuk commune Kirivong district, Takeo province

Interviewed May 30, 2013

The majority of the agricultural supply store staff was also trained by both the agricultural extension agents from the province or district and private chemical and fertilizer company representatives in how to apply or use chemicals and fertilizers. Some agricultural stores in the district were given training by chemical, fertilizer or rice seed companies in Vietnam in order to ensure effective use of the products and avoid the dangers of using such chemicals. Agricultural supply stores inside and outside the villages were actively involved in sharing knowledge of chemical and fertilizer application, along with seed selection for rice growing in the selected study sites. Most farmers in the villages went to buy these inputs from these stores and asked the sellers about usage:

The technical people did not train us much about applying chemicals or fertilizer, taking care of the rice field, applying fertilizer, and how to choose and select chemicals. I always seek someone who operates an agricultural supply store whom I have known for a long time. He has good skills and experience in growing rice. He grows 30 hectares of rice.

Farmer from Kork Prech Commune

Kirivong district, Takeo province

Interviewed September 4, 2013

Since the location of the selected study sites is near Vietnam, rice production technology from there has been extended and adopted by some Cambodian farmers. This knowledge and technology for rice cultivation was learned through radio broadcasts from Vietnam in Khmer and through actual visits to rice fields in Vietnam by Cambodian farmers. Cambodian farmers practiced what they saw in Vietnam in their own rice field, as reported in a KII:

“I learned that *ea air* [three-month growth rice seed in Khmer] gives good yield but my late father strongly condemned me for growing this rice. But I still grow it and I get good yield. In addition, I heard from the Vietnam radio broadcast about this rice seed as well.”

Farmer from Ream Andaeuk commune,

Kirivong district, Takeo province

Interviewed September 3, 2013

Finally, they received good yield and high profits, so other farmers were inspired by these rice production activities and methods. As of today, almost 100% of the farmers in Kirivong district have adopted the fast-growing rice seed (*ea air peitsebbram* in Khmer) and they can produce from two to

three crops per year.

4.7 Reasons cited for unwillingness to learn and share agricultural knowledge

The majority of the farmers shared and learned about rice growing practices one, two or three times per year. Meanwhile, some farmers adhered to the traditional practices of rice growing. Some reasons cited for this choice were being unwilling, which is related to attitude, as well as habit, knowledge, experience, limited agricultural assessment and capital, and having alternative options. Some farmers did not show much interest in and attention to growing new rice seeds or new methods, while other farmers were not confident with it. Furthermore, some farmers who received training from agricultural agents did not practice or apply what they had learned. Other families had problems at home, like drinking too much alcohol, or had no land or only a small plot. Hence, they did not care much about cultivation. Likewise, some farmers adhered to their rice cultivation practices because of their long experience of growing traditional rice seeds and its methods. They were also old and had poor understanding of the instructions for applying chemicals. In relation to limited access to agricultural production in the selected study sites, especially among poor farmers who had no land or a small plot, no agricultural tools such as cows or water pumps, working tractors, and with limited capital, they selected local or overseas migration to places like Thailand or Korea as alternative strategies to provide their livelihood. Lastly, because of the loss of profits in planting new seeds and rice growing methods, some farmers were unwilling to participate in learning and sharing rice growing knowledge in local communities.

5. Discussion

In extension services, farmers who are chosen and given knowledge and skills through comprehensive training are titled differently, such as model farmer, master farmer, lead farmer, farmer promoter or farmer trainer (Franzel and Simpson 2014). The model farmers are graduates of the Farmer Field School and extend learning and sharing of agricultural knowledge to local communities.

Model farmers' characteristics and contributory factors for learning and sharing of rice growing knowledge

To ensure the effectiveness of agricultural knowledge sharing in rural communities in Cambodia, the characteristics of model farmers should include knowledge, attitude, practice, and networking and communication skills. This means that the model farmers have not only good knowledge, a friendly attitude, and good practices, but also strong networking and good communication skills which allow more effective learning and sharing of agricultural knowledge and skills among model and other

farmers.

First, while the KIIs and the FGDs of the study revealed that the model farmer's knowledge significantly influenced learning and sharing of rice growing knowledge between model farmers and other farmers, studies are limited. On the other hand, some studies reported that farmers with a higher level of education were likely to have better given knowledge (Tornimbene et al. 2014; Khoram et al. 2006; Eckert et al. 2005). In addition, model farmers with sufficient knowledge of concepts and principles of technologies were able to share and learn with other farmers actively and fruitfully (Kiptot et al. 2006). However, other studies have asserted that having more years of schooling made individuals less likely to give or to share knowledge, skills, and goods with their fellow farmers (Kiptot et al. 2006).

Second, Tornimbene et al. (2014) and Khoram et al. (2006) reported that a farmer's attitude was also relevant to the level of effective practices of learning and sharing of agricultural knowledge.

Third, some KIIs and the FGD illustrated that certain model farmers already had some practical experience in growing rice before they were chosen, which concurs with the KAP model. Practical experience not only helps them to familiarize themselves with new practices but also serves as benchmark or baseline to analyze and perceive better practices in rice growing.

Fourth, in relation to networking and learning and sharing of rice growing knowledge, other literature reported that informal social networks such as relatives, friends and groups are important avenues for spreading new technology (Kiptot et al. 2013, Nathaniels 2005, and Simpson and Owens 2002). The research results corroborated existing literature they are mostly learning and sharing rice growing knowledge with relatives at the village, commune, and district level only.

Fifth, based on the KIIs of the study, good communication by the model farmers will enable them to learn and share about rice cultivation more successfully. Proper communication within the network is central for efficiency and to facilitate knowledge mapping and knowledge sharing (Capnet, 2004, as cited by Assefa, 2012; Ponniah et al. 2008). However, according to this study, interviews and some literature revealed that communication skills are not included in the training programs of the agricultural extensions. Hence, if the model farmer's communication skills are poor or limited, this becomes a hindrance because of difficulty in explaining knowledge and skills in agriculture. Thus, fellow farmers will give up on the new technology and adhere to their traditional practices.

Lastly, the study of Ebewore (2013) pointed out that a knowledge sharing contract for the model farmers should be introduced in the farmer field school program. This ensures knowledge sharing of the model farmer.

In order for rice growing knowledge sharing and learning to succeed among farmers, important characteristics such as knowledge, attitude, practice, networking, and communication skills should be considered in the process of selecting farmers to be trained as model farmers. Furthermore, additional communication skill should be taught to the model farmers. Field days should be held annually in the

rural community.

Based on the results of the study, communication skills and learning and sharing of rice growing knowledge should be further studied in order to fully understand the effectiveness of communication skills in the exchange of rice growing knowledge in rural communities.

How Do the Model Farmer and Other Farmers Share and Learn Rice Growing Knowledge?

Based on the results of the study, the effective means of learning and sharing of rice growing knowledge are informal ways such as at special ceremonies (wedding and funeral), before or after meetings and especially during break time, during discussions in an agricultural supply store, and when farmers meet each other during evenings or along roads or at the rice fields when they go to inspect, monitor or water the paddy rice. On the other hand, the study by Kiptot et al (2006) reported that effective means of agricultural knowledge sharing are through an informal social network. An informal social network refers to an individual's family and their extended families, friends, neighbors and wider communities of interest (including informal connections developed at work, through education and the neighborhood settings as well as those increasingly formed on-line). Informal social networks can generally be defined as a set of relationships or linkages among individuals, each of which has a varying degree of significance to the wider network (Government of Canada 2014). A study from Nigeria reported similar insight, that traditional dissemination methods were vital in technology transfer in the diffusion process (Kormawa et Al. 2004). On the other hand, the knowledge and skills of the model farmers were mostly shared with their kin (Evelyne et al. 2006).

Furthermore, Ebewore's study (2013) revealed that field days should be promoted to encourage knowledge sharing. Field days allow the model farmers or FFS to share what they have learned and encourage other farmers to change their attitude, participate and share with other farmers.

Hence, informal discussions during gatherings such as weddings and funerals, in the rice field, at agricultural supply stores in the village, commune or district, and field days held in rural communities, especially at the commune level, should be considered for diffusion of agriculture knowledge and skills in rural communities.

6. Conclusion

This study revealed that the characteristics of the model farmers such as knowledge, attitude, and practice (the KAP model) are not enough to ensure the effectiveness of sharing and learning of rice growing knowledge among farmers. To have an effective rice growing knowledge exchange, the networking and communication skills of the model farmers should be integrated into the KAP model as

key characteristics in identifying farmers who will be given training.

Informal discussion during events or ceremonies and field days are effective means of sharing and learning rice growing knowledge between model farmers and among farmers in rural communities, especially at the commune and village level. Family members, close friends, and agricultural supply stores in the village, commune or district are active in learning and sharing rice growing knowledge.

Based on the findings of the study, communication skills or networking and learning and sharing of rice growing knowledge between model farmers and other farmers should be further studied to fully understand the effectiveness of communication skills or networking in the exchange of rice growing knowledge in rural communities.

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APPENDIX
Provision of agricultural knowledge and skills in Cambodia

No	Topics	SMS	Completed	Required
Rice Production	1 Soil identification and fertility management	CARDI	✓	
	2 Lowland rice variety selection	CARDI	✓	
	3 Rodent control	CARDI	✓	
	4 Land leveling	CARDI	✓	
	5 Seed storage protection	AQIP	✓	
	6 Threshing	AQIP	✓	
	7 Drying	AQIP	✓	
	8 Wet season aromatic rice	CARDI	✓	
	9 Recession aromatic rice	CARDI	✓	
	10 Rice crop diversification	ACIAR	✓	
	11 Pure line selection of popular traditional varieties	AQIP	✓	
Home Garden	1 Dry season vegetables	DAALI	✓	
	2 Wet season vegetables	DAALI	✓	
	3 Drip irrigation	IDE		✓
	4 Heat tolerant tomato varieties	CARDI		✓
	5 Biological control of diamond back moth (DBM)	DAALI		✓
	6 Safe pesticide use	CARDI		✓
	7 Vegetable postharvest management	ACIAR		✓
	8 Compost preparation	Individual	✓	
Fruit/Trees	1 Cashew production	Individual	✓	
	2 Small-scale cashew processing	RUA	✓	
	3 Banana production	CARDI	✓	
	4 Watermelon production	CARDI	✓	
	5 Coconut <i>Brontispa</i> control	DAE	✓	
Livestock	14 Single pig fattening	Individual	✓	
	15 Sow management	Individual	✓	
	16 Intensive pig management	Individual	✓	
	17 Commune/village pig vaccination program	Individual	✓	
	18 Cattle fattening	Individual	✓	
	19 Haemorrhagic septicemia vaccination	Individual	✓	
	20 Foot and mouth disease management	Individual	✓	
	21 <i>Leucaena</i> management	DAE	✓	
	22 Forage legumes and grasses	DAE	✓	
	23 Village hen and chick management	CelAgrid	✓	
	24 Chicken growers and layers	CelAgrid	✓	
25 Newcastle disease control	DAHP	✓		
26 Intensive duck management	DAHP	✓		
Fish Culture	27 Smallpond production	DOF	✓	
	28 Hatchery construction and management	DOF	✓	
	29 Paddy fish management	DOF	✓	
	30 Pagoda fish management	CRS	✓	
	31 Tilapia production	DOF	✓	

Source: MakSoeun

Department of Agricultural Extension (DAE)

Ministry of Agriculture, Forestry and Fisheries (MAFF)