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Innovating the L-Lead Learning Management Model for Community Leaders in Transforming Chemical into Organic Farming

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Abstract

The intensive use of farm chemicals in Thailand must be stemmed, if not stopped. In view of the rural Thai cultural tradition where farmers followed their community leaders, this study innovated a learning management model for community leaders in leading the transformation from chemical to organic farming. The methodology of the study followed the educational action research approach whereby a questionnaire survey was conducted to obtain the situation of farm chemical uses in the Padeng community of Petchaburi province, Thailand before a conceptual model was created. Data on the community leaders' active learning processes, outcomes and impacts were obtained by using observation forms, learning assessment tests and interview schedules. Results revealed that the use of farm chemicals in the community was extensive and bore impacts on household economy and health and the environment. The L-Lead model that was synthesized from their learning processes comprised (1) preparing mind space to absorb new things, (2) recognizing the problems with empirical evidences, (3) searching for additional knowledge to strengthen problem-solving capacity, (4) pondering over the problems as community leaders, (5) planning on leading the community to transform, (6) implementing the community transformation plan, and (7) presenting the implementation results to intensify the transformation. The leaders' learning performances reflected the efficiency of the model (80/83). Their evaluative knowledge and value status demonstrated positive change ($p = 01$) while their leading action projects practically increased the number of households practicing purely organic farming from 15 to 17%. Further study should focus on how to sustain and widen the transformation.

Keywords: Farming; Chemicals; Organic; Learning; Community leaders; Environment

1. Introduction

Agriculture has long been the Thais' way of life, being practiced on nearly 24 million hectares or half of the country's land area (Office of Agricultural Economics, 2015a) by 12.3 million people or 34% of the country's population (Bureau of Occupational and Environmental Diseases, 2014). It generated a large proportion of the national income, amounting to nearly four million US dollars in 2014 (Office of Agricultural Economics, 2015b). However, its recent economic orientation led farmers to shift to commercial monoculture, using newly improved varieties that necessitated, or beguiled the necessity of, the use of various kinds of chemical fertilizers and pesticides. That sent Thailand, ranked as the 48th of the world in terms of the farming area, to the fourth rank of the world in terms of the amount of pesticide use (Office of Supporting Fund for Health Promotion, 2015). The quantity of imported farm chemicals rose from 3.8 million tons in 2004 to 5.5 million tons in 2014, with its value in 2004 doubling to 2,756 million US dollars in 2014 (Office of Agricultural Economics, 2015c). The uses of farm chemicals cost farmers a large amount of investment and plunged them into the vicious circle of debts.

Toxic substances from farm chemicals accumulated in the environment, degrading the quality of water resources and bio-diversity, hampering the natural interdependent and symbiotic living. Continued use of farm chemicals caused hardening, acidity and loss of microorganisms in the soil and stimulated farmers to use them further in order to restore the soil and to cope with disasters induced by ecological imbalances. The chemical farming practices put farmers into greater health risks and their farm produce, contaminated with toxic substances, caused a wide range of food safety and health problems among consumers. Chemical farming rendered serious impacts on the quality of the natural resource base, the environment and the health of the people (Office of the National Economic and Social Development Board, 2006), threatening the sustainability of agriculture, the mainstay sector of the country. It is expedient to look for an alternative approach for chemical farming.

Organic farming stood out as one of the promising farming alternatives to address the earlier-mentioned problems of chemical agriculture. In terms of household economy, it corresponded with the philosophy of Self-Sufficiency Economy (Kunwong, 2004) that encouraged cascading growth starting from self-reliant and subsistence production at household level to collaborative processing and manufacturing at community level and creative economic innovations to add higher market values. Documentary reviews confirmed that organic farming complied with nature, created less impacts on human health and the environment and reduced the production cost of farmers. However, the process of veering farmers from chemical farming to the organic direction was slow. This study tried to fill up the gap by innovating educational measures to support community leaders to become the bellwethers in transforming chemical to organic farming in their community. It based itself on the theoretical concepts of Bloom's classical Taxonomy of Learning, Adult Education (Knowles, 1980; Tenant, 1993), Contemplative Education (Wasi, 2007; Nilchaikowit, 2008), Constructivism (Fugkhao, 2001), Diffusion of

Innovations (Rogers, 2003) and Leadership Development (Davis, 1981; Dubrin, 1995; Carnall, 1995; Mezirow, 2003; Allio, 2005) in innovating a learning model that was effective for the local situation. The objectives of this educational action research were (1) to clarify the actual farming and farm chemical uses in the rural Thai community context, (2) to innovate a learning management model for community leaders in leading the transformation from chemical to organic farming in their community, and (3) to assess the efficiency of the learning management model, the leaders' learning outcomes and their social impacts.

2. Research Methodology

2.1 Research Site

The Padeng community in Kaengkajarn district of Phetchaburi province, Thailand that was reported as using a high amount of farm chemicals (Phetchaburi Community Development Office, 2011) was purposively selected. Six adjacent villages (Village Nos. 1, 6, 7, 8, 9 and 10) where farmers practiced milk and crop farming near natural water sources were selected in view that chemical contamination in the environment and farm produces could be of a high prone.

2.2 Population, Samples and Target Groups

From a total of 1,307 farm households in the community, 307 households were sampled by using Taro Yamane's formula for inclusion in the farm chemical situation survey. The sample size was stratified according to the population in each village.

All kinds of identifiable leaders including official leaders like village headmen, special area leaders like leaders of occupational groups, and natural leaders like respected or charismatic persons were included in the study. A total of 30 community leaders willingly participated in the research activities.

2.3 Research Procedure

To innovate a learning management model that was contextually suitable in supporting Thai community leaders in transforming chemical farming practices in their community into organic farming, the following educational action research procedure was used.

(1) Literature review: Official reports and research papers were reviewed to understand the extents and the impacts of farm chemical uses in Thailand. Educational theories that possessed potentials in strengthening the capacity of the community leaders in the transformation were eclectically reviewed for use.

(2) Local context review: A questionnaire survey was conducted to understand household farming and related practices in the study site.

(3) Recognition of local farm chemical use situation: The survey results were fed back to the participative community leaders at two group discussion sessions at different locations in order to facilitate their access. The participants absorbed the information on the community's situations of farm chemical use and discussed the reasons for farm chemical uses, the chemical use behavior, the impacts of chemical uses on health, economy and environment and decided how they, in their capacity as community leaders, would proceed to improve the situation.

(4) Empowering activities:Based on the characteristics of the participative community leaders as obtained from the questionnaire survey and observations at group discussion sessions, two sets of activities were designed to empower them as follows: (1) Reflecting as a community leader, and (2) Expanding knowledge about organic farming by observing examples at a learning center.

(5) Adoption projects: For hands-on experience in leading changes towards organic farming, the participative community leaders were requested to plan their organic farming and related projects. The projects for which the leaders could afford or gain supports from others were implemented over a period of three months.

(6) Diffusion projects: Upon completion of their adoption projects, the community leaders summarized their experience in the form of documents and verbally presented their adoption results to 84 community members and the general public.

(7) Assessment of community leaders' learning: The community leaders' performances were measured against the set targets in terms of their evaluative knowledge and changing values. Their behavioral changes were assessed based on their authentic action. The results of these assessments were used to confirm the efficiency of the learning management model devised under the study.

(8) Monitoring of project impacts: Impacts of the community leaders' action were monitored by means of a survey on the number of households totally or partially adopting organic farming. The survey results were compared with the pre-project statistics.

2.4 Research Instruments

Five research instruments were developed for use in the educational action research. These instruments passed the reviews by seven experts in related fields. The questionnaire for farm chemical situation survey sought for data regarding households, crop selection, farming methods, farm inputs, farm chemical uses, observations on the impacts of farm chemical uses and related problems, needs and recommendations with regard to farm chemical uses. The mean score of its quality as perceived by the expert was 3.94 which was above the target of 3.5 with improvements being added as suggested by the experts. The observation form for monitoring the behavior of the community leaders, householders and farmers was rated with the Item-Objective Congruence Index of 0.61. The knowledge test for monitoring changes in the community leaders had the construct validity with an IOC index of 0.58 and the finally selected 31 test items had the reliability by KR20 at 0.78. The attitudinal test for monitoring changes in the community leaders had the construct validity with the mean score of 4.45 and the discrimination value above 1.75. The interview schedule to obtain the community leaders' opinions regarding their learning experience had the IOC index of 0.86.

3. Results and Discussion

3.1 Results

3.1.1 Farming and Chemical Uses Survey

By means of questionnaires administered verbally to accommodate the literacy level in the community, it was found that the majority of the sampled households were engaging in chemical agriculture while about one-fifth engaged in a combination of chemical and organic farming. The number of households engaging in only organic farming constituted only 7%. See details in Table 1.

The survey also revealed that 22% of the households used chemical sprayers to apply pesticides in their farms. Most of them used farm inputs brought in from outside the community. Eighty per cent of the households had never locally produced fertilizers for their own uses. On the questions relating to the health in the family, more than half to the sampled households (56%) reported incidents of dizziness that they believed was caused by farm chemicals. More than half of them (58%) also observed reduction of bio-diversity especially small animals and insects.

The findings above confirmed that the community was a typical Thai farming community where most farmers were engaged in chemical farming. The survey results informed that the average household expenses on chemical farm inputs were as much as 807 US dollars per year, with most were spent for fertilizers as shown in Table 2. At the same time they hardly produced local materials as farm inputs. More than 30% of them had in their possession farm machines and equipment that would support their action to use local materials as farm inputs. For examples, 37% had water pumps, 32% had grass mowers and 32% had tractors or pushcarts.

Table 1. The Production Types in the Study Site

Production Types	Households	
	Number	Percentage
1. Chemical farming	217	71
2. Organic farming	22	7
3 Mix of chemical and organic farming	62	20
4. Non-farm occupations	7	2
Total	308	100

Table 2. Expenses on Chemical Farm Inputs

Average Expense	US$/Year
For the fertilizers	645
For the pesticides	81
For the herbicides	81
Total	807

From the interviews with the heads of the sampled households, it was understood that they viewed the local problems and needs in relation to farm chemical uses as follows:

1. Farming problems in the community were related to the following: (1) the expensiveness of chemical fertilizers and pesticides contributed to high of production costs. (2) Farm chemicals caused health problems in farm families such as weakness, hard breathing, and skin rashes. (3) The fluctuations of farm produce prices in certain periods of time or seasons made farming not profitable. Delayed or erratic rainfall and droughts aggravated the farming profitability.
2. The government offices should continually provide knowledge to the community especially that on the method on how to reduce the use of the chemicals in agriculture in the form of trainings. They should take farmers on technical visits to the areas where villagers were successful in running organic agriculture. They should set up activities or projects to promote the organic agriculture. They should look for the markets for organic produces for the farmers in order to inspire the farmers to perform organic agriculture. Moreover, schools in the area should buy their organic produces to cook lunch for students.

The contextual survey in the study site indicated that chemical farming created economic, health and environmental problems in the study site. Some local materials were available for use in place of the chemicals but farmers who had sufficient equipment still did not see that they could be more self-reliant if they did farming in an alternative way. Their opinions as to how to solve their personal and collective problems indicated that the farmers tended to push the responsibility to the government offices. They were enthusiastic to obtain rather tangible supports while their mindset was not ready to try alternative production methods. In order to encourage their changes, bellwethers were needed to lead them. Observations on the local culture indicated that, as in other rural farming communities in Thailand, farmers were risk averse. They were not confident in embarking on new ways of farming. The group of people who could lead them en masse were their community leaders instead of the government offices whose roles would be intermittent. If the community leaders were empowered with necessary competencies, they would play important roles in convincing the farmers to adopt organic farming, saving themselves from economic, health and environmental problems. It is expedient to consider in what way the community leaders would be trained as effective leaders to lead the transition from chemical to organic farming in the study site.

3.1.2 *The Learning of the Community Leaders*

In order to empower the community leaders to lead their community residents to shift from chemical farming to organic farming, a vast body of knowledge in education theories were eclectically chosen to suit the local situations and the characteristics of the community leaders. The learning goals, processes and expected outcomes were synthesized as shown in Table 3.

Table 3. Learning Goals, Processes and Expected Outcomes

Learning Goals	Learning Processes	Expected Learning Outcomes
Adequate knowledge to evaluate and effect the transformation of chemical to organic farming	• Constructing images of farm chemical uses and problems in the community by using local information and empirical evidences, • Receiving knowledge related to leading the transformation from experts, • Hands-on experience in organic farming techniques, and • Witnessing feasibility of organic farming.	• Able to evaluate their farming environment, necessity of farming transformation, own roles as farm community leaders, and feasibility of organic farming in their community.
New value on organic farming	• Dialog and deep listening on chemical farming situation, • Use of stimulating questions, • Sharing of opinions with experts and fellow leaders, • Reflecting on the consequences of chemical farming, • Reflecting on their own role as farm community leaders, and • Reflecting on new knowledge and experience regarding organic farming.	• Able to perceive the dangers of chemical farming, • Able to appreciate organic farming as an alternative to reduce economic and environmental impacts, • Able to see the importance of their own health and food safety for their consumers, • Willing to try their hands on organic farming and lead their community residents to do likewise.
Capacity to manipulate organic farming and leading changes towards organic farming	• Practice making organic farm inputs such as organic insect repellents, bio-extract fertilizer and compost fertilizer, • Practice preparing action plans to lead the transformation from chemical to organic farming, • Practice implementing the action plans, and • Practice sharing experience with community residents to convince them about the transformation.	• Able to prepare organic farm inputs, and • Able to inform, convince and lead the transformation from chemical into organic farming.

Cognitive tests were administered with the community leaders four times during the educational action research process. The results illustrated that on average their knowledge improved from 18 to 36, 80 and 84%, respectively. It was noticeable that their learning achievement during the value-oriented learning periods shot higher than during the skill-oriented periods. This pointed out that the learning in the affective domain had high influence on their knowledge acquisition. A comparative study of their pre-learning and post-learning mean scores indicated that their positive difference (t=41.071) occurred at the statistical significance level of .01 as shown in Table 4. Attitudinal tests were administered with the community leaders, once before and once after their learning experience. Results showed in Table 4 illustrates their post-learning mean score improved with the statistical significance level of .01.

The community leaders' success in developing 12 action projects illustrated their authentic achievement. Over a period of three months, they implemented projects that did not require budgetary supports such as a project to campaign on reducing the farm chemical use and a project to plant heritage wood and fruit trees for their own uses. They also completed projects with supports from external agencies such as the project for the construction of an eco-farming learning center in Village No. 7. In addition, they presented their action results to the general public verbally and in brochures.

Their ex-poste village-wide monitoring of their social impacts revealed that the number of the households engaging purely in organic farming increased from 12 to 17% of farm households as shown in Table 5. Reasons given by the changing households included the effectiveness of organic farming, local availability of farm inputs, close guidance by officials, more free time and fears of health problems caused by chemical spraying.

Table 4. Differences in the Cognitive and Affective Domains

Tests	N	$\bar{x}$	$\sum D$	$\sum D^2$	t
Cognitive Test					
Pre-Learning	31	11.19			
Post-Learning	31	25.87	13650	6117300	41.071**
Attitudinal Test					
Pre-Learning	25	86.24			
Post-Learning	25	98.87	810	26742	35.564**

** with the statistical significance level of .01

Table 5. The Farming Types in the Padeng Community

No. and Name of Village		Purely Chemical Farming		Organic & Chemical Farming		Purely Organic Farming	
		(households)	*(%)*	*(households)*	*(%)*	*(household)*	*(%)*
1	Padeng	51	22	121	52	61	26
6	Padeng Tai	147	49	120	40	35	12
7	Huai Satyai	35	26	65	48	36	26
8	Khao Laem	142	57	76	31	29	12
9	Pang Maai	58	31	91	49	37	20
10	PaPhak	117	58	58	29	28	14
	Total	550	42	531	41	226	17

Table 6. The Efficiency of the Learning Management

Number of Test Items (N)	Total score of the test during learning	(E_1)	Total score of the test after learning	(E_2)	Efficiency of Learning Management Model (E_1/ E_2)
31	23,100	80.12	24,060	83.45	80.12/83.45

3.1.3 Efficiency of the Learning Management

The cognitive development scores of the community leaders were used to evaluate the efficiency of the learning managed for them. As shown in Table 6, the efficiency of the learning process and outcome was 80.12/83.45 or greater than the 80/80 criterion.

3.2 Discussion

This educational action research confirmed that chemical farming was prevalent and caused social, economic and environmental impacts in the study site. A contextual survey indicated that the most prospective solution was for the farmers to adjust their production from chemical to organic farming and the rural Thai culture indicated that community leaders would play a pivotal role. Allio (2005) likewise stated that leaders could induce effective transformation and support innovative development. In order to determine the desirable characteristics in three domains of learning of the community leaders, the study employed the classical Bloom's taxonomy of learning and set the domain goals as EVM. E represented a cognitive ability to critically evaluate and decide in what way the farming would proceed. V in the affective domain represented the value of organic farming. Value was the third highest learning level in the domain but it would suffice in view that internal changes were difficult to achieve within a short period of time. M in the psychomotor domain represented an ability to manipulate the transition from chemical to organic farming. Manipulation, the second highest stage in the domain, was chosen in view of the means available for possible implementation by the community leaders.

Contemplative education emerged as the most influential theoretical approach in starting up the community leaders' learning and rolling them to the end of the study. Evidently, a preceding contemplative module bore impacts on the succeeding cognitive module. Wasi (2007) explained that contemplative education led learning about one's mind and then generated wisdom. The contemplative session in the study achieved basic changes in the community leaders, their feelings, thoughts and perspectives about other humans and nature and spurred them to lead a wider scale of changes such as their households, villages and communities.

The community leaders in the study had ample opportunities to construct knowledge from direct experience. According to Dewey (1859-1952), upon being stimulated to create new knowledge, learners would create a relationship between new experience with their prior knowledge or experience. This would cause a cognitive conflict and disequilibrium in which the learners would try to seek an equilibrium by searching for answers to solve the conflict. This process was followed by an assimilation and/or accommodation in their intellectual structure. The empowering activities designed for the community leaders under the study upheld the principles of constructivism, particularly the process of knowledge construction, the reflexive awareness of that process, the provision of authentic tasks and the differences among individual learners.

In addition, in arranging learning for the community leaders, cautions were exercised to gain acceptance of the community leaders who were adults. Adults tended to accept things only when they were convinced of their usefulness. Hence, visits to successful organic farms were included in their learning process. Furthermore, as adults learnt well in certain learning conditions (Knowles, 1980), comfortable and convenient environs were created to facilitate their learning. Mutual respect, mutual assistance, freedom of expression, prior experience and acceptance of individual differences were observed in all stages. Active participation in the learning process and reiterations of their progress towards their own learning goals generated their sense of obligation to continue. In the learning process, they were tolerated to construct knowledge, stimulated to have self-confidence and share experiences and encouraged to think and take actions. Their learning eventually involved a variety of activities, e.g. educational trips, practice, problem-solving, and preparation of their action plan, all of which resulted in the community leaders being aware of their obligations to their communities.

The approach used in the study was similar to Dubrin's leaders' development model (1995) of knowing oneself, self-discipline, education, experience and counseling in some aspects, particularly the early stage of knowing oneself. However, in this study, greater freedom in learning was given to the community leaders. In addition, the concept of transformational leaders with a good vision, flexibility, expertise, and positive viewpoints was incorporated in this research so that the community leaders could motivate their followers to develop a higher level of desire and new ideology and empower them to fulfil the desire. Mezirow's concept (2003) on the ability to share thoughts in a rational and independent fashion was also applied. In sharing their thoughts, the community leaders possessed two basic abilities, namely the ability

of self-reflection through critical thinking and the ability to make decisions in a reflective way during the process of sharing critical thinking.

According to Rogers (2003), diffusions of innovations involved a process in which early adopters underwent five stages of knowledge, persuasion, decision-making, trial and confirmation. Rogers suggested that change managers needed to take into account differences in individual characteristics and recognized that some individuals could support the changes better than others. The adopters were classified into groups according to their adoption speed. One-third of the population would wait until the first two groups changed their behavior before they themselves changed. Another one-third were skeptical laggards who would accept innovations cautiously only when necessary and after others had accepted them. The slight but significant increase of the number of organic farming households in the study right after the research process would expand if the community leaders participated in the research continue to serve as the role model and disseminate the results of organic farming.

The learning management in the study was different from the ASIA model developed by Boonraeng (2004). The four-stage model comprising activation, selection, incubation and adoption and assessment placed emphasis on activating trainees through motivation. On the contrary, the approach used in the study considered that an evaluation of the trainees' need for training was an important process for changing knowledge, skills, attitudes and behaviors. It deployed a learning process that allowed awareness of the local problems to present themselves to the community leaders, instead of showing the problems to them. The ASIA model concentrated on the trainees' personal adoption of new technology based on their primary decision-making, attitudinal changes, and behavioral changes. Instead, the learning management under the study targeted on communal adoption of new technology by developing various capacities of the community leaders so that they could serve as leaders and role models that community members would follow. The impact of the changes could be wider than that of the ASIA model.

The present learning management, despite its partial application of constructivist educational approach, was different from general constructivist models. For instance, the ADDMER Instructional Design and Development Process of Bamrungcheep (2008) aimed to develop the trainees' creativity through the process of analysis, determination, design and development, monitoring, evaluation and reflection. The application of the contemplative education in the early stage of the learning process in this study led to internal development and contemplation that continued throughout the research.

The problem-solving learning styles in the study made the learning experience in the study heavily social constructivist. The community leaders had to relate socially in learning exchanges. They developed their capacities through negotiations and discussions in a real context. Consequently, they could demonstrate to and lead community members on their action plan. This corresponded with the research results by Naktim (2008) which indicated that the social factors contributed to success in organic farming promotion.

3.3 Conclusions

As a result of the innovative educational action research, the Learn-to-Lead (L-LEAD) Model was synthesized for use to assist community leaders in transforming chemical into organic farming in their community. The procedural model as shown in Figure 1 consists of the following processes:

(1) Preparing the mind space to absorb new things: This contemplative module is the starter in which the community leaders empty their mind and contemplate on the local situation and their leadership.

(2) Recognizing the problems with the empirical evidences: This constructivist module allows the community leaders to possess learning-by-doing and problem-solving. The activities to convince them of the local problems caused by the farm chemicals involve the tests of chemical contamination in the local soil, water, and vegetables.

(3) Searching for the additional knowedge through learning-by-doing to strengthen problem-solving capacity: This module is related to constructivist learning and diffusion of innovations that consist of five stages of knowledge, persuasion, decision-making, trial, and confirmation. It exposes the community leaders to new knowledge regarding the relationships in their farming environment, the use of farm chemicals and its impacts, the organic farming techniques and the feasibility of organic farming as well as the characteristics of leaders. They have opportunities to sharpen their skills by trying their hands on preparation of the bio-extracts, bio-fertilizers and organic fertilizers.

(4) Pondering over the problems as a community leader: This is a contemplative and decision-making module in which the community leaders exercise their leadership potential. This involves their review of the local problems and needs for rolling a transition from the chemical to the organic farming in their community.

(5) Planning on leading the community to transform: Under this constructivist module, the community leaders increase their experience by formulating the leaders' action plans. The ample lee time is given to the community leaders to decide what and how they would do with their action plans.

(6) Implementing the community transformation plan: In this manipulative module, the community leaders become aware of their leadership and implement their action plans. This module involves their conducting of activities that involve local farmers in enjoyable learning atmosphere and monitoring of the transformational results.

(7) Presenting the implementation results to intensify the transformation: In this module, the community leaders summarize the results of their implementation and point out the changes for their community

residents to see and think of riding on the on-going farm changes.

The model was proved effective as the community leaders participated in the study gained higher evaluative knowledge, shifted their values from the chemical to organic farming and obtained the skills in leading community transformation towards organic farming. In addition, their recognition of their role as the community leaders was heightened and their skills in charting changes through the action planning and extending innovative knowledge and skills through the presentation and implementation of the plans also improved.

Recommendable for further studies are a study on how the leadership of community leaders in transforming chemical farming to organic farming could be sustained, a study that uses health as the contemplation issue for converting to organic farming, and a study in which community leaders lead their community members on a comparative economic study of chemical and organic farming.

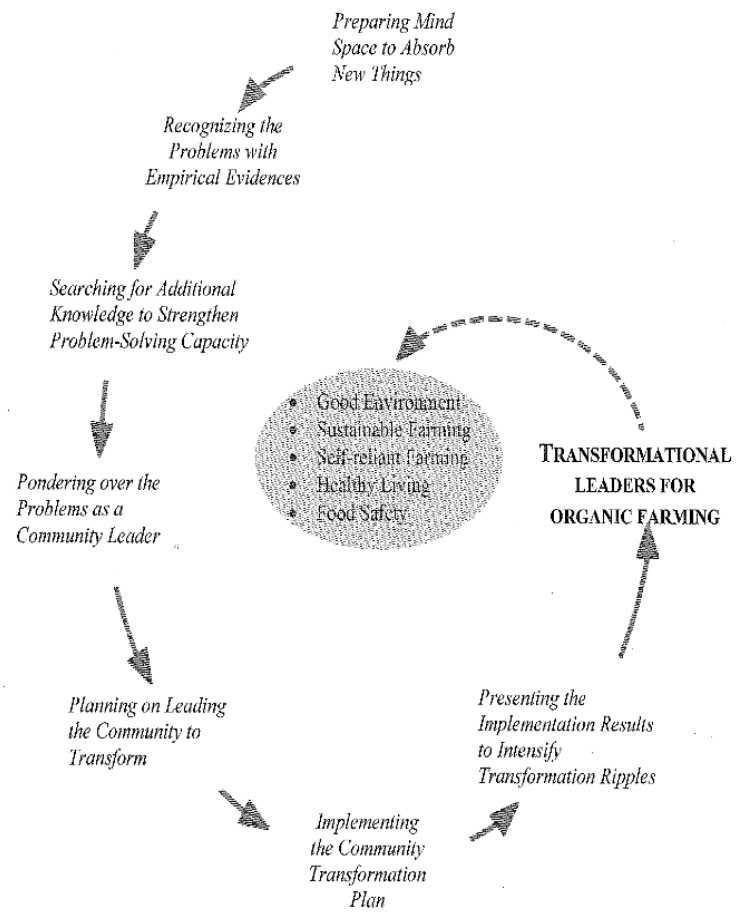

Figure 1. The L-LEAD learning management model for the community leaders in transforming the chemical into the organic farming

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References

Allio RJ. Leadership development: Teaching versus learning. Management Decision 2005; 43(7/8): 1071-1077.

Bamrungcheep U. The web-based instruction model using the constructionism for creative thinking development. Kasetsart University, Bangkok, Thailand. 2008.

Boonraeng, S. Development of a bio-extract technology transfer model for farmers: A case study of Mae Taeng District, Chiang Mai. Maejo University, Chiangmai, Thailand. 2004.

Bureau of Occupational and Environmental Diseases. Impacts on health by pesticides. Available from: http://envocc.ddc.moph.go.th/contents/view/106. 2014.

Carnall CA. Managing changes in organizations. Prentice Hall, London, UK.1995.

Davis K. Human behavior at work: Organizational behavior. McGraw-Hill, New York, USA. 1981.

Dubrin S. Leadership: Research findings, practice and skills. Houghton Mifflin, Boston, USA. 1995.

Fugkhao S. Learners-centered instruction. Emphan, Bangkok, Thailand. 2001.

Knowles MS. The modern practice of adult education: From pedagogy to andragogy. Cambridge, New York, USA. 1980.

Kunwong S. Changing from chemical to organic agriculture for environmental sustainability of Ban Pa Phai Farmers, Amphoe Doi Saket, Chiang Mai. Chiang Mai University, Chiangmai, Thailand. 2004.

Mezirow J. Transformative learning as discourse. Transformative Education. 2013; 1(1): 58-63.

Nakthim C. The roles of leaders in knowledge management of the farmers organic rice farming: A case study of natural farming group in Thamo Sub-district, Prasat District, Surin Province. Thammasat University, Bangkok, Thailand. 2008.

Nilchaikowit T. Transformative learning and contemplative education. Contemplative education for human development. Mahidol University, Nakhon Pathom, Thailand. 2008.

Office of Agricultural Economics. Agricultural statistics. National Office of Buddhism Publisher, Bangkok, Thailand. 2015a.

Office of Agricultural Economics. Export statistics. Available from: http://www.oae.go.th/ewt_news.php?nid=146. 2015b.

Office of Agricultural Economics. The quantity and price of imported farm chemicals. Available from: http://www.oae.go.th/ewt_news.php?nid=146. 2015c.

Office of Supporting Fund for Health Promotion. Danger from farm chemicals. Available from: http://www.thaihealth.or.th. 2015.

Office of the National Economic and Social Development Board. A summary of the 10th National Economic and Social Development Plan (2007 – 2011). NESDB, Bangkok, Thailand. 2006.

Phetchaburi Community Development Office. Basic needs of Phetchaburi Province. Available from: http://www.cddweb.cdd.go.th/phetchaburi. 2011.

Rogers EM. Diffusion of Innovations. Free Press, New York, USA. 2003.

Tennant MC. Perspective transformation and adult education. Adult Education Quarterly 1993; 44.(1): 34-42.

Wasi P. Human way in the 21st century. Soonnuengkow, Bangkok, Thailand. 2007.