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Eco-Friendly OTOP Production for Sustainable Society: A case study of Thailand

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Abstract

The government of Thailand launched the OTOP program as a grassroots economic development strategy in 2001, and it has been functioned nationwide. However, some instances of environmental pollution occurred over a decade due to human activities. This research aimed to develop an environmental education strategy that enhance eco-friendly production and respond to the sustainability concept. The participatory action and survey research were applied. The policy makers and key informants were the target groups of this study namely; 10 policy executives, 25 entrepreneurs, and 20 OTOP representatives, meanwhile, structured-questionnaire was applied among 411 consumers. The results showed that the awareness level for pollution problems and participation in environmental conservation activities among the stakeholders were high. Majority of participants have high level of knowledge, attitude, skills and practices on eco-friendly production. The strategy based on sufficiency economy philosophy was developed, whereas four strategies with specific goals, measures, and 19 associated projects included. Expert evaluation and quality assessment were carried out, and showed that the strategy is highly rated in terms of satisfaction and confidence. As recommendations, the government agencies and stakeholders should promote targeted education and awareness programs about integrated eco-friendly OTOP production. Comprehensive learning centers, integrated budgets, initiatives for green marketing and communication strategies should be encouraged. Further in-depth research should be conducted for creative OTOP and green products to get better understanding about the overall market dynamics and respond to the sustainable concept of society.

Keywords: *One Tambon One Product (OTOP) program; eco-friendly production; environmental education strategy; sufficient economy philosophy; sustainable society.*

Introduction

The world today is facing environmental crises in multiple dimensions, both physically and socially due to changing lifestyles. Decades of creating new wealth through a "brown economy" model have failed to significantly address social exclusion and resource depletion, and remain far from attaining the Millennium Development Goals (MDG). Thus, the United Nations Environmental Protection Programme (UNEP) set the main theme for World Environment Day as "Green Economy: Does it include you?". As the core value, a green economy is a low-carbon, resource-efficient, and socially inclusive economy that improves human well-being and social equity while reducing environmental risks and ecological scarcities. The goal is to create public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services. These investments need to be supported by targeted public expenditure, policy reforms, and regulation changes to achieve sustainability (UNEP, 2011). In addition, UN launched the program of sustainable Development goal after the end of MDG in 2015 for 16 targets including the partnership in SDG target 17 that is an important key to achieve the sustainability (Department of Economic and Social Affairs, 2024).

Thailand was primarily an agricultural country, the majority of population lived in rural areas and were farmers. Throughout his reign, the King visited and studied the ways of life of his people in all regions of the country. During the visits, he witnessed the environmental degradation and the struggles of the people. These experiences leading him to analyze the causes of these issues and propose solutions for sustainable national development. His philosophy of a "Sufficiency Economy" aims for the betterment of the quality of life of people and local communities, and to achieve self-reliant and sustainable development. Theoretically, the "Sufficiency Economy Philosophy" emphasizes moderation, particularly in economic development, to keep pace with globalization (Jirasatthumb, 2017). Furthermore, the King emphasized

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"human development" in all dimensions, including health, hygiene, and education, and stressed the importance of peaceful coexistence between people, natural resources, and the environment.

In 2001, the Thai government launched the OTOP (One Tambon One Product) program as a grassroots economic development strategy, integrating efforts across government agencies to link the domestic economy with the global economy. The strategy involved changing the community's perception of their assets, such as local knowledge, culture, skills, natural resources, and agricultural products as valuable resources that could be managed wisely to increase income. And, it aims for strengthening Thailand's economic foundation to withstand future challenges. The program categorizes products into five types: (1) food, (2) textiles and garments, (3) household items, decorations, and souvenirs, (4) herbal products (excluding food), and (5) beverages. In the production process, every step has been considering to avoid the environmental damage, and environmentally friendly. According to the meaning of Tambon is the sub-district level, the operation and implementation of OTOP cannot be successful without the consideration of sustainability concept (Department of Community Development, 2020).

However, some instances of environmental pollution occurred over a decade of OTOP program implementation, whether intentional or unintentional, known or unknown. Thus, Thailand's 11th National Economic and Social Development Plan (2012-2016) emphasized to enhance the creative economy development with sustainable production and consumption. As a part of this plan, it aimed to integrate the environmental education with human resource development (HRD) processes to raise awareness and understanding of the environment among OTOP entrepreneurs and stakeholders. Environmental education is an educational process that focuses on human development, providing knowledge about world studies and future studies to appreciate the value of natural resources and the environment, and to deeply understand the relationship between humans and the environment across past, present, and future. Enhancing environmental education involves more than just awareness of ecological issues and systems; it also requires developing the cognitive skills, attitudes, and knowledge essential for effectively addressing these environmental challenges. (Llopiz Guerra et al., 2024).

Thus, this research aimed to develop an environmental education strategy model leads to eco-friendly production of OTOP products in Thailand. The following steps has been carried out; situational analysis regarding environmental problems related to OTOP product production, and development of an environmental education strategy model for eco-friendly production of OTOP products. This research was conducted among four categories of participants, (1) policy-makers or government officials who related to OTOP programs, (2) OTOP producers and entrepreneurs who registered at the Department of Community Development, Ministry of Interior, and have been selected for OTOP products rated 3-5 stars in 2012, (3) individuals who affected by OTOP production in their communities, and (4) OTOP products consumers.

Materials and Methods

Study Design and Data Collection

The research conducted by using a mixed research method (multi-instrument approach) including both quantitative and qualitative methods, and included participatory action research, research and development (R&D), and survey research. The participants were recruited according to the selection criteria by both purposive and accidental sampling methods. Qualitative method was conducted among 10 relevant policy executives, 25 community entrepreneurs, and 20 affected people who were recruited by purposive sampling method, meanwhile, quantitative method by using structured-questionnaires was applied among 411 consumers who recruited by accidental sampling method. Our consumers are the group of people representative for four regions of the country. Ethical approval for the study was obtained from the Faculty of Social Sciences and Humanities, Mahidol University (ethical approval number: COA.NO 2013/106.040). The later was carried in the central area at the OTOP Mid-Year Exhibition and Sales Fair and OTOP City, Muang Thong Thani, Pak Kret District, Nonthaburi Province and OTOP Regional Fairs in Nakhon Pathom Province, Ratchaburi Province, Nakhon Sawan Province, Songkhla Province and Ubon

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Ratchathani Province. Nonthaburi, Nakhon Pathom and Ratchaburi are located in the central region, whereas Nakhon Sawan is representative for northern region, Songkhla is representative for the southern part and the representative of northeastern region is Ubon Ratchathani.

Concept of the study and Qualitative data from in-depth

The study was conducted based on 9 theoretical concepts, such as (1) strategy development, (2) sufficient economy philosophy, (3) environmental education, (4) eco-friendly products, (5) cleaner technology, (6) intermediate technology, (7) community enterprise and cultural economic, and (8) One Tambon One Product, and (9) evaluation.

The in-dept interview was carried out to obtain the ideas and their suggestion. The in-depth structured interviews were conducted in 4 groups of informants: (1) manufacturers and entrepreneurs of specific target groups (25 participants), (2) 20 affected people in the community, (3) 10 policy makers, and (4) 30 consumers who were not the sample from the questionnaire responses.

Data Analysis

The data were analyzed by using a matrix method which integrate the qualitative and quantitative data. Triangulation and synthesizing were logically carried out to summarize the qualitative data. For quantitative results, the data were analyzed by using the SPSS Mahidol license version 23.0, and described the data with percentage, mean, frequency, and standard deviation.

Results

General characteristics of participant

Table.1 represented the general characteristics of participants, whereas 42.3% of participants were male and 57.7% were female. The majority of respondents reported being in the sales profession (57.9%), followed by farmers (35.5%), government officials (4.4%), state enterprise employees (1.2%), and company employees (1%). Regarding education, most respondents had completed secondary education (32.8%), followed by bachelor's degrees or higher (31.4%), elementary education (18.5%), associate degrees (11.2%), and others (6.1%). In concerning with social status, most of them were group chairmen or committee members (64.7%), follow by member of OTOP product group (24.3%), meanwhile, the laborer group are the least number in the study with only 3.4%.

Table 1 General characteristics of sample participants (n=411)

General information	category	Number of Participants	Percentage (%)
Gender	Male	174	42.3
	Female	237	57.7
Age	15-20 years	28	6.8
	21-30 years	82	20.0
	31-40 years	131	31.8
	41-50 years	83	20.2
	>51 years	87	21.2
Religion	Buddhism	385	93.6
	Christianity	2	0.5

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	Islam	18	4.4
	Other religions	6	1.5
Occupation	Sales	238	57.9
	Farmers	146	35.5
	Government officials	18	4.4
	State enterprise employees	5	1.2
	Company employees	4	1.0
Education Level	Elementary education	76	18.5
	Secondary education	135	32.8
	Bachelor's degree or higher	129	31.4
	Associate degrees	46	11.2
	Others	25	6.1
Social status	Chairman or committee of OTOP product group	266	64.7
	Member of OTOP product group	100	24.4
	Employee or laborer	14	3.4
	Other	31	7.5

Fig 1. indicated the product categories of the group, in which food category had the highest number of products, with 132 groups, accounting for 32.1%. After that, clothing and accessories stand in second place with 114 groups (27.7%), decorations and souvenirs with 65 groups (15.8%), non-food herbal products with 55 groups (13.4%), and beverages with 37 groups (9%) respectively.

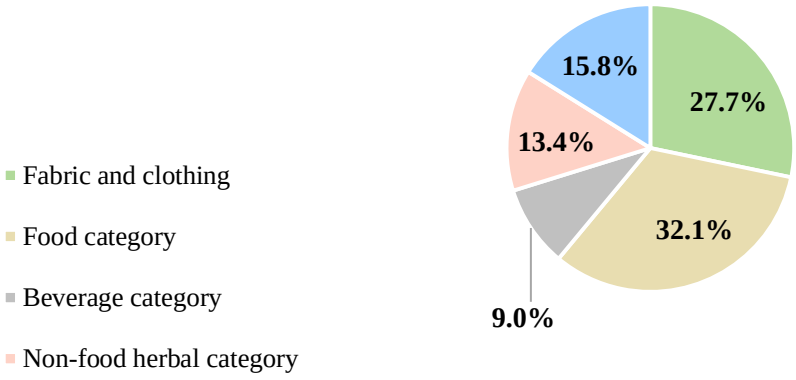

Fig. 1. The product groups of the study.

Fig. 2 illustrates the role and participation of participants in conservation of natural resources and environment in the community. Interestingly, the majority of the participants (55%) have the roles and participate sometimes, meanwhile the participants who have the role and participate regularly stood in second place with 27.3%. Among the participants who have no role and participation, the reason for health problems and lack of opportunity and time occurred as 12.8% and 4.9% respectively. In concerning with having training in promoting, restoring and conserving natural resources and the environment, 54% and

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14.4% of participants received the training in some occasional basis and regular basis, but 27% did not receive the training according to Fig.3.

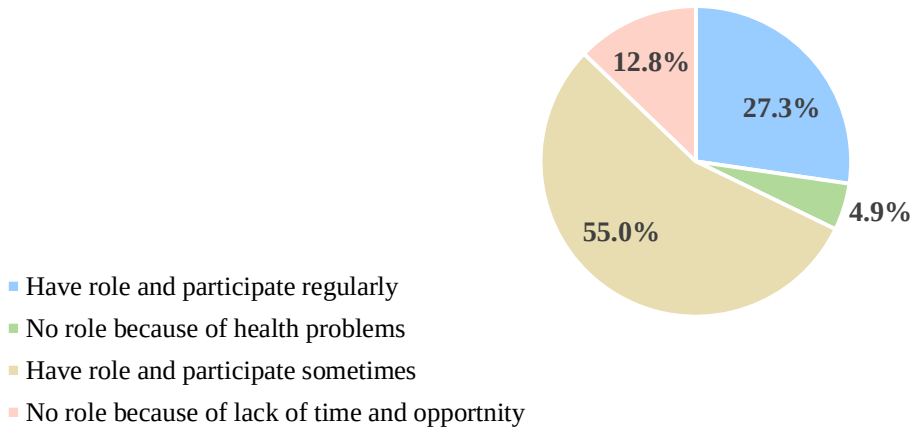

Fig.2 Role and participation in conservation of natural resources and environment in the community among participants

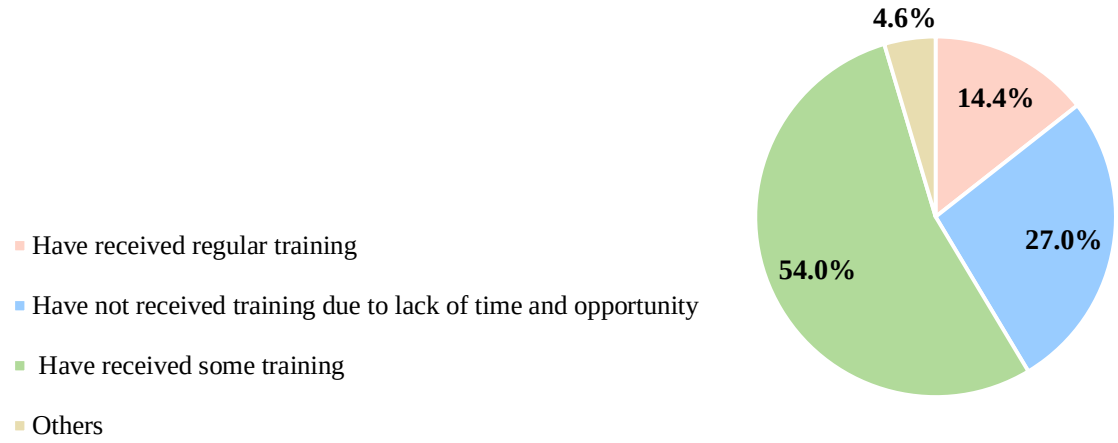

Fig. 3 Receiving training in promoting, restoring and conserving natural resources and the environment

The situation of environmental problems from OTOP productions.

In this study, we explored the opinions among participants on the environmental problems that can cause community nuisances, and causes of the pollution problems such as soil, water and air pollution. Moreover, the study assessed the opinions on the problems that can arise from the relating factors including energy consumption, plant resources and other living thing utilization, and waste pollution. Furthermore, the possible group participatory activities and management practices that can solve the environmental problems have been elaborated. In concerning with the environmental problems that can causes community nuisances, the participants considered that nearly all types of pollution from OTOP productions enhanced the public nuisances, whereas 97.3% (400 participants), 92.7%, 91.2%, 82.5%, 82.2%, 76.4%, 73.5%, and 52.6% of all participants stated other types (unspecified pollution), water, noise, soil, air, odor, dust and waste pollution, respectively. These results highlighted that the concerns for environmental problems from OTOP production were occurred obviously among the majority of participants.

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To be specify in detail, other actions (unspecified actions), waste burning and destroying the soil, and dumping chemical and waste to the soil stood for the main reasons of soil pollution in the opinions of participants with the responses of more than 80% in all reasons. The responses for agricultural and agricultural materials (69.1%), and dumping wastewater from productions (64.7%) as the sources of problems. In concerning with water pollution, more than 90% of the participants considered the potential causes such as dumping wastewater, chemicals and waste from productions to the water body as the most important reasons. For the opinions on reasons behind air pollution, others (unspecified actions), emission of chemicals, smog, unpleasant odor and dust into the air from OTOP productions stood serially with 94.6%, 93.7%, 81.0%, 72.7%, and 64.5% respectively. Interestingly, only 2.2% of participants considered that OTOP productions creates the environmental problems which cannot be prevented and eliminated, meanwhile 39.4% (162 participants) and 47.7% (196 participants) believed that the OTOP productions never create the environmental problems, and the problems that can be properly prevented and eliminated, respectively.

In terms of opinions on the possible environmental problems that can arise from energy consumption, 68.4% of participants considered that OTOP productions consumed the energy more than necessity, meanwhile, other categories (unspecified categories), and smell from burning had been identified as the possible rising problems. On another hand, around 60% of the participants believed that OTOP productions utilize the plants resources and other living things more than necessary and balance, and lack of planting and substituting. From the waste pollution, 57.8% of the participants concerned that OTOP productions produce unnecessary wastes, and littering in community (94.9%), smell from rotting waste (79.6%), smoke from burning waste (69.8%) stood as the most important possible problems. Table.2 illustrated the opinions on severity of environmental problems from OTOP among 411 participants, the largest percentage (40.4%) responded the solid waste problems in severity level-1 as the largest environmental problem, but only 4.6% (19 participants) considered the severity level-5. And, the second largest percentage (37.5%) revealed that the severity level-4 air pollution as an important problem. In concerning with environmental degradation of natural resource, 130 participants (31.6%) reported that the problem was in severity level-1. Regarding water pollution, 33.6% of participants indicated that the problem is level-3. In brief, the majority of the participants expressed concerns on solid waste, environmental degradation, water pollution and air pollution as the important environmental problems, and mostly considered as severity level 1 to 3. However, the responses for considering as severity level-5 in all stated problems were lowest among all responses.

Table.2. The number and percentage of opinions on environmental problems caused by OTOP production

Environmental Problems	**Severity level Number (Percentage)**				
	1	**2**	**3**	**4**	**5**
Solid waste	166 (40.4%)	93 (22.6%)	29 (7.1%)	22 (5.4%)	19 (4.6%)
Natural resources degradation	130 (31.6%)	75 (18.2%)	27 (6.6%)	42 (10.2%)	12 (2.9%)
Water pollution	23 (5.6%)	72 (17.5%)	138 (33.6%)	36 (8.8%)	9 (2.2%)
Air pollution	32 (7.8%)	17 (4.1%)	54 (13.1%)	154 (37.5%)	13 (3.2%)
Others	15(3.6%)	2 (0.5%)	-	16 (3.9%)	33 (8.0%)

*Production (1: Minimum, 5: Maximum)

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The awareness level and environmental education learning about environmentally friendly production

Knowledge on environmentally friendly OTOP productions

According to the results, the majority of the participants responded positively in almost all categories about these issues. The majority 85.9% (353 participants) believed that they have the knowledge and learned about environmental-friendly productions. Similarly, 76.9% (316 participants) responded as they have learned about the methods and production processes which are not harmful to the environment in the community, whereas only 0.2% mentioned that they have never trained about these methods. To be specified for the knowledge and learning about environmental issues related to soil resources, water resources, air pollution, solid waste, and various living things in the community, 74.9% (308 participants), 82.7% (340 participants), 81.3% (334 participants), 85.9% (353 participants), and 74.0% (304 participants) respectively indicated that they have learned and received knowledge about these related issues. Contradictorily, 18.2%, 12.7%, 13.1%, 9.2%, and 19.2% stated that they had no knowledge or learning about these environmental issues(soil resources, water resources, air pollution, solid waste, and various living things).

Importantly, 74.4% (307 participants) described that they are aware, learned and have knowledge about local knowledge and modern sciences and technology for integration with environmentally friendly production that does not create environmental problems in the community. However, 19.5% (80 participants) and 5.8% (24 individuals) expressed that they have not and unaware about these issues. For sufficiency economy philosophy to apply in producing environmentally friendly products that do not create environmental problems in the community, the majority, 299 participants (72.7%) have knowledge and educated about this philosophy. But, 97 participants (23.6%) and 15 individuals (3.6%) responded that they have not learned and did not know about sufficient economy philosophy.

Awareness level on environmentally friendly OTOP productions

The awareness level among participants on environmentally friendly OTOP productions was assessed and analyzed with mean score for 3 categories. The highest score, 4.62 (± 0.7) occurred for the statement about promoting conservation and restoration of natural resources and the environment, and the majority of participants believed that it is necessary to start from themselves. In concerning with the awareness level about environmental problems in the community that created by OTOP productions, the high level of mean scores, 4.21 (± 1.02) occurred too. And, the large number of the participants stated that OTOP productions destroy natural resources and the environment in the community with the mean score of 4.09 (± 1.06).

In brief, these findings indicated that Thai consumers concerned on sustainability, community responsibility, and the application of local knowledge in their purchasing decisions. In addition, they clearly preferred the environmentally friendly products that align with local culture and values. The assessing decision-making factors in purchasing OTOP products, 45.3% of participants stated that environmentally friendly practices influenced their decisions for overall OTOP products. 60.3% decided to purchase if the products originating from local communities, and 64.8% preferred to purchase if the products applied local culture. In concerning with efficiency and sustainability, 68.8% prioritizing resource conservation. However, only 38% responded that they valued the use of clean technologies, and 32.8% preferred traditional knowledge combined with modern science. In detail for each product categories, 53.8% and 36.8% of all participants decided to purchase for unique designs and safety from natural materials in textiles and clothing category. For herbal category, 54.8% prefer to buy the natural products, and 43.8% choose based on the trust for product standards. Concerning the beverages, 71.8% decided based on the health-orientation, and 48.8% of participants decided to purchase that beverage composed of natural ingredients.

Model of Environmental Education Strategy for Eco-Production of OTOP Products in Thailand

As illustrated in Fig. 6, the model is based on five components: (1) philosophy: the model based on sufficient economy philosophy to achieve balance and sustainability in all aspects of life, and shared vision and mission among producers aiming for excellence in eco-friendly OTOP productions, (2) epistemology:

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which is the environmental education process, including SWOT analysis and stakeholder involvement, (3) internal environmental analysis: whereas the strengths and weaknesses within the OTOP project would be identified, (4) external environmental analysis: to identify the opportunities and threats from the external environment, and (5) axiology: to set the values of the strategy, including economic, social, and environmental benefits. The detail for strategy development is described in following paragraphs.

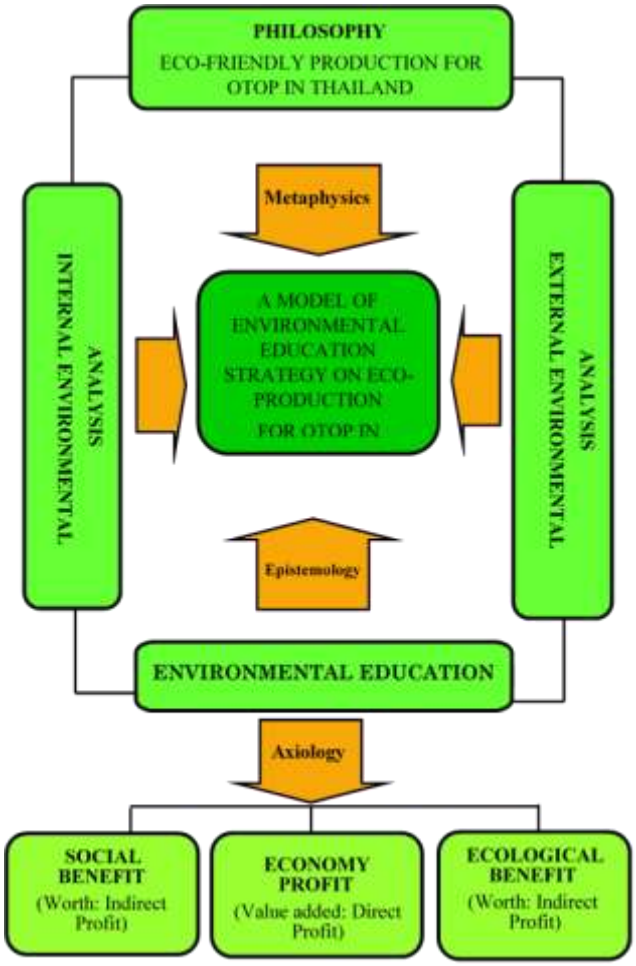

Fig.6. A model of environmental education strategy on eco-production for OTOP in Thailand

Quality Evaluation for Environmental Education Strategy

The evaluation was conducted by seven experts selected for their relevant experience with OTOP strategy. In involved monitoring, reviewing, and assessing whether the strategy achieves its intended objectives and identifying any challenges or obstacles, and examined whether the strategy needs to be adjusted to align with the current environment and situation. Structured questionnaires were used to collect data and opinions, which were then analyzed and synthesized with additional information for a more complete strategy that could be integrated systematically. The questionnaires focused on 10 key areas with 59 questions. In brief, opinions and satisfactions for the components, vision, missions, objectives, tactics, and implementation stages were evaluated.

In concerning with the components, the mean scores for suitability to apply in future OTOP programs, alignment with government strategy, and appropriateness with current situation were high in general, with 4.14 ± 0.82, 4.14 ± 0.58, and 4.0 ± 0.69 respectively. The mean score of overall satisfaction for strategy components among experts was 3.83 ± 0.62. The experts recommend to replace TWOS analysis instead of SWOT analysis, and suggested that environmental education should analyze weaknesses and prioritize

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problems from most to least critical for more targeted solutions, especially in raising awareness of the limited nature of resources and how their consumption impacts the environment. Regarding vision-related issues, the experts have seen that it covered all aspects of OTOP project (3.86 ± 0.49), appropriate and aligned with the government strategy (3.86 ± 0.76). However, the mean score for representativeness about shared aspiration and achievability was relatively low but moderate (3.14 ± 0.82). The experts believed that the strategy can provide excellence in professional community business with the high mean score of 4.0 ± 0.69. And, they have the confidence that the community business management learning center can be effective as a tool for strategy with the higher mean score of 4.29 ± 0.69.

The experts also have high confidence on establishing a National OTOP Public Organization with the mean score of 4.29 ± 0.69, and Green Marketing with the mean score of 4.29 ± 0.69. In relating with management in OTOP production process, the high mean scores occurred in managing productions, developing and enhancing the products, and establishing the products with the mean score of 4.14 ± 0.82, 4.13 ± 0.53 and 4.29 ± 0.69 respectively. However, the high score but lower than previous processes occurred in promoting green marketing (3.71 ± 0.53), and branding and communication process (3.71 ± 0.79). Furthermore, the participants have high confidence and satisfaction on strategy that it may develop community culture through creative OTOP with environmental education, and development of environmental education curriculum. The mean scores for these issues were 4.14 ± 0.0, and 3.86 ± 0.49 respectively. But, only the moderate score (3.57 ± 0.0) occurred in development of community culture through the establishment of environmental education service centers for creative OTOP. Again, the high scores occurred for measures that supporting knowledge and technical things (4.14 ± 0.82), and resources and facilities (4.29 ± 0.69) to meet strategic goals. The higher scores also resulted for budget and monitoring in production strategies with the score of 4.29 ± 0.69 and 4.43 ± 0.76 respectively. It showed that effective budget management and monitoring are crucial for success.

Importantly, the experts considered strategic plans for integrating Local Wisdom and Modern Science are highly beneficial for product development, with the high mean scores of 4.29 ± 0.69 in both promotion of OTOP products and learning about technologies. Interestingly, very high score occurred in establishing local wisdom institutes and knowledge management centers (4.57 ± 0.53), meanwhile, the high scored appeared in establishing OTOP innovation centers and creating OTOP models with 4.29 ± 0.69 mean score. Last but not least, the highest mean scores occurred for leadership development in community economic and cultural development with Creative eco-friendly OTOP productions with the score of 4.71 ± 0.53. Overall, the mean score for opinions, satisfaction, and confidence towards the environmental education strategy for environmentally friendly OTOP products in Thailand across 10 assessment quality issues among 7 experts was high level (4.03 ± 0.72), and indicating strong positive feedback and support for the strategy.

Discussion

The study was conducted with the aim of developing an environmental education strategy for eco-friendly production of OTOP products in Thailand. For this purpose, we analyzed the current environmental issues arising from OTOP production processes, investigated the knowledge and perspectives of entrepreneurs and stakeholders on eco-friendly production methods, developed a participatory environmental education strategy, and evaluated the efficiency and effectiveness of this strategy.

Environmental Education Strategy for Eco-Friendly OTOP Production in Thailand

In the strategy that we developed, it composed of five key components: (1) philosophy, (2) strategy model, (3) environmental education process (epistemology), (4) internal and external environmental analysis (SWOT), and (5) values (axiology). In concerning with philosophy, sufficient economy philosophy was applied to receive the shared vision and mission among producers and entrepreneurs on emphasizing for community business excellence with eco-friendly products. This philosophy conceptualized by King Bhumibol, can promote balanced and sustainable development through moderation, reasonability, and resilience (Jitsanguan, 2001). And, it encourages careful planning, knowledge, ethical conduct, and ensuring

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preparedness for global changes and fostering sustainability. Furthermore, it aligns with the strategy's goals in integrating local wisdom with scientific knowledge to achieve self-sufficiency, risk reduction, and sustainability across economic, social, and environmental dimensions.

In concerning with model development and environmental education process (epistemology), the model was developed by analyzing both internal and external environmental factors through a SWOT analysis among all stakeholders. It aligned with the strategy formulation in previous study by beginning with proper research and analysis, followed by strategic objectives that guide long-term goals (Blumstein & Saylan, 2007). In detail, the internal analysis identifies strengths and weaknesses within the OTOP network, while the external analysis considers opportunities and threats. These factors are crucial for shaping an effective strategy for eco-friendly production. Regarding education process, it based on participatory approach with the aim of encouraging simple, cost-effective, and resource-efficient production methods that address environmental challenges. It emphasized on knowledge building, awareness raising, attitude formation, and skill development to enhance the collective wisdom and overall community resilience.

About the axiology that set by strategy, ethical conduct, wisdom, perseverance, and community cooperation that aligned with sufficient economy concepts were developed to achieve sustainable development and long-term success (The Chaipattana Foundation, 2017). It also aligned with the previous work developed, where knowledge and cooperation are key in the context of transitioning global society. In detail, the values of strategy composed of three main perspectives, including economic (direct), social (indirect), and ecological (indirect) benefits. In aimed to receive financial returns to producers and entrepreneurs, in which job creation, income generation, added value to products, contributions to both the micro-level (local economy) and macro-level (national economy) were considered. In terms of social benefits, it intended to foster the cooperation, mutual support, and harmony in the community, human resource development, and enhancing the overall well-being of society. Furthermore, it proposed to achieve community development, cultural preservation, and ultimately, national progress to create a society with shared values and a positive culture. Regarding ecological benefits, it targeted to promote responsible management of natural resources and eco-friendly production methods that focus on environmental conservation. It was developed based on the research, which conceptualized that the effective environmental management involves the careful allocation and use of resources to meet human needs while achieving economic, social, and environmental stability (Ashraf et al., 2024).

The strategy included various plans and projects tailored to the needs of producers and entrepreneurs. In brief, it included the strategies for integrating local wisdom (LW) and modern science (MS), enhancing professional excellence in community businesses with eco-friendly production processes, establishing learning centers and management systems for eco-friendly community enterprises, and enhancing community cultural economy with creative OTOP products.

The proposed steps that intended to fulfill the first strategy were the projects promoting eco-friendly OTOP production, enhancing learning programs focused on cleaner production technologies, training on intermediate and appropriate technologies, establishing practical learning centers and innovation centers for creative eco-friendly OTOP development, developing eco-friendly OTOP prototypes (ECO-OTOP), and creation institutes and learning centers for local wisdom and knowledge transfer. For the second strategy, the projects to enhance the professionalism of community businesses, and set up a professional learning center that integrates business management practices with a focus on eco-friendly products. OTOP primarily aims to drive economic growth, focusing on urban and international markets rather than local community development. Additionally, efforts were made to establish a national organization dedicated to coordinating and promoting OTOP products throughout Thailand, alongside advancing Green Marketing initiatives to support eco-friendly products under the second strategy (Claymone & Jaiborisudhi, 2011).

In the third strategy, the projects to develop management systems in OTOP learning centers, promote eco-friendly OTOP product designs and added value, establish distribution and exchange centers, and promote branding and communication were included. Moreover, developing leadership in community cultural and economic development also involved with the aim of cultivating leaders who can drive community development through eco-friendly practices and creative product designs. For the last one, community

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cultural economy with creative products, environmental education curriculum, and establishment of environmental education service centers were collected to fulfill the strategy.

Effectiveness and Efficiency Evaluation of the Environmental Education Strategy

The strategy was assessed through training programs focusing on eco-friendly OTOP production. The evaluation showed high satisfaction levels among participants, and they recognized the value of the innovations introduced. The strategy incorporates the Sufficiency Economy philosophy and the Royal Guidance of Princess Maha Chakri Sirindhorn, which emphasizes integrating local wisdom with modern practices for sustainable development. The strategy's acceptance is aligned with Shoemaker's innovation adoption theory, which outlines five stages: awareness, interest, evaluation, trial, and adoption. The success of the strategy depends on both the innovation's characteristics and the readiness of the producers to adopt new practices.

The utilizing a nexus model that connects academia, policymakers, and businesses, OTOP can effectively prioritize and position products that are not only economically viable but also environmentally friendly. This approach aligns with the findings of Suttipong, who emphasize the importance of understanding market dynamics and consumer preferences in product development (Suttipong et al., 2022)

Conclusions

The study aimed for the development of an environmental education strategy for eco-friendly OTOP production in Thailand. Participatory action research, research and development (R&D), and survey research methods were applied. This strategy is built on the sufficiency economy philosophy, integrating environmental education to foster understanding, awareness, positive attitudes, and skills related to environmental protection. It was set up by four primary development strategies with specific goals, tactics, measures, and 19 associated projects. Expert evaluation and quality assessment were carried out, and showed that the strategy is highly rated in terms of satisfaction and confidence. Besides, the strategy was further tested through training programs for producers and entrepreneurs on "How to Produce Eco-Friendly OTOP Products and Services?" and the evaluation results confirmed a high level of satisfaction and confidence.

However, the implementations of these strategies should be encouraged. Moreover, monitoring and evaluation units to assess the progress and outcomes of the strategy should be developed. The evaluation system should be launched to ensure that the OTOP production follow the eco-friendly production and concern about the environmental problems. The sustainable concept should be incorporated in the implementation.

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