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A qualitative study of knowledge transfer on pepper farmers' agriculture practices

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Abstract

Malaysia is the fifth-largest pepper exporter in the world, after Vietnam, Brazil, Indonesia, and India. Distribution of the right knowledge to pepper farmers will produce high output for the country. To ensure that agriculture produces sufficient food, farmers need the right incentives, knowledge, and technology to enable the distribution of the right knowledge to pepper farmers that can produce high pepper output for the country. Therefore, the objective of this study was to explore the impacts of knowledge transfer on farmers' knowledge of pepper cultivation. A phenomenological approach to gathering qualitative data was conducted to allow an in-depth understanding of the farmer's experience. A series of semi-structured interviews was conducted with six pepper growers in Sarawak. The data from the interview was analysed using the thematic analysis method. The findings indicated that knowledge transfer programs have benefited pepper farmers in many ways. The participants experienced knowledge enhancement to increase productivity. They shared how the recommended varieties help to increase pepper productivity. They were also exposed to new inventions that could help them produce quality berries, such as an application called NutriLada. This application helps in managing the pepper production. The programs also taught them how to identify pests and diseases that are affecting their pepper, such as *white root disease or aphids*. Apart from that, participants also showed proper planting management to improve or maintain plant performance. This study provided beneficial insights for the relevant agencies, not necessarily pepper plantation agencies only but other agricultural agencies to enhance their programs and implementation plans in transferring the knowledge to farmers in the country.

1. Introduction

Pepper has been introduced to Malaysia for more than a century. It was planted at the beginning of the 19th century in Johor and Singapore (Liew *et al*., 2003). Over a century later, Malaysia has become the world's fifth pepper producer. With a long history of pepper farming, local farmers have passed the knowledge from one generation to another. Scholars have argued that the distribution of the right knowledge to farmers can produce high production output of farming produce for the country. Thus, knowledge is seen as a vital component in agriculture, especially for the development of any community, because when it is poorly disseminated, it will result in a certain constraint. For example, a study conducted by Mubushar *et al*. (2019) reported that 73.8% of farmers have no knowledge of the application of pesticides and biosafety. Therefore, they rely on retailers for information who have not received any training. Due to the retailers having poor knowledge regarding the harmful effects of pesticides, spraying

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techniques, and their toxicities, the majority of the farmers (98.5%) in the study area report that they consistently have issues with the pesticide's effectiveness or efficacy on insects, pests, and diseases.

The transfer of knowledge is the dissemination of professional knowledge from one person to another. This is important for farmers because they are taught to employ modern farming methods in managing their farms, even though farm management knowledge is inherited or gained through experience (Tan *et al*., 2021). Thus, this study investigates the influence of knowledge transfer on farmers' knowledge of pepper cultivation.

Knowledge transfer means knowledge sharing or dissemination and providing insight to solve problems. Argote and Ingram (2000) defined knowledge transfer as the process by which another experience affects a unit, group, department or division. Knowledge transfer is needed by every farmer nowadays to shift from traditional farming methods to new ones. There are several impacts of knowledge transfer among farmers, which are knowledge, lifestyle, and attitude.

Many farmers prefer the traditional method of acquiring farming knowledge from their forefathers. However, this method is less effective if the farmers intend to employ modern farming methods, gain new farming information relative to the current ones, and increase their pepper production. This is due to the knowledge factor of previous farmers who employed traditional farming methods. Such farmers lack proper knowledge of the drainage system, plant spacing, and the correct application of fertiliser. Furthermore, farming knowledge acquired from past generations may vary across lands because such farmers came from different locations, had dissimilar socioeconomic backgrounds, and were exposed to different farming techniques without proper records. According to Wales Rural Observatory (2013), knowledge transfer among farmers is mostly unresponsive due to an absence of encouragement. As such, without the implementation of proper knowledge transfer, it will be difficult for a farmer to change and explore new farming methods.

The progress of agricultural technology transfer following socio-economic conditions has long been recognised as an obstacle in accelerating agricultural development. Farmers in rural areas are generally not well empowered with knowledge and innovations to solve their agricultural problems despite the growing presence of such knowledge resulting from research and innovation activities across the globe. The transfer of agricultural knowledge and technology is one of the most important challenges in changing the perspective of farmers. Moreover, this is also fueled by a lack of knowledge and one's refusal of new farming knowledge, which eventually leads to less efficient output. On the other hand, Sikhweni and Hassan (2014) perceived that agriculturalists and other players in rural development need better access to technical information, knowledge, and advice, and must link with other actors in agri-food markets and value chains to improve their livelihoods.

The approach to the system of agricultural innovation is recognised as the best way of using it as a comprehensive framework to analyse the status of the agricultural system in developing countries (Klerkx *et al*., 2012). The involvement of all innovations, information, or exchanges of knowledge, the use of indigenous knowledge, and farming systems by farmers is crucial for speeding up the transfer of information. This included the adoption of technology by farmers for making genuine decisions (Aflakpui, 2007). Technology transfer is also the main component of technological development. However, to apply the developed technology effectively, the output needs to reach the end-users of the technology with its full package. This is explained by Van Crowder and Anderson (1997) that knowledge generation is considered to be the mandate of researchers and extension agents, but the active participation of farmers is important to improve productivity in the agricultural sector to have an effective information system.

One example of a successful knowledge transfer in agriculture can be credited to Vietnam. In particular, North-western Vietnam has been plagued with many difficulties and constraints over the last 50 years, such as a lack of access to productive factors in agriculture and limited formal education (Leisz *et al*., 2005). However, it has now become a dynamic region in the country due to the application of agricultural knowledge and information systems in most of the region's agricultural lands. This has signified that the transfer of knowledge and innovations has played a leading role in the transformation of the region's agriculture (Thai *et al*., 2011).

It is important to make the best use of the gift of knowledge so that it achieves great achievements and heights in all areas of life, in particular for farmers, to improve their skills. Farmers' knowledge has an important role to play in bringing about sustainability in agriculture, as stated by Röling and Jiggins (1998), where it helps them to improve. Acknowledging the significance of knowledge transfer among the current generation of farmers, the evidence regarding the influence of knowledge transfers on pepper cultivation in the Malaysian context is scarce, particularly in Kuching, Sarawak. Moreover, the pepper industry in Malaysia is known as one of the largest in the world, yet little is

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known about to knowledge transfer influences pepper farmers' knowledge in pepper cultivation. Thus, this study investigates the knowledge transfer affects farmers' knowledge of pepper cultivation in Kuching, Sarawak.

2. Materials and methods

The research method employed in the qualitative study involved collecting data through a series of interviews in April 2018. The interviews were recorded and transcribed verbatim. Participants were recruited personally through third parties, the Malaysian Pepper Board (MPB), Kuching, Sarawak. The interviews were carried out at the Malaysian Pepper Board Training Centre, Kuching. The samples of this research involve 6 participants of self-employed pepper growers between the ages of 40 to 75 years old, as shown in Table 1. In-depth interview sessions were conducted to explore several aspects which are relevant to the research purpose. The data from the interviews were transcribed, and a thematic analysis protocol was performed as displayed in Table 2. Thematic analysis is the process of identifying patterns or themes within qualitative data (Maguire and Delahunt, 2017). This involves the process of coding the overall data that led to identifying and reviewing the key themes. Each theme was inspected to gain an insight into participants' perceptions and motivations. Subsequently, the initial theme is generated and then reviewed to define the main themes and sub-themes.

Table 1. Demographic profile of participants.

No.	Participant (Pseudo name)	Gender	Age	Acre
1	Ronaldo	Male	62	0.40
2	Adam	Male	55	1.60
3	Zayn	Male	45	0.20
4	Abdel	Male	40	1.20
5	Shane	Male	75	2.47
6	Mikael	Male	64	0.10

3. Results and discussion

The analysis of qualitative data has revealed that all six participants expressed that they have enhanced their knowledge in four major themes: pepper variety, new invention, pest and disease management and pepper planting management through knowledge transfer.

3.1 Pepper variety

The participants experienced knowledge enhancement by joining the extension programme. Three participants agreed that information about variety was useful. They shared how these recommended varieties help to increase pepper productivity. They also found out that there is a lot of variety of pepper that exists.

"From the Malaysian Pepper Board extension programme, I received the latest information about the good pepper varieties. We were recommended to plant Semengok Aman, Semengok Perak, and Kuching varieties. These three varieties are more resistant to diseases and produce more berries". (Zayn)

"I initially did not know the advantages of each pepper variety. After attending the program, I have opened up my mind that different varieties have different resistance and benefits. When I was at a younger age, I just followed what my mother-in-law taught me, and she never gave me any information about the function of various varieties". (Mikael)

"I only used one pepper variety in the past, and I don't even know that there are many types of pepper varieties. I planted pepper based on my father's knowledge, as long as the pepper is in good condition, I can use it. After joining the programme, I finally explored that there was a lot of variety that I could use. Now I only use varieties that are recommended by the Malaysian Pepper Board, and it helps increase my pepper productivity". (Shane)

3.2 New invention

New inventions had been introduced to increase pepper productivity. The participants acknowledged that they learn about new inventions which helped the farmers a lot, especially in producing quality berries.

"In Vietnam, we have been informed that they use brick as support, but in Malaysia, we use W-

Table 2. Interview questions, prompts and responses.

Interview Guide Questions and Prompts	Theme	Respondents					
		Ronaldo	Adam	Zayn	Abdel	Shane	Mikael
What is the impact of the knowledge transfer that you gained? • Specific examples of knowledge gained • How has it influenced your work or perspective	Pepper variety			/		/	/
	New invention	/	/		/	/	/
	Pest and disease management	/	/	/	/	/	/
	Pepper planting management	/	/	/	/	/	

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configuration. It needed 3 wooden sticks, and Belian is preferable. This new support helps me to increase more berries and helps farmers like us". (Adam)

Another participant shared that there is digital technology that has been introduced to them during the extension programme.

"Nowadays, everyone is using smartphones, which is more convenient. The Malaysian Pepper Board had introduced an application called NutriLada. The application helps by giving information about pepper nutrient requirements and pepper management; thus, this new invention is helping farmers to overcome certain problems in the fields. I downloaded this application after attending the extension programme conducted by the Malaysian Pepper Board". (Mikael)

Another participant shared the effectiveness of the W -configuration.

"I did try this new invention, W-configuration, in my field. I just tried with one to find out if it is effective or not. For the rest, I am using normal support. As a result, W-configuration did produce a lot of berries as compared to normal support". (Abdel)

3.3 Pest and disease management

Participants acknowledged that the programme makes them familiar with how to identify pests and diseases that are affecting their pepper.

One participant informed that the Agriculture Department enrolled him directly on an extension programme conducted by the Malaysian Pepper Board due to the pest and disease issues in his pepper farm.

"After reporting the issue of pest and disease in his farm to the Agriculture Department, they enrolled me on the programme, which helped me a lot. I can identify the problem. Before this, there was a white root disease problem attacking my pepper farm. Before, I was unable to identify the problem by myself. After enrolling in the extension programme, I know what the problem is with the pepper and how to identify white root disease". (Shane)

Another participant acknowledged the importance of an extension program to overcome the issues with the good qualities of pepper berries.

"I am concerned with the qualities of the pepper berries on my farm, but thankful due to participating in the extension programme, I know how to manage the crop properly. Good management at the farm will prevent the crop from pests or any disease". (Mikael)

Interestingly, another participant, Adam, admitted the importance of knowledge in pest and disease management of the crop to the farmers.

"It is compulsory to apply a proper amount of pesticide to prevent the pest from becoming immune to the pesticide. As a farmer, I should know how to identify the pest, aware of the danger of the pest. In my field, I applied the proper amount of pesticide to prevent unwanted things from happening. It also helps me minimise the cost of plant defects. Although I am an old farmer, with an extension programme, it helps me a lot in identifying pests properly. Before, I just used my instinct and applied a traditional method on how to control any pest infestation". (Adam)

It was apparent that the farmer without the proper knowledge might do things differently. Abdel is one of the participants who admitted that he always makes assumptions in managing his pepper farm due to a lack of knowledge.

"Previously, I thought that pepper plants which turned yellowish were due to a lack of fertiliser. After joining the extension programme, I found out that pests like mites and aphids will suck the nutrients and water from the plants, which causes the leaves to turn yellowish. Once I know the real cause, then I can treat the plants properly, for instance, in this case, it can be treated with an insecticide". (Abdel)

Another two participants agreed that the extension programme helped to improve their knowledge of the old method and the new ones.

"The old method, I was just concerned with the pest which physically attacked the plant. But now I'm aware that it is not only pests but also diseases we need to tackle and control". (Ronaldo)

"I usually applied the traditional method, which was inherited from the older generation. However, the extension programme gave me more information on how to deal with pests and diseases effectively. Now I know what I should do first if there is a symptom of disease or an attack by a pest". (Zayn)

3.4 Pepper planting management

Proper pepper planting management will improve or maintain optimum plant performance. One of the participants agreed that a good knowledge of pepper planting management will lead to good-quality pepper production.

"Starting from planting until harvesting, it is important to maintain the drainage system. What I'm trying to highlight is that to get a good quality of pepper,

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there must be a good drainage system, a correct planting distance which is within 2.5 meters, proper pruning, and proper fertiliser application". (Shane)

Three participants acknowledged that good knowledge of pepper planting management can increase their income.

"I used the information that I gained from the extension programme repeatedly until I was used to it. It also helps me to join a programme called "1 AZAM", where I got my incentive from the Malaysia Pepper Board. I sold my pepper berries to them as I met their requirements, and I managed to produce quite a high volume now". (Abdel)

"Good pepper management leads to higher output, in terms of return and satisfaction. It was worth my time to join the extension programme before and then also apply the knowledge. I can support my family with the income I have generated". (Adam)

"Managing proper plant seedlings from the nursery is important. This is what I gained from the extension programme. The seedling process had been done carefully. For instance, how many nodes should I get for my seedling? It was suggested by the Malaysia Pepper Board that the seedling should have 4 nodes to make a good quality seedling, and some of the seedlings I sold as my side income". (Zayn)

4. Discussion

Improvement of knowledge is important because it increases the capacity for strategic thinking, innovative exploration and advancement of knowledge. This study has found that knowledge transfer programs by the extension officers have benefited the pepper farmers in four areas: enhanced knowledge of pepper varieties; increased awareness of the latest pepper farming technology; improved understanding of pest and disease management of pepper; and better insight of pepper planting management. In 2010, World Intellectuals stated that one of the reasons why many developing countries have poor agricultural performance is the lack of progress in improving the performance of traditional plant varieties over the centuries. This indicates that farmers should be exposed to the knowledge regarding plant varieties in their field to ensure that they know the types that are most suitable for their environments. This is where the role of extension officers in facilitating knowledge transfer programs is as a platform for providing such information to pepper farmers. Local farmers are recommended to plant pepper varieties such as Semengok Aman, Semengok Perak, and Kuching varieties. This variety is recommended to the participant during the extension programme, which helps to improve their pepper productivity. Next, this study has found that the local pepper farmers in the area gained awareness of the latest pepper farming technology via means of knowledge transfer provided by the extension officers. Past studies have indicated that extension can reduce productivity differentials amongst farmers by accelerating technology transfer, increasing farmers' knowledge, and assisting them in improving their farm management practices (Feder *et al*., 2004). For instance, a new farming technology introduced to participants called W-configuration had helped in increasing pepper productivity in the study area. Furthermore, the W-configuration cultivation method was developed to ensure high production whilst maximising land use in pepper farms (Sivaraman, 1987). Jain *et al*. (2009) also claimed that agricultural technologies include all kinds of improved techniques and practices that affect agricultural output growth. This study indicates that the knowledge transfer programs have enlightened the farmers about new farming techniques that can produce better-quality berries. Moreover, the use of digital technology that provides current information on pepper nutrient requirements and pepper management has helped farmers manage their crops. This finding supports Leeuwis *et al*. (2006) that inventions play an important role in the development of agricultural systems and as a driver of innovation for sustainable agricultural development. The subsequent finding of this study is related to how knowledge transfer has benefited the farmers in terms of enhancing their knowledge of pest and disease management. The farmers informed that prior to the knowledge transfer programs, they were not familiar with identifying the pests and diseases that commonly attack their pepper crops, but after attending several programs by the extension agencies, they are more aware of these issues. According to Munyuli *et al.* (2017), empowering farmers with knowledge about insect pests is essential for the reduction of pesticide misuse and uptake of more environmentally friendly approaches like Integrated Pest Management and related strategies (climate-smart and Bt-varieties).

Pepper planting management is another benefit of the knowledge transfer provided by relevant agencies, as perceived by the pepper farmers. With such knowledge, they can produce quality peppers for the market, which indirectly improves their income. This finding supports Khan *et al*. (2012) that agricultural extension services have been shown to build farmers' agricultural knowledge and skills, disseminate new technology and change farmers' attitudes. Most of the farmers claimed that proper pepper planting management can increase pepper productivity and also alleviate their pepper revenue. Moreover, Manevska-Tasevska (2013) also

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argued that farmers who can handle and have proper knowledge of farm management seem to generate better economic performance than others who do not possess such knowledge.

5. Conclusion

To improve agricultural productivity, it is important to enhance accessibility, usage, and creation of knowledge, which are contributed by an effective agricultural knowledge flow. Furthermore, the flow of agricultural knowledge among farmers is facilitated by knowledge exchange and transfer. This research gives good background information about the influence of knowledge transfer on farmers' knowledge of pepper cultivation. The extension programme conducted with the participants somehow imparts their knowledge in pepper variety, new inventions, pest and disease management and pepper planting management. Agricultural knowledge should be repackaged using appropriate strategies for it to be shareable, exchangeable, and understandable. Moreover, to enhance a consistent flow of agricultural knowledge among farmers, the surrounding community, stakeholders, and relevant organisations should play significant roles. In emphasising the roles of stakeholders, every agricultural stakeholder should participate in organising agricultural knowledge-related programs to improve the accessibility, exchange, spreading, and use of agricultural knowledge.

Conflict of interest

The authors declare no conflict of interest.

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