Developing the Capability of Community Innovator in Managing Waste Agricultural By-products in Chiang Rai Province

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Abstract

This research aims to generate income for communities from waste Agricultural By-products and evaluate changes in social knowledge and technology, using the Learning Innovation Platform (LIP) concept and creating collaborative Learning Spaces. The target group for this research is longan farmers in areas facing recurring burning problems and poverty in Mae Suay and Wiang Pa Pao districts, Chiang Rai province. Fifty community innovators were selected from 10 sub-districts to participate in three practical training activities: constructing low-pollution wood vinegar and charcoal kilns, product quality inspection, and marketing. Research findings show that (1) communities gained a total additional income of 103,140 baht from 191 uses of the charcoal kilns over 4 months, with each community experiencing varying increases in income; (2) the Societal Readiness Level (SRL) of the community innovators increased from level 1 to level 4 across all dimensions: collaboration networks, knowledge and technology, and community learning process management. Community innovators became capable of mobilizing local resources, adapting technology to their traditional knowledge, and functioning as learning facilitators. This research demonstrates success in generating income and developing community potential through efficient management of waste agricultural by-products. Before researching, the Societal Readiness Level (SRL) of community innovators was at level 1: which means community innovators were aware of waste agricultural by-product management uneducated problems. They could analyze problem root causes and jointly determine guidelines for solving community problems.

After researching, the Societal Readiness Level (SRL) of community innovators is at level 4: which means as follows 1) Community innovators have waste agricultural by-product management knowledge and skills. Start by collecting branches of various sizes obtained from pruning longan trees and then request burn permission by registering in the Burn Check application every time before using the kiln. 2) Community innovators have the knowledge and skills to construct and use a low-pollution wood vinegar and charcoal kiln. and 3) Community innovators have marketing and organizing groups into community enterprises' knowledge and skills.

Keywords: 1) capability developing 2) community innovator 3) management 4) Chiang Rai province

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Introduction

Chiang Rai Province has an area of 245,311 rai of longan orchards and a longan production of 109,796 tons (Office of Agricultural Economics, 2022) ranking fourth in the country after Chiang Mai, Lamphun, and Chanthaburi. When examining the area of longan orchards by district, it is found that Mae Suai District has the largest area of longan orchards, with 69,019 rai, followed by Thoeng District with 33,128 rai, Phaya Mengrai District with 25,399 rai, and Wiang Pa Pao District with 22,291 rai. Each year, after the longan harvest season from July to September, longan farmers prune the branches to increase production for the following year. This results in a large number of longan branches of varying sizes. An average of 459 kilograms of longan branches can be obtained per rai of a longan orchard (Sasujit, Homduang and Dussadee, 2014, p. 126). Consequently, Chiang Rai Province generates approximately 112,597.749 tons of waste agricultural by-products (longan branches) annually. These by-products can be managed to add value and generate income for longan farmers. However, in the past, most longan farmers have lacked the technical knowledge to manage these waste agricultural by-products (longan branches) and often burn them in the open, contributing to increased problems of smoke and particulate matter (PM2.5) in the air in Chiang Rai Province.

The management of waste agricultural by-products (longan branches) began due to longan farmers in Chiang Rai Province facing issues with the quality of longan not meeting standards, high production costs, low product prices, natural disasters, and a lack of knowledge about effectively managing available resources. This situation led to longan farmers having income barely sufficient to cover household expenses, resulting in increased debt. Therefore, in this research, the research team organized a Focus Group discussion with stakeholders who are similar in characteristics (homogeneous) (Teerawithayalers, 2016, p. 286) including district officers, community leaders, longan farmer leaders, Chiang Rai Agricultural Occupation Promotion and Development Center staff, and district agricultural officers. The results of the Focus Group discussion revealed that longan farmers expressed a need for knowledge that aligns with the local context. Specifically, longan farmers wanted to utilize the large quantities of waste agricultural by-products to create added value and increase their income.

Subsequently, a training program was designed to enhance the capabilities of community innovators in managing agricultural by-products, consisting of three activities: 1) Providing knowledge on building low-pollution wood vinegar charcoal kilns, 2) Teaching techniques for collecting and inspecting the quality of wood vinegar and charcoal, and 3) Providing knowledge on community enterprises and marketing wood vinegar.

In transferring knowledge to community innovators, the research team possesses expertise and technology in low-pollution, portable wood vinegar charcoal kilns, which are at a Technology Readiness Level (TRL) of 5. The research team has completed the construction and real-world testing of these

kilns. It is thus prepared to apply this technology in target areas through collaboration with various stakeholders, including longan-growing communities, the Chiang Rai Agricultural Promotion and Development Center, and local government organizations. The shared goal is to develop innovations that can increase community income and help reduce burning that contributes to PM 2.5 problems in the area. Regarding the readiness of longan farmers in terms of knowledge and social technology (Societal Readiness Level: SRL), community innovators are at Level 1. This means that longan farmers have knowledge, skills, expertise, and local wisdom in using longan branches, lychee branches, jackfruit branches, santol branches, tamarind branches, mahogany branches, mango branches, etc., from pruning for household charcoal production. Some communities can even produce wood vinegar, but they lack knowledge and skills in measuring and inspecting the quality of wood vinegar and marketing it. The community is ready to integrate existing knowledge with new knowledge from the research team and is aware of the need for knowledge in managing waste agricultural by-products (longan branches). The development of community innovators' capabilities in managing waste agricultural by-products (longan branches) in this research relies on the creation of knowledge and a learning model using innovation (Learning Innovation Platform: LIP) to transfer knowledge into practical applications. This approach aims to develop community innovators with the ability to learn and adapt innovations and to use the knowledge gained to address and manage community issues related to improving quality of life, economic conditions, and environmental sustainability. The process involves: Upstream: Creating low-pollution, smokeless wood vinegar kilns. Midstream: Producing and inspecting the quality of wood vinegar and charcoal. Downstream: Forming community enterprises and marketing wood vinegar.

This approach helps communities increase their income and leads to positive changes in the local economy sustainably. It follows the Community-Based Development Approach, which promotes self-management and strengthens the community, offering an important solution to address farmers' poverty (Community Organizations Development Institute (Public Organization), 2022, p. 25).

The development focuses on the specific problems and environmental conditions of each area, addressing the farmers' lack of knowledge by utilizing new technologies for self-reliance that yield tangible results. This ensures sustainable and environmentally friendly development (Sukoun, 2022, p. 295) and aligns with the government’s strategic plan for strengthening communities for the years 2022-2027.

Objectives

1. To develop the capabilities of community innovators in managing agricultural by-products.

2. To evaluate the changes in community innovators.

Research Framework

The target group for this research involves the selection of specific community innovators based on criteria related to the geographic characteristics of community innovators. This includes longan farmers who are already organized in groups within the area and wish to enhance their management capabilities with knowledge and innovation.

The research focuses on the following areas: Mae Suai District - 7 sub-districts: Ban Pong Pufuang Community, Mae Suai Sub-district, Ban Huay Mo Thao Community, Chedi Luang Sub-district, Ban Hua Thung Community, Mae Prik Sub-district, Ban Don Kaew Community, Tha Ko Sub-district, Ban Huay Hea Community, Si Thoet Sub-district, Ban Thung Phrao Community, Wawee Sub-district, Ban San Khong Community, Pa Daet Sub-district

Wiang Pa Pao District - 3 sub-districts:

Ban Pa Chan Community, Wiang Ka Long Sub-district, Ban San Sali Community, San Sali Sub-district, Ban Pa Sak Community, Pang Ngiew Sub-district

In total, 10 communities from 10 sub-districts, with 5 people from each sub-district, totaling 50 community innovators. The research will be conducted in 3 steps: 1) Study the local context of community innovators. 2) Develop the capabilities of community innovators. 3) Evaluate the changes in community innovators.

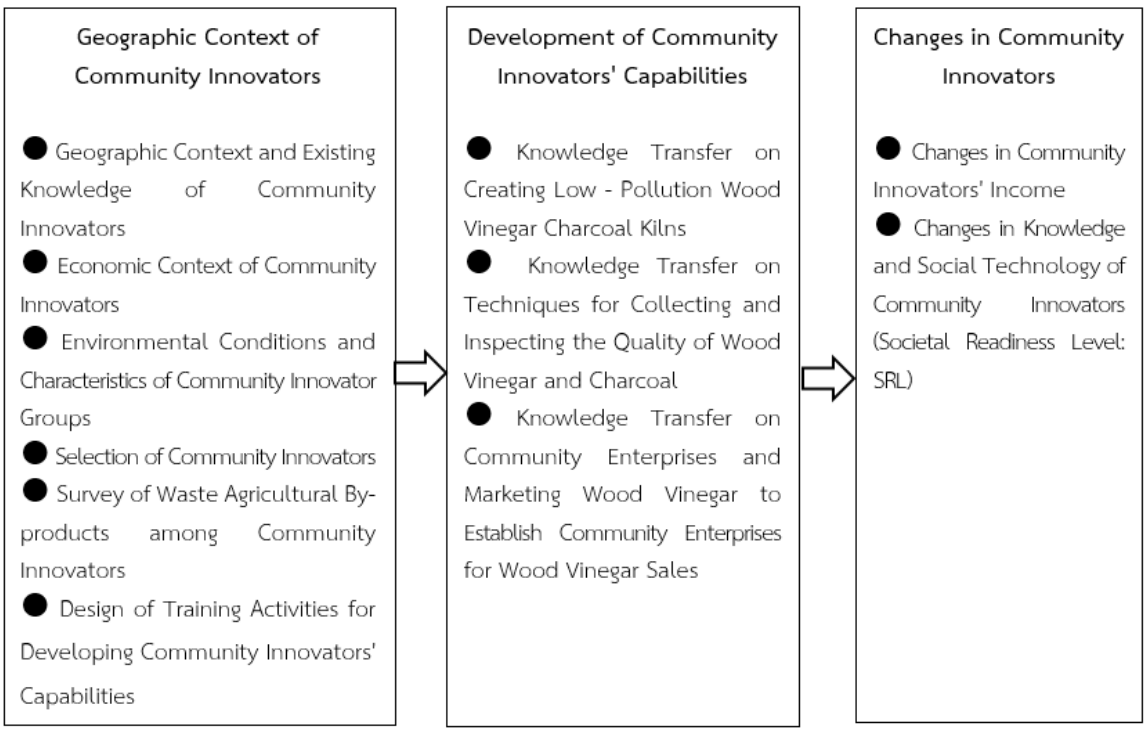

Figure 1 A research framework for developing the potential of community innovators in the management of agricultural by-products.

Literature Review

Development of Community Innovators' Capabilities in Managing Waste Agricultural By-products through 3 Practical Training Activities, which are:

Activity 1: Knowledge Transfer on Creating Low-Pollution Wood Vinegar Charcoal Kilns

This activity is based on the concept from the Technology Transfer Office, Department of Alternative Energy Development and Efficiency (2007, pp. 34-37) which involves using a 200-liter drum to create low-pollution wood vinegar charcoal kilns. The process of producing charcoal and wood vinegar from these kilns, as described by the Technology Transfer Office, Department of Alternative Energy Development and Efficiency, reveals that many stages release a significant amount of smoke, especially during the carbonization process (the conversion of wood into charcoal).

The smoke emitted contains toxic and flammable gases, such as hydrogen (H_2), carbon monoxide (CO), and methane (CH_4). These gases not only impact human health but also contribute to the greenhouse effect, which is a key factor in global warming.

Activity 2: Knowledge Transfer on Techniques for Collecting and Inspecting the Quality of Wood Vinegar and Charcoal

This activity is based on the concept from the Industrial Standards Institute (2010) Standard No. 1592 (B.E. 2553). Wood vinegar (also known as pyroligneous acid) must be tested for its pH level and specific gravity to meet the criteria outlined in the Wood Vinegar Standard, MOC 659/2010.

Activity 3: Knowledge Transfer on Increasing Community Innovators' Income through Marketing Using the 4 P's and Social Media

This activity is based on the marketing mix concepts by Kotler and Armstrong (2011, p. 38). Marketing relies on the fundamental components of the 4 P's, which are: Product, Price, Place, and Promotion.

The training will cover strategies for leveraging these elements and utilizing social media platforms to enhance market reach and increase income for community innovators.

Methods

1. Methods to Achieve Objective 1: To Develop the Capabilities of Community Innovators in Managing Agricultural By-products.

1.1 Study the geographic context of Community Innovators: 1) Study the geographic context and existing knowledge of community innovators. 2) Study the economic context of community innovators. 3) Study the environmental conditions and grouping characteristics of community innovators. 4) Select community innovators in the target communities to serve as models. 5) Survey the waste agricultural by-products of community innovators. 6) Design the curriculum/activities for practical training for community innovators.

1.2 Organize Practical Training Workshops to Transfer Knowledge to Community Innovators, consisting of 3 activities: 1) Knowledge transfer on constructing low-pollution wood vinegar and charcoal kilns. 2) Knowledge transfer on techniques for collecting and

inspecting the quality of wood vinegar and charcoal. 3) Knowledge transfer on community enterprises and marketing wood vinegar.

2. Methods to Achieve Objective 2: To Evaluate The Changes in Community Innovators.

2.1 To Evaluate Community Innovators' Income Changes.

2.2 To Evaluate Community Innovators' Knowledge and Social Technology (Societal Readiness Level: SRL) Changes.

Results

1. Result related to objective 1: To develop the capabilities of community innovators in managing waste agricultural by-products.

1.1 The result of the geographic context of community innovators:

1) Result of the geographic context and existing knowledge of community innovators: (1) The study revealed that community innovators are engaged in the cultivation of longan, corn, and rice, resulting in a significant amount of waste agricultural by-products in the area, such as various sizes of longan branches, corn stalks, and rice straw. For corn stalks and rice straws, community innovators generally incorporate them into the soil to enrich it. Small longan branches are burned in the open air, while larger longan branches are used as firewood for households or sold to tobacco curing and longan drying factories at a rate of 0.50 - 1 baht per kilogram. (2) Some community innovators possess knowledge of using traditional clay kilns for charcoal production, which emit a large amount of smoke. Each charcoal burning process takes 2-3 days, contributing to local smog and dust issues. (3) Community innovators lack knowledge on how to manage waste agricultural by-products to add value. (4) Community innovators also lack knowledge on producing wood vinegar and charcoal, as well as on testing the quality of these products. (5) All community innovators expressed a need for knowledge to add value to waste agricultural by-products and generate income for their communities.

2) The result of the economic context of community innovators: The study found that the 10 communities across 10 sub-districts have similar occupations, primarily engaging in agriculture by cultivating longan, corn, and rice paddies. The produce is used for household consumption and sold locally. Additionally, some communities produce and sell charcoal using traditional clay kilns, raise fish in ponds to reduce food costs and undertake general labor work. The average household income for community innovators is less than 3,000 baht per month, indicating an imbalance between income and expenses

3) The result of the environmental conditions and grouping characteristics of community innovators: The study revealed that before the research, some community innovators had already formed groups for their occupations. For example: The community of Ban Hua Tung, in Mae Prik Sub-district, had organized itself into a self-sufficient economic group. The community of Huai Mo Thao, in Chedi Luang Sub-district, had formed a group of longan farmers focused on producing compressed longan charcoal. The community of Ban Pa Chan, in Wiang Ka Long Sub-district, had established a group for agricultural career

development. Other community innovators had loosely organized themselves to assist each other in agricultural activities, such as cooperative labor for rice farming and pooling agricultural products for sale.

4) The result from the selection of community innovators to serve as models: The selection of community innovators to serve as models in the target communities was carried out with the assistance of the Mae Suai District Chief, the Wiang Pa Pao District Chief, village heads, and local leaders. 5 innovators were selected from each community. In Mae Suai District, 7 communities across 7 sub-districts had a total of 35 selected innovators. In Wiang Pa Pao District, 3 communities across 3 sub-districts had a total of 15 selected innovators. In total, 50 community innovators were selected from 10 communities across 10 sub-districts.

5) The result from the community innovators' waste agricultural by-products survey: (1) The results from the community innovators' waste agricultural by-products post-harvest quantity (longan branches) survey: are illustrated in Figure 2.

Figure 2 Results of the community innovators' waste agricultural by-products post-harvest quantity (longan branches)

(2) The result of the community innovators' waste agricultural by-products quantity estimation is the following results: 1) An area of 1 rai planted with longan trees produces approximately 625 kilograms of longan branches from pruning. 2) An area of 1 rai planted with corn produces about 500 kilograms of corn stalks. 3) An area of 1 rai planted with rice yields approximately 600 kilograms of rice straw.

Therefore, for a total of 50 community innovators, the cumulative waste agricultural by-products are as follows: 1) A total of 406,625 kilograms of longan branches, which can be managed to increase value and generate income for the community innovators. 2) A total of 71,500 kilograms of corn stalks, are entirely used as soil amendment after harvesting. 3) A total of 83,400 kilograms of rice straw, which is also entirely used as soil amendment after harvesting. These findings are illustrated in Table 1.

Table 1 Estimation of the amount of waste agricultural by-products used by community innovators.

No.	Community	Innovator (person)	Area of longan cultivation (Rai)/ Amount of waste agricultural by-products (kg.)	Area of corn cultivation (Rai)/ Amount of waste agricultural by-products (kg.)	Area of rice cultivation (Rai)/ Amount of waste agricultural by-products (kg.)
1	Ban Pong Pufuang Community, Mae Suai Sub-district	5	76/47,500	76/47,500	-
2	Ban Huay Mo Thao Community, Chedi Luang Sub-district	5	90/56,250	90/56,250	-
3	Ban Hua Thung Community, Mae Prik Sub-district	5	39/24,375	39/24,375	30/15,000
4	Ban Don Kaew Community, Tha Ko Sub-district	5	144/90,000	144/90,000	4/2,000
5	Ban Huay Hea Community, Si Thoet Sub-district	5	87/62,875	87/62,875	17/8,500
6	Ban Thung Phrao Community, Wawee Sub-district	5	20/12,500	20/12,500	11/5,500
7	Ban San Khong Community, Pa Daet Sub-district	5	80/50,000	80/50,000	13/6,500
8	Ban Pa Chan Community, Wiang Ka Long Sub-district	5	23/14,375	23/14,375	18/9,000
9	Ban San Sali Community, San Sali Sub-district	5	67/41,875	67/41,875	34/17,000
10	Ban Pa Sak Community, Pang Ngiew Sub-district	5	11/6,875	11/6,875	16/8,000
	Total	**50**	**637/406,625**	**143/71,500**	**250/150,000**

Source: The survey of agricultural areas and the amount of waste agricultural by-products of community innovators.

6) The result of designing a curriculum/ workshop for community innovators: The design of the curriculum and workshop activities for community innovators was developed based on interviews and focus group discussions with community innovators from 10 communities across 10 sub-districts. This included discussions with community leaders, longan farmers' leaders, directors and staff from the Chiang Rai Agricultural Occupation Promotion and Development Center, district agricultural officers, and local government officials.

The design process revealed that Longan farmers expressed a need for knowledge that aligns with their local context. Specifically, they wanted to add value to the waste agri-

cultural by-products in their area and increase their income. As a result, a curriculum was created to develop community innovators with the following components: 1) Knowledge transfer on constructing low-pollution wood vinegar and charcoal kilns. 2) Knowledge transfer on techniques for collecting and testing the quality of wood vinegar and charcoal. 3) Knowledge transfer on community enterprise organizing and marketing of wood vinegar products.

1.2 Results from the practical training workshops for community innovators

1) The result of the knowledge transfer on constructing low-pollution wood vinegar and charcoal kilns is as follows: A total of 50 community innovators from all 10 communities in 10 sub-districts participated in this activity. The results of the training indicated that all community innovators were able to independently construct low-pollution wood vinegar and charcoal kilns, with each community setting up 1 to 2 kilns. The kilns were inspected for accuracy by a mechanical engineering team from Chiang Rai College. The community innovators' satisfaction showed at a very high level, with an average rating of 4.65 and a standard deviation of 1.45 illustrated in Figure 3.

Figure 3 Workshop on knowledge transfer in building low-pollution wood vinegar charcoal kiln.

2) The result of knowledge transfer on techniques for collecting and testing wood vinegar and charcoal quality is as follows: A total of 50 community innovators from all 10 communities in 10 sub-districts of Mae Suay and Wiang Pa Pao participated in this activity. The results of the training revealed that all community innovators gained knowledge of the techniques for collecting wood vinegar, including skills in using digital pH meters and specific gravity meters to test wood vinegar quality according to community product standards. They also acquired skills in testing charcoal quality using a digital multimeter for electrical current. The community innovators were evaluated by the mechanical engineering team from Chiang Rai College and successfully passed the test.

The satisfaction in knowledge transfer activity on techniques for collecting wood vinegar and testing its quality according to community product standards from 50 community innovators showed at the highest level with the average rating was 4.75, with a standard deviation of 1.85, as illustrated in Figure 4 and 5.

Figure 4 Workshop on knowledge transfer on collection techniques and quality testing of wood vinegar and charcoal

Figure 5 Quality testing of wood vinegar and charcoal activity

3) Results of knowledge transfer on community enterprise organizing and marketing of wood vinegar: A total of 50 community innovators from all 10 communities in 10 sub-districts of Mae Suay and Wiang Pa Pao participated in this activity. The results of the training revealed that all community innovators understood how to register as a community enterprise, and they grasped the concepts of sales and pricing very well, as measured by a questionnaire. The satisfaction evaluation of the 50 community innovators showed the highest level with the practical training on community enterprise knowledge and marketing of wood vinegar. The average satisfaction rating was 4.80, with a standard deviation of 1.75, as illustrated in Figure 6.

Figure 6 Workshop on knowledge transfer of community enterprises and marketing of wood vinegar and charcoal.

2. Results of objective 2: Evaluating the changes in Community Innovators

2.1 The community innovators' income changes: Before the research project, community innovators had no income from the sale of charcoal and wood vinegar. Thus, any changes in income were measured based on the earnings post-project implementation. The changes in income were assessed after community innovators began managing agricultural waste (longan branches) by processing it in low-pollution wood vinegar kilns over time as illustrated in Table 2 and Figure 7.-9.

Table 2 Period for management of waste agricultural by-products (longan branches)

Activity	Period	Action
Early keep	1 Sept.-15 Oct.	Pruning longan branches and storing them in storage.
Early Burn Round 1	16 Oct.-14 Feb.	1. Cut the prepared longan branches into 10-15 cm lengths.
		2. Put the longan branches into the kiln to produce wood vinegar and charcoal.
		3. The charcoal obtained can be sold.
		4. Keep the wood vinegar obtained to settle for 45-90 days.
Forbidden burn	15 Feb.-30 Apr.	1. Check the quality of wood vinegar that has been stored for 45-90 days to settle according to community product standards.
		2. Pack the wood vinegar product and sell it.
Early Burn Round 2	1 May-31 Aug.	1. Cut the prepared longan branches into 10-15 cm lengths.
		2. Put the longan branches into the kiln to produce wood vinegar and charcoal.
		3. The charcoal obtained can be sold.
		4. Keep the wood vinegar obtained to settle for 45-90 days.
		5. Check the quality of wood vinegar that has been stored for 45-90 days to settle according to community product standards.
		6. Pack the wood vinegar product and sell it.

Figure 7 Management of waste agricultural by-products (longan branches) by burning them in a low-pollution wood vinegar and charcoal kiln.

Figure 8 Products made from waste agricultural by-products

Picture 9 Community shop selling wood vinegar and charcoal products.

The community innovators' income changes resulted from their use of low-pollution wood vinegar and charcoal kilns, which were operated a total of 191 times. Each operation generated an actual income of 540 baht, totaling 103,140 baht over four months (from November 2023 to February 2024). The income was derived from sales in various outlets including local communities, community shops, restaurants, BBQ restaurants, organic rice farmers, and orange farmers. Each sale of wood vinegar and charcoal was recorded in a cash flow log, and the revenue was promptly distributed among the community enterprise groups. Financial management of the community enterprises was handled by designated community innovators in each community, as detailed in Table 3.

Table 3 Results of community innovators' income changes.

No.	Community	Longan Branch Quantity of Innovator Group (kg)	No. of times that can be burned (use of incinerator)	Product obtained	Income Per time	Total income estimate	Times of use the incinerator	Economic Impact of Community Innovators (Baht)
1	Ban Pong Pufuang Community, Mae Suai Sub-district	47,500	528	Wood vinegar	300	285,000	15	8,100
				Charcoal	240			

No.	Community	Longan Branch Quantity of Innovator Group (kg)	No. of times that can be burned (use of incinerator)	Product obtained	Income Per time	Total income estimate	Times of use the incinerator	Economic Impact of Community Innovators (Baht)
2	Ban Huay Mo Thao Community, Chedi Luang Sub-district	56,250	625	Wood vinegar	300	337,000	27	14,580
				Charcoal	240			
3	Ban Hua Thung Community, Mae Prik Sub-district	24,375	271	Wood vinegar	300	146,000	25	13,500
				Charcoal	240			
4	Ban Don Kaew Community, Tha Ko Sub-district	90,000	1,000	Wood vinegar	300	540,000	24	12,960
				Charcoal	240			
5	Ban Huay Hea Community, Si Thoet Sub-district	62,875	699	Wood vinegar	300	377,000	21	11,340
				Charcoal	240			
6	Ban Thung Phrao Community, Wawee Sub-district	12,500	139	Wood vinegar	300	75,000	10	5,400
				Charcoal	240			
7	Ban San Khong Community, Pa Daet Sub-district	50,000	556	Wood vinegar	300	300,000	23	12,420
				Charcoal	240			
8	Ban Pa Chan Community, Wiang Ka Long Sub-district	14,375	160	Wood vinegar	300	86,200	20	10,800
				Charcoal	240			
9	Ban San Sali Community, San Sali Sub-district	41,875	465	Wood vinegar	300	251,000	18	9,720
				Charcoal	240			
10	Ban Pa Sak Community, Pang Ngiew Sub-district	6,875	76	Wood vinegar	300	41,200	8	4,320
				Charcoal	240			
	Total					**2,438,400**	**191**	**103,140**

2.2 The result from the community Innovators' Societal Readiness Level (SRL) changes assessment.

Before researching, the Societal Readiness Level (SRL) of community innovators was at level 1: which means community innovators were aware of waste agricultural by-product management uneducated problems. They could analyze problem root causes and jointly determine guidelines for solving community problems.

After researching, the Societal Readiness Level (SRL) of community innovators is at level 4: which means as follows 1) Community innovators have waste agricultural by-product management knowledge and skills. Start by collecting branches of various sizes obtained from pruning longan trees and then request burn permission by registering in the Burn Check application every time before using the kiln. 2) Community innovators have the knowledge and skills to construct and use a low-pollution wood vinegar and charcoal kiln. and 3) Community innovators have marketing and organizing groups into community enterprises' knowledge and skills.

Conclusion and Discussion

1. Conclusion of the Research

1.1 Conclusion of developing the capability of community innovators in managing waste agricultural by-products in Chiang Rai Province.

The results show that community innovators have used the low-pollution wood vinegar and charcoal kilns a total of 191 times, generating a total income of 103,140 Baht from November 2023 to February 2024, over 4 months. The actual income was derived from sales within the community, including community stores, restaurants, BBQ restaurants, organic rice farmers, and orange farmers. Each income transaction from the sale of wood vinegar and charcoal products is recorded in a cash receipt and expenditure log. The income is then immediately distributed within the community wood vinegar and charcoal enterprise group. Community innovators responsible for managing the financial aspects of the community enterprises in each community oversee this process.

1.2 Conclusion of community Innovators' Societal Readiness Level (SRL) changes.

Before researching, the Societal Readiness Level (SRL) of community innovators was at level 1, meaning that the 10 communities across 10 subdistricts were aware of the lack of knowledge in managing waste agricultural by-products. The innovators were able to analyze the causes and collaboratively determine solutions for community problems.

After researching, the Societal Readiness Level (SRL) of community innovators is at level 4: which means as follows 1) Community innovators have waste agricultural by-product management knowledge and skills. Start by collecting branches of various sizes obtained from pruning longan trees and then request burn permission by registering in the Burn Check application every time before using the kiln. 2) Community innovators have the knowledge and skills to construct and use a low-pollution wood vinegar and charcoal kiln. and 3) Community innovators have marketing

and organizing groups into community enterprises' knowledge and skills.

2. Discussion of the Research Results

In this research, the research team employed a knowledge-creation process using the Learning Innovation Platform (LIP) model. This approach aligns with the work of Wijitkul, et al. (2023, pp. 69-70) which focuses on knowledge creation and the Learning Innovation Platform (LIP) model to build and disseminate knowledge. This research involved creating networks across 11 sub-districts with community forests that are deciduous, mixed dry dipterocarp, and mixed deciduous forests. This research analyzed the issues related to forest fires, their causes, and the economic impacts on communities to develop a shared learning center (Learning Space).

The findings are consistent with the report by the Community Technology Division, Department of Science Services (2022, p. 33), which detailed the development of wood vinegar products. The report highlighted that the community enterprise in Nakhon Si Thammarat could significantly increase its income from wood vinegar production. Before the project, production was approximately 22.5 liters per month for 120 baht per liter, totaling 2,700 baht per month. After the project, production increased tenfold to about 225 liters per month, with the same price per liter, totaling 27,000 baht per month.

These results align with Kempetch and Watanyoo (2023, p. 348), which found that when communities are supported with innovations that meet their needs, they can effectively address their problems. This results in the elevation of community innovations tailored to their specific contexts. Key success factors identified include the social context, innovation, leadership, and team efforts.

Furthermore, this research supports the findings of Sasujit, Homduang and Dussadee (2014, p. 126) who conducted participatory action research (PAR). This research revealed that community product development must build on existing community resources. For example, in Ban Nong Sai, Pa Sak Sub-district, Mueang District, Lampoon Province, where there is significant longan cultivation, the community has leveraged pruned longan branches to produce charcoal and increase the value of wood vinegar products. This has become a community product of the Ban Nong Sai Sufficiency Agriculture Learning Center in Lampoon Province.

In summary, the research illustrates that using a Learning Innovation Platform to build and disseminate knowledge can lead to substantial improvements in community practices and incomes. By aligning innovations with community needs and existing resources, significant positive changes can be achieved, as demonstrated by the successful case studies in Chiang Rai and Lampoon Province.

Recommendations and Applications of Research Findings

1. It is recommended to extend the benefits of research to longan and organic rice farmers in Chiang Rai because organic rice farming requires a significant amount of wood vinegar, which leads farmers to purchase it, thus increasing production costs. If farmers

can produce wood vinegar themselves, it will reduce production costs and lower the price of organic rice, making it more competitive in the market. Additionally, wood vinegar can be sold to other organic farming groups, such as those growing plants, vegetables, and fruits without chemicals. Wood vinegar is chemical-free, environmentally friendly, and can be used to control pests effectively. It can also be used to nourish tree trunks and plants, replacing expensive pesticides and fertilizers. By-products from burning branches can produce high-quality charcoal for household use, replacing costly cooking gas. This will reduce expenses for farmers and provide an additional source of income.

2. It is recommended to develop community leaders as innovators, such as village headmen, sub-village headmen, and health volunteers (Village Health Volunteers - VHVs).

The research findings indicate that community innovation groups lacking community leaders in their teams experienced a lack of cooperation and cohesion in their activities. Therefore, it is essential to cultivate community leaders as innovators to ensure effective collaboration and commitment to assigned tasks. These leaders should be able to integrate the knowledge and innovations shared by the research team with existing traditional wisdom. They should also be capable of coordinating with external partners to establish concrete cooperation, as well as organizing learning activities and transferring knowledge to other communities.

3. It is recommended to establish community enterprises for community innovators to ensure the sustainability of the development achieved (Exit strategy).

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