

Key Success Factor of Low Carbon Cities toward Sustainability at Local Levels: Case Study of Mid-Size Municipalities in Thailand

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Abstract

The Low Carbon Municipality (LCM) project aimed to promote in target municipalities correct knowledge and understanding carbon emissions and identify and implement activities to reduce the emissions. This study aimed to find the Key Success Factor (KSF) that can assure the sustainability or continuity of the LCM project GHG emission reduction activities to lead the municipalities to a sustainable development path, as defined by the UN Sustainable Development Goals (SDGs). The study conducted surveys and interviews in four municipalities representing the four regions of Thailand. The results of the surveys showed that “mindset, attitude, awareness and knowledge” are correlated with sustainable behavior that can assure sustainability or continuity of LCM strategies. The study also identified the main issues or constraints faced by the respondents in the implementation and the continuation of LCM strategies. The results of the surveys and interviews showed that “knowledge” is the KSF. This is in accord with the approach about behavioral change under the Sufficiency Economy Philosophy (SEP). SEP states that knowledge is one important mechanism which motivate mindset, attitude and awareness and that all these factors are mechanism driving behavioral change. This behavioral change can lead to sustainability or continuity of LCM strategies that will lead to LCM, which then helps achieve the goals of sustainable development.

Keywords:

Low Carbon Municipality, Key Success Factor, Sufficiency Economy

1. Introduction

The 2016 Paris Agreement under the United Nations Framework Convention on Climate Change (UNFCCC) committed member countries to reduce their Greenhouse Gas (GHG) emissions. The Paris Agreement explicitly recognized that global warming exists and that human-made CO₂ emissions are the major cause [1]. With this global agreement, carbon emission reduction has become a major development goal for countries. Many countries have now integrated targets for GHG mission reduction to achieve low carbon development plan and activities. GHG emissions, particularly CO₂ emissions, are steadily increasing in Thailand. From 2002 till 2018, Thailand had CO₂ emissions per capita of 2.60 tons in 2002, 3.21 tons in 2008 and it increased to 3.96 tons in 2018 [2] (Fig. 1). CO₂ emissions increased every year, despite the increase in projects to reduce CO₂ emissions.

Thailand, as a party to the UNFCCC has been implementing climate actions to reduce greenhouse gases since 2002. One of these was the project on promoting low carbon cities which targeted to motivate local municipalities to implement low carbon activities at the local levels. The title of this project was “The Promotion of Low Carbon City across Municipalities in Celebration of His Majesty King’s 84th Birthday”. The goals of the project were to promote, in the target municipalities, correct knowledge and understanding on the causes of CO₂ emissions, and identify in these towns and cities, activities which can reduce CO₂ emissions [3]. It aimed for the development of low-carbon towns and

cities. The specific objective was to develop the understanding of central and local government officials of the basic principles for planning effective low-carbon policies and for formulating an appropriate combination of low-carbon measures while taking into account the specific socio-economic conditions and characteristics of the cities [4]. This project was operated in 84 municipalities between 2011 till 2014. After the project was completed, only a few municipalities, however, were able to continue the implementation of low-carbon planning guidelines and the low carbon activities promoted by the project. As such, this was seen as an indication of the unsustainability of the activities that the project had undertaken. There was lack of continuity, in some of the towns and cities, of the low carbon activities that the project started. This showed that the operational activities and project management adopted by the project could not assure continuity or sustainability of the implementation of low carbon planning guidelines and low carbon activities that were introduced, after the “Low Carbon City” project had ended. Some of the operational activities and project management tools used were for solving only immediate problems and did not address the sustainability or continuity of the activities after the project ended. It is now generally accepted that environmental problems, like the greenhouse gas emissions, are also caused by human activities at the local levels, that is, at the household and community levels. It is also generally accepted that suitable solutions to many environmental problems, including GHG emissions, can be helped solved at the local source of the problems. Local solutions to local sources of the problems are one sustainable approach to addressing environmental problems such as rising GHG emissions. Some human behavior leads to the creation and worsening of environmental problems [6]. These can be observed best at the household at community levels. However, behavioral change can, on the other hand, can lead to solutions to environmental problems, and actions for changing human behavior can be best done at the household and community levels. Behavioral change can be directed to helping assure the sustainability or continuity of local solutions and activities established to address the environmental problems.



Fig. 1 CO₂ emission (ton/capita) of Thailand from 1997-2018 [2].

However, the following factors; knowledge, awareness, attitude, and mindset need to be properly addressed to push forward change in human behavior [7-12]. People should have proper knowledge and awareness of the environmental problems and the possible solutions, and the right attitude and mindset to develop plans and implement actions for environmental solutions. These factors have been discussed under the philosophy of the “Sufficiency Economy”. The Sufficiency Economy Philosophy (SEP) was initiated by His Majesty King Bhumibol Adulyadej of Thailand. The philosophy proposes major

principles of thoughts and practices to achieve a balanced way of living under sustainable development. People need to use knowledge and morality in their lives under the philosophy [13]. This philosophy tells that sustainability must “burst from within”[14], which means that “human behavior can change towards sustainable living and move forward to sustainable development of their communities by making changes within him/herself in terms of improving his/her knowledge, awareness, attitude, and mindset regarding the environment and sustainable development.

With the proper knowledge and awareness and the right attitude and mindset, appropriate local actions can be plan and implemented for sustainable development to drive towns and cities towards the path of low carbon municipalities. More importantly, the sustainability and continuity of the plans and actions can be assured. This paper aimed to discuss how knowledge, awareness, attitude and mindset are the key success factors (KSF), which can lead to the sustainability or continuity of actions for Sustainable Development (SD) towards Low Carbon Municipalities (LCM) in Thailand, by using the philosophical framework of Sufficiency Economy (SE) .

2. Sustainable Development

The Global Sustainable Development Agenda

The Brundtland Commission’s brief definition of sustainable development as the “ability to make sustainable development to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs” is the standard and earliest definition of SD [15]. In 2015, all United Nations Member States adopted the 2030 Agenda for Sustainable Development. This provided a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

The SDGs build on decades of work by countries under the UN. Key international agreements and milestones are given as follows:

- June 1992, at the Earth Summit in Rio de Janeiro, Brazil, more than 178 countries adopted Agenda 21, a comprehensive plan of action to build a global partnership for sustainable development to improve human lives and protect the environment.
- The Member States unanimously adopted the Millennium Declaration at the Millennium Summit in September 2000 at UN Headquarters in New York. The Summit led to the elaboration of eight Millennium Development Goals (MDGs) to reduce extreme poverty by 2015.
- The Johannesburg Declaration on Sustainable Development and the Plan of Implementation, adopted at the World Summit on Sustainable Development in South Africa in 2002, reaffirmed the global community's commitments to poverty eradication and the environment, and built on Agenda 21 and the Millennium Declaration by including more emphasis on multilateral partnerships.
- At the United Nations Conference on Sustainable Development (Rio+20) in Rio de Janeiro, Brazil, in June 2012, Member States adopted the outcome document "The Future We Want" in which they decided, inter alia, to launch a process to develop a set of SDGs to build upon the

MDGs and to establish the UN High-level Political Forum on Sustainable Development. The Rio +20 outcome also contained other measures for implementing sustainable development, including mandates for future programs of work in development financing, small island developing states and more.

- In 2013, the General Assembly set up a 30-member Open Working Group to develop a proposal on the SDGs.

Sustainable Development in Thailand

From 1957 to 1992, Thailand focused mainly on economic development which resulted in prosperity for the nation. Unfortunately, this development strategies had also negative effects such as natural resources exploitation and degradation, air and water pollution emission, as well as social, economic and cultural issues and concerns. Furthermore, past development policies promoted poverty eradication strategies which inefficiently and unsustainably used natural resources. Technology to address prevention of pollution problems were not mostly locally available and importation, particularly of new ones, were costly and unaffordable. This resulted to a substantial rise in pollution problems and unsustainable use and severe degradation of natural resources in Thailand and situations found similarly in other in developing countries [16].

Thailand adopted the Agenda 21 and its impacts have been felt by the administration of every governmental agency since 1992. The conceptual framework and principles of the Rio Declaration 1992 have been employed as a guideline for the country's development. During the Tenth National Economic and Social Development Plan (NESDP), Thailand identified its social, economic, and environmental development goals by using the holistic development pattern focusing on people-centered development [17]. In the current NESDP, the Sustainable Development Goals (SDGs) have been integrated in Thailand's 20-year National Strategy. Thailand has been continuously strengthening its national programs, plans and strategies to achieve the 17 SDGs. From these 17 SDGs, there are five goals that are relevant to the objectives of reducing CO₂ emission and achieving the path to low carbon municipalities (LCM) [18]. These five goals are:

Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all,

Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation,

Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable,

Goal 12: Ensure sustainable consumption and production patterns, and

Goal 13: Take urgent action to combat climate change and its impacts.

The objectives of the project "The Promotion of Low Carbon City across Municipalities in Celebration of His Majesty King's 84th Birthday" are very much in line with the five SDGs mentioned above. The goal of the project is the same as the SDGs.

3. Behavioral Change for Sustainability of Actions for Low Carbon Municipalities

Behavioral change is needed to solve environmental problems and to achieve the Sustainable Development Goals (SDG), including reducing GHG emissions and achieving a path to low carbon municipalities. In this study, the "Social Cognitive Theory" and the "Theory of Planned Behavior" [19, 20] were applied to analyze and validate the key success factors (KSF) to attaining the path to LCM and sustainable development.

Social Cognitive Theory presupposes that people are driven by external factors. The Theory of Planned Behavior, on the other hand, presupposes that behavior is dependent on one's intention which determined by an individual's attitude, perceived behavioral control and subjective norms. From these two theories; knowledge, awareness, attitude, and mindset – are the factors identified as affecting human behavior. These factors can also drive behavioral change in the desired direction.

“Knowledge” is a familiarity, awareness or understanding of someone or something, such as facts, information, descriptions, or skills, which is acquired through experience or education by perceiving, discovering, or learning. Knowledge requires that the evidence for the belief necessitates its truth.

“Awareness” is an understanding of the activities of others, which provides a context for his activity. To raise awareness of something is to inform and educate people about a topic or issue to influence their attitudes, behaviors, and beliefs towards the achievement of a defined purpose or goal.

“Attitude” is a relatively enduring organization of beliefs, feelings, and behavioral tendencies towards socially significant objects, groups, events, or symbols. The link between attitudes and behavior is that of consistency, it means that the behavior of a person to be consistent with the attitudes that they hold.

“Mindset” is the combination of thoughts, beliefs, and values or a simple idea that makes all the difference. The one mindset directly influences his behavior. Changing one's mindset will create a sustainable change in long-term behavior.

The definitions above show the relationships of each factor in influencing behavior. These factors are in line with the approach of both SD and SEP. As mentioned previously, the objective of this study is to analyze and validate the KSF that influence behavioral change, which can lead to the sustainability or continuity of plans and actions for sustainable development towards the path to LCM in Thailand.

4. Sufficiency Economy Philosophy (SEP)

The Sufficiency Economy Philosophy (SEP), bestowed by His Majesty King Bhumibol Adulyadej, King Rama IX, to the people of Thailand in 1974, was reiterated again during the economic crisis in 1997. SEP emphasized a more balanced, holistic and sustainable development approach which tresses the middle path. It has been widely adopted at the individual, community, business, household, and government levels. SEP promoted small-scale agriculture, suitable farming technologies, self-support, renewable energy production, community strengthening, conservation of natural resource and environment, sustainable use of water resources, flood and drought mitigation, community forest preservation, improving health care and education, and invulnerability to external changes and globalization [21]. SEP consists of 3 components; “moderation, reasonableness, and self-immunity”, which is based on the conditions of “appropriate knowledge”, and “ethics and virtues”.

SEP has six main features: 1) moderation within reason, 2) prudence and risk management, 3) pursuit of knowledge, 4) ethics and moral consideration as well as the spiritual dimension, 5) foundation-building, and 6) SEP is a philosophy that can be used as a guiding principle [22].

The mindset of the people is the most important, nurturing and cultivating the mindset of people are essential things that they are imbued with the inclination to be sufficient in living their lives. People need to build a strong foundation with an awareness of the risks involved. The people should prepare themselves for receiving development influences from the outside by “burst from within” or they can be self-reliant in terms of basic necessities, equipped with strong social and cultural capital and enough knowledge to manage their material resources sustainably.

Referring back to the 2015 declaration of the Global Agenda for Sustainable Development, it can be seen that all 17 goals of SDGs are in line with SEP. The SDGs focus on the sustainability of human life, social, education, health, environment, energy, economic and local & community participation. SEP has also focused on these since it was started in 1974. It can also be seen that key factors that affect human behavior and direct behavioral change - knowledge, awareness, attitude, and mindset – can also drive the adoption and assure continuous implementation of SEP. These factors are the mechanisms to motivate behavioral change towards successful sustainable or continuous implementation of SEP, which also leads to successful SD for LCM. These factors become the KSF for SEP, SD, and of course, LCM.

5. Low Carbon Municipality (LCM) Project

The LCM project, “The Promotion of Low Carbon City across Municipalities in Celebration of His Majesty King’s 84th Birthday”, operated by The Municipality League of Thailand (MLT) (later changed to The National Municipal League of Thailand “NMT”) began 2011 and ran till 2014. 90% of the project’s budget was granted by the European Union (EU). The operated in 84 municipalities [23].

As mentioned previously, the goals of the project were to promote, in the target municipalities, correct knowledge and understanding on the causes of CO₂ emissions, and identify in these towns and cities, activities which can reduce CO₂ emissions [3]. It aimed for the development of low-carbon towns and cities. The specific objective was to develop the understanding of central and local government officials of the basic principles for planning effective low-carbon policies and for formulating an appropriate combination of low-carbon measures while taking into account the specific socio-economic conditions and characteristics of the cities [4]. This project was operated in 84 municipalities between 2011 till 2014. After the project was completed, only a few municipalities, however, were able to continue the implementation of low-carbon planning guidelines and the low carbon activities promoted by the project. As such, this was seen as an indication of the unsustainability of the activities that the project had undertaken. There was lack of continuity, in some of the towns and cities, of the low carbon activities that the project started.

The LCM project adopted the Sufficiency Economy Philosophy (SEP), bestowed by His Majesty King Bhumibol Adulyadej, King Rama IX. Specifically, the LCM project target was to reduce greenhouse gas emissions to not less than 84,000 Kg.CO₂. The project promoted the following strategies to achieve the target; 1) City of trees, 2) City of waste minimization, 3) City of energy efficiency, and 4) City of sustainable consumption.

The selected municipalities developed and implemented their CO₂ emission projects, on their own, with the participation of people in their municipalities. The outputs of the project included; 1) at least 84 municipalities had one CO₂ emission reduction project adopted and had integrated LCM project in their strategy plan, 2) reduced GHG to not less than 84,000 Kg.CO₂ as originally targeted by the LCM project and 3) had submitted a best practice report for the 84 selected municipalities. Even if the project was started in 2011, the LCM project objectives were aligned with the SDGs, which were adopted only in 2015, as mentioned previously. The LCM project objectives were aligned particularly with SDG # 7, 9, 11, 12 and 13.

In this research, the aim is to study the operation and management of the LCM project at the municipal levels, to analyze and validate the Key Success Factors (KSFs), which led to the successful

sustainability or continuity of SD strategies and actions started under the Low Carbon Municipality (LCM) project.

6. Research Objectives and Methods

This study is both a qualitative and quantitative research based on document and field survey research. The survey population was the people of selected municipalities, plus other key stakeholders of LCM project.

6.1. Selection of Survey Municipalities

For this study, four municipalities from each four regions of Thailand, from the 84 municipalities originally targeted by the LCM project were selected. The four municipalities were: 1) Tak municipality, Mueang Tak district, Tak province for northern region 2) Sing Buri municipality, Mueang Sing Buri district, Sing Buri province for central region 3) Sadao municipality, Sadao district, Songkhla province for the southern region and 4) Nongsamrong municipality, Mueang Udon Thani District, Udon Thani province for the northeast region. The criteria for the selection of the municipalities were the size and number of populations, which was, middle size municipality (or “Tessabarn Mueng” in Thai) with a population of between 10,000 – 50,000.

6.2. Scope of the Study

The action plans of these four municipalities, developed under the project “The Promotion of Low Carbon City across Municipalities in Celebration of His Majesty King’s 84th Birthday” were analyzed for the sustainability or continuity of the implementation of their action plans, including the period after the LCM project has ended. The research focused on the social aspects by analyzing the Key Success Factors (KSF) – “knowledge, awareness, attitude, and mindset” - and how they contributed to the “sustainability or continuity” of the action plans after the LCM project has ended. The four municipalities mentioned above were targeted for this study, for which data were collected from and survey were conducted for the key stakeholders of LCM Project in these municipalities.

6.3. Data Collection

The population of the selected municipalities was about 17,000-27,000 people. The sample size for the survey was 400 people that allow the results to be calculated using the Yamane’s equation. The respondents were selected by purposive sampling. The conditionalities for the samples were 1) found in the municipality area, and 2) are convenient to answer the questionnaire. For the interview, 26 stakeholders were selected from each target municipality. They were key informants consisting of 4 mayors, 8 people, 5 officers of municipality league of Thailand, 4 municipality officers, and 5 project officers, and 8 people representing the population of the municipalities.

For quantitative analysis, 400 samples from each of the target municipality selected and were asked to answer a questionnaire. The questionnaire had five parts, consisting of questions relating to Low Carbon Municipality Development questions and about the four KSFs; 1) Mindset, 2) Attitude, 3) Knowledge and 4) Awareness, and about 5) Sustainability. The response format for the questionnaire used the 5-level Likert scale, for the four parts (“Knowledge” used a different one), with responses ranging from extremely agree (4), very agree (3), moderately agree (2), slightly agree (1), and disagree (0), and the alternates for negative statements. There were 10 statements for each part. For the (3)

“Knowledge” part, 10 statements were used, but the response format was “yes” (1) or “no” (0), and the alternate for negative statements.

For qualitative analysis, the interview questions focused on the LCM project, questions regarding the beginning of the specific project activities implemented in the selected municipalities until the completion of those activities. Survey and analysis of project documents were also conducted covering project reports, project planning documents of the municipalities when they join the LCM project, and the municipality planning documents from 2011-2017.

6.4. Data Analysis

The quantitative data were analyzed using statistical tools to find and test correlation among “sustainability” and the 4 KSFs – “knowledge, awareness, attitude, and mindset”. The qualitative data and documents were analyzed by using the behavior-changing approach, SD and SEP, which its components of knowledge, awareness, attitude, mindset, and sustainability. All document data were analyzed by consideration about the activity of each municipality, which concerned with major components of this study.

7. Results and Discussions

7.1. Demographics

Demographics data for the selected municipalities are shown on Tables 1-a & 1-b. In spite of the four municipalities bring located in different areas or regions of Thailand, their demographics were similar. All municipalities are the center of the community, education, commercial and government service. These were general characteristics of the municipalities and these characteristics had influenced demographics. With regards to information about LCM project, the respondents from the 4 municipalities indicated that they received the procedures for project launching in the same ways, and as such data about how it affected them were not different. However, there were difference in the source of the data. It had been more convenient to receive data and to response, for municipalities wherein the community or stakeholders are involved in project operation.

Table 1-a Percentage distribution of selected demographics from the respondents of selected municipalities.

Demographics	Percentage (%)			
	Tak	Sing Buri	Sadao	Nongsamrong
Gender				
Male	40.0	39.2	45.2	43.0
Female	60.0	60.8	54.8	57.0
Age (years)				
Lower than 20	8.4	13.7	12.5	8.4
21-30	30.5	29.3	23.3	35.3
31-40	26.5	32.5	22.0	34.5
41-50	16.3	11.3	17.5	12.7
51-60	10.8	7.5	14.2	5.3
Over 60	7.8	5.7	10.5	3.8
Education Level				
Graduated High School or Lower	31.0	34.3	48.3	33.7
Diploma or Equivalent	37.5	40.3	25.5	39.5
Bachelor's degree	28.5	24.0	24.2	25.8
Postgraduate	3.0	1.4	2.0	1.0
Income per month (baht)				
Lower than 5,000	8.4	14.8	20.3	9.3
5,001-10,000	37.5	23.5	28.0	35.7

Demographics	Percentage (%)			
	Tak	Sing Buri	Sadao	Nongsamrong
10,001-15,000	36.4	39.0	39.5	46.0
15,001-20,000	14.4	21.3	11.5	8.0
20,001 or over	3.3	1.4	0.7	1.0
Occupation				
Gov. officials/State enterprise/ Gov. employees	34.8	26.8	17.8	22.7
Employees	23.0	19.2	19.8	32.5
Student	7.7	13.0	12.7	8.3
Mercenary	12.3	14.5	5.5	14.8
Merchant	14.7	16.0	18.5	15.0

Table 1-b Percentage distribution of selected demographics from the respondents of selected municipalities (continue).

Demographics	Percentage (%)			
	Tak	Sing Buri	Sadao	Nongsamrong
Farmer	5.5	7.8	15.5	5.7
Others	2.0	2.7	10.2	1.0
LCM data receiving				
Ever	65.3	62.0	56.0	53.5
Never	34.7	38.0	44.0	46.5
Source of data receiving				
Newspaper	-	-	0.3	-
Magazine	-	-	-	-
Television	-	-	0.3	-
Radio	2.3	-	-	4.3
Internet	-	-	1.8	-
Billboard	14.7	11.3	16.0	12.8
Local voice	5.0	11.5	11.3	6.8
Officers	17.5	19.8	15.8	14.8
Letters	25.8	19.5	11.5	15.0
Others	-	-	-	-
LCM activity attending				
Ever	53.0	62.0	37.2	37.2
Never	47.0	38.0	62.8	62.8

7.2. Mean of main factors in Low Carbon Municipality Development

The results of the statistical analysis of the collected data are presented in Table 2.

Table 2 Mean of main factors from 4 selected municipalities[†]

Main Factors	Mean			
	Tak	Sing Buri	Sadao	Nongsamrong
Mindset	2.65	2.61	2.68	2.89
Attitude	3.45	3.25	3.33	3.37
Knowledge	0.98	0.99	0.97	0.94
Awareness	3.24	3.20	3.57	3.14
Sustainability	3.19	3.38	3.70	3.23

The “statistical mean” of the collected values for “mindset, attitude, knowledge, awareness and sustainability” are similar. These results were consistent with the results of the data on demographics. This is an indication that the respondents of four municipalities representing the four regions of Thailand had the same “mindset, attitude, knowledge, awareness” about the “LCM project”, and view or opinion on the “sustainability” of the “LCM project”.

Table 3 The correlations of factors: mindset, attitude, knowledge, awareness and sustainability of 4 selected municipalities¹

Main Factors	Mindset	Attitude	Knowledge	Awareness	Sustainability
Tak					
Mindset	1	.87**	.25**	.95**	.97**
Attitude	.87**	1	.18**	.95**	.95**
Knowledge	.25**	.18**	1	.23**	.23**
Awareness	.95**	.95**	.23**	1	.99**
Sustainability	.97**	.95**	.23**	.99**	1
Sing Buri					
Mindset	1	.81**	.18**	.87**	.80**
Attitude	.81**	1	.23**	.99**	.99**
Knowledge	.18**	.23**	1	.22**	.23**
Awareness	.87**	.99**	.22**	1	.99**
Sustainability	.80**	.99**	.23**	.99**	1
Sadao					
Mindset	1	.62*	.19**	.30**	.23**
Attitude	.62**	1	.11*	.59**	.47**
Knowledge	.19**	.11*	1	.11*	.07
Awareness	.30**	.59**	.11*	1	.66**
Sustainability	.23**	.47**	.07	.66**	1
Nongsamrong					
Mindset	1	.77**	.26**	.14**	.06
Attitude	.77**	1	.22**	.16**	.09
Knowledge	.26**	.22**	1	.54**	.31**
Awareness	.14**	.16**	.54**	1	.85**
Sustainability	.06	.09	.31**	.85**	1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

7.3. The Correlations of Factors

The correlation of the four KSFs – “mindset, attitude, knowledge and awareness”, with “sustainability” of the LCM project, based on the results of the surveys in the four municipalities, were analyzed. (“Sustainability means that the project activities can be sustained or continued even after the project has ended.) The results, showing the correlation factors, obtained from the statistical analysis conducted, are shown in Table 3. The relationships of “mindset”, “attitude”, “knowledge”, and “awareness” with “sustainability” in the four municipalities showed that the relationships are at different levels (from .23-.99). It is significant at 0.01 level except “knowledge” in Sadao, while “mindset”& “attitude” showed no relationships in Nongsamrong. The results showed which factors are most relevant to the behavior of the respondents. Apart from the relationship with “sustainability”, the results found that ‘mindset, attitude, knowledge and awareness’ have relationships with each other too. The approaches about behavioral change and the SEP theory both mentioned that “knowledge” is one of important mechanism which motivates “mindset, attitude and awareness”. It then showed that these three factors could drive changes in the behavior of people involved in the LCM project. When the behavior of these people changes because of these three factors, it can lead to sustainability of the LCM project. “Knowledge” becomes the main mechanism that will drive the sustainability of the LCM project.

7.4 Main Issues from Former LCM Project Stakeholders

Data were collected from former LCM project key stakeholders. Interviews were conducted for these key informants. They include 4 mayors, 8 community people, 5 officers of the Municipality League of Thailand (MLT), 4 municipality officers, and 5 project officers - a total of 26 respondents. The issues they raise can be summarized into six points as follows:

1) The activities were finished with the end of the project (17 opinions from 26 respondents). “When the municipalities joined with the project, the specified period of the project was from 2012-2015. After the end of the project, all activities operated under the project were not continued even though these activities were useful for building LCM or environmental preservation. They should have been continued to support to achieve the LCM project goal and lead to sustainable development. The main reason which led to the stopping of the project and activities was the lack of budget.”

2) The activities for LCM projects were composed mostly of campaigns (22 opinions from 26 respondents). “These activities include the (a) mobilization people to participate in the project, (b) planting trees, (3) reducing waste, (4) saving energy and t950 sustainable consumption. These campaigns were the strategies that the LCM project has defined. Some municipalities also added (a) reducing plastic bag use and promotion of cloths, (b) bicycle for transportation within the municipality, (c) turning off the light when not in use and (d) using environmentally friendly products. All these activities lacked continuity. Some activities were finished within 1 day. Some activities had no participation of people from the municipality, and some activities lack understanding of people.”

3) Actions to continue some project activities were not included in the regular Municipality Action Plans (16 opinions from 26 respondents). The “Municipal Action Plans” could have supported the sustainable or continuous operation of the LCM project activities after the project ended. It is one of the important mechanisms to support project sustainability or continuity. When the municipalities specified LCM activities in the Municipal Action Plans, they could be formally implemented as the budget had been allocated for the activities. However, the integration of LCM activities in the Municipal Action Plans was not clearly specified in the LCM project management or operational tasks. This was even if everyone agreed that integration is needed. The reasons for these lack of initiative to integrate at the start of the LCM project was that - the stakeholders were told that the municipalities must manage their plans in accordance with the existing budgets, which was just enough for routine operation or have already been allocated for other specific activities already in the action plans. However, LCM activities were still not taken into account in the formulation of the next Municipal Action Plans, and as such LCM activities stopped after the project ended.”

4) “Knowledge, awareness, attitude and mindset” were not recognized as factors or indicators for sustainability or continuity of activities of the LCM project (26 opinions from 26 respondents). “The LCM activities were assessed at the end of the activities and the project. The indicators used to assess LCM activities were the number of participants, number of trees planted, amount of reduction in fuel used, amount of biogas produced from the fermentation of waste, amount of reduction in the use of electricity, and the calculated amount of reduction in CO₂ emission per activity. Some indicators were not directly related to CO₂ emission reduction, such as the donation of waste materials, the purchase of eco-friendly appliances, and sales in the green market. The assessment did not consider social factors such as “knowledge, awareness, attitude and mindset”, which can be influenced by the LCM project activities and, in turn, also affect and make stronger the support to the LCM activities. Furthermore, these are behavioral factors that can influence the sustainability or continuity of the LCM activities after the project ended. It would have been good had these factors been assessed before and after the LCM.”

5) Some municipalities lack knowledge of the issues in building LCM (17 opinions from 26 respondents). Knowledge about the LCM project and the issues related to building LCM were lacking in some municipalities because only a short time was devoted to training and learning before the beginning of activities. This the case for the following activities; tree planting, using bicycles for transportation, waste fermentation, waste separation, and the basics of LCM. Learning happened only when the activities were already being undertaken; when the activity was finished, the learning process was finished too. However, there were some municipalities that continued the learning process even after the LCM activities had ended. They got some LCM activities included in the action plans of municipalities. However, these were also short-term actions and involved only a small group of participants. No municipalities took the LCM knowledge and integrated it in the local school curriculum or any continuous training activity.

6) The use of the LCM project approach stopped when the assignment of the local administrators handling the project ended. (20 opinions from 26 respondents). “When the LCM project was finished, the LCM project approach was not continued when the municipality administrators were changed as most the new ones did not give emphasis on the project approach or have not included it in the first order of the municipalities’ operation”. The six main issues discussed above, which were gathered from interviewing the five groups of former LCM project stakeholders, can be divided into two; issues with the group working with the project and issues with the group working with the municipalities.

The main issues with the group working with the project consisted of the following: 1) ending of the project, 2) campaign activities, 4) non-inclusion of social factors (knowledge, awareness, attitude, and mindset) in the project indicators and 5) Lack of knowledge (understanding) of the project by stakeholders. The main issues with the group working with the municipalities consisted of the following: 1) ending of the project, 3) lack of municipality planning, 5) lack of knowledge of LCM project, and 6) change in or replacement of local administrators. If these issues facing the two groups had been properly addressed, the sustainability or continuity of LCM project activities might have been assured.

The results of the survey on the main issues showed that there was a lack of knowledge on the LCM project operation, and this led to a lack of seriousness in driving the continuous operation of the LCM project activities. There was a lack of sustainability and continuity of the LCM project activities. This occurred for both groups. There were issues on what are the roles of the different groups and stakeholders in LCM project operation and implementation. There were issues that should be responsible in promoting basic knowledge about the LCM project, in expanding the knowledge to other participants, and in creating awareness, and the proper attitude and mindset, among the different stakeholders. Efforts in addressing these issues should have been done systematically and continuously.

7.5 Planning for Low Carbon Municipality

One way to achieve sustainability or continuity of LCM project activities was integration in the municipal action plans but there had been issues in doing that. The main issues in integrating LCM project activities into the action plans of the municipalities, for the period 2011-2017 were the following:

1) Tree planting. There were plans for tree planting activities specified in the action plan for 2011 till 2017 for the four municipalities. However, most of these activities were operated by municipality officers as routine activities. Increasing the green space in the municipalities was one of the indicators used by the central government to assess the accomplishment of municipalities in achieving their

environmental targets. As such, according to this indicator, tree planting must really be specified in municipality planning targets.

2) Campaign Activity. These activities were specified in the action plans of all municipalities for the period 2011 to 2017. Campaign activities can be easily implemented. The campaign activities were about environmental protection such as; reducing waste, waste separation, tree planting, use of alternative energy, conservation of water resources, using the bicycle for transportation etc., These campaign activities were held only for short time durations, with some activities held only for within one day. Participants were about 20-30 people per year. The participants came from communities or students from schools within the municipalities. The results of the campaign activities were immediately known and impacted only the direct participants of the activities.

3) Education. The issues related to education were raised only in two municipalities, Sadao and Nongsamrong, Education activities involved training activities such as; LCM basic training, collection of carbon-footprint data, environmental management in schools, and conservation of water resources. This training was for a short time and targeted 20-30 people per year. Education activities should have been conducted yearly, but systematic and continuous plans for education were lacking.

4) Waste Management. Waste management was specified in the 2011 to 2017 action plan of the four municipalities. It was one of the main tasks of municipalities that directly relate to the LCM project. Wastes was collected by the communities and then transported to a waste disposal plant. The municipalities managed the waste in various ways and were regarded as an action for environmental preservation.

The results of the study showed that the characteristics of the people, which is the basis for their actions and activities to support and participate in LCM project activities, are the same. These is shown by the correlation analysis done for the four key factors - mindset, attitude, knowledge and awareness, which all demonstrated correlation with sustainability. The correlations validated the SE philosophy regarding these factors. These factors were demonstrated in human behavior as stated in SE; and they can “burst from within”, and lead to changes in behavior. Such changes in behavior can affect and drive the sustainability or continuity of the development of LCM. The SE believes that “knowledge” is the foundation for the building “mindset, attitude and awareness”.

However, when the correlations were analyzed together with the results of the interview with the stakeholders and with the municipal action plans, it showed that actually the stakeholders did not have or have only less “knowledge”, even if “knowledge” factor is essential to sustainability. According to this result, the sustainability of LCM project is driven not only by internal factors found at the municipality levels but also by external factors, such as outside organizations.

They were not systematic education. This was observed during the interview with the stakeholders. They provided information about the project procedures for giving information on greenhouse gas emissions and guidelines for the reduction of emissions. They provided information about the project activities implemented in their municipalities. However, these were not systematic education.

7.6 KSF for LCM

The correlations or relationships between “mindset, attitude and awareness” with “knowledge” are significant. The results of the interview with the LCM project stakeholders showed that the main KSF for sustainability is “knowledge”. “Knowledge” is the factor that indicated the same direction of correlation for all factors, including and most importantly, with “sustainability”. These results are according to the principle of SEP with regards to behavioral change, which proves that “knowledge” is

the KSF that assures sustainability or continuity of LCM strategies. This KSF will assure sustainability or continuity of LCM strategies that will reduce GHG emissions, which will help lead to sustainable development paths for municipalities. To ensure sustainability or continuity of LCM strategies, “knowledge”, as KSF, need to be done through a systematic learning process. It should consist of the following elements: 1) learning objective, 2) assessment of the target learners, 3) description of the learning process, 4) learning evaluation, and 5) results from feedback [24]. To assure success and achieve maximum effectiveness of the learning process, there should be support from the municipalities and external organizations. It should be specified that municipal action plans include continuous and sustainable learning activities. These are all needed to achieve LCM.

This KSF – “knowledge” – can assure sustainability or continuity of LCM strategies to reduce GHG emissions and contribute sustainable development of municipalities. “Knowledge” can have different levels of indicators and several procedures for assessment, such as numbers of; LCM learning centers, LCM learning center activity per year, LCM lecturers, training or workshops for LCM key persons in municipalities per year, training or workshops for LCM basics, LCM curriculum in a local school or knowledge activity in the municipality planning process. For the other KSFs which are correlated with “knowledge”, such as “mindset, attitude and awareness”, they can also be indicators for checking the success of enhancing “knowledge” by assessing them before and after “knowledge” activities are undertaken and also before and after LCM activities are implemented.

8. Conclusion

The LCM project aimed to promote in target municipalities correct knowledge and understanding carbon emissions, together with identify and implement activities to reduce emissions. The objective of this study was to find the KSF that can assure the sustainability or continuity of LCM project GHG emission reduction activities to lead the municipalities to a sustainable development path, as defined by the SDGs. The study conducted surveys and interviews to identify the KSF affecting sustainability of LCM strategies from among four factors – knowledge, awareness, mindset and attitude. The surveys and interviews were conducted in four municipalities (from among the 84 municipalities targeted by the project) representing the four regions of Thailand. The results of the surveys showed high mean values for the four factors affecting sustainability, with “knowledge” higher than the others. “Mindset, attitude, awareness and knowledge” are correlated with sustainable behavior that can assure sustainability or continuity of LCM strategies. The factors also have relationships or are correlated with each other. It is an indication that the respondents were ready to continuously pursue the LCM goal and “knowledge” is the KSF to sustain or continue their actions towards LCM that can lead to sustainable development. The main issues or constraints faced by the stakeholders in the implementation and the continuation of LCM strategies were related to the following: 1) ending of the project, 2) campaigning activities, 3) non-inclusion in municipality planning, 4) factors were not included in the project indicators, 5) lack of knowledge and 6) ending of assignments of local administrators responsible for the project. The sustainability of LCM strategies can be assured by integrating them in municipality planning. However, there were issues in integrating LCM strategies such as in tree planting, campaign activities and waste management for the four municipalities. However, two municipalities also had issues relating to education or knowledge build-up.

The results of the surveys and interviews showed that “knowledge” is the KSF. This is in accord with the approach to behavioral change under the SEP. SEP states that knowledge is one important mechanism which motivate mindset, attitude, and awareness and that all these factors are mechanism

driving behavioral change. This behavioral change can lead to sustainability or continuity of LCM strategies that will lead to LCM, which then helps achieve the goals of sustainable development. Knowledge of LCM should be a factor considered in municipality planning, and as such LCM strategies are integrated into municipality plans assuring sustainability or continuity of the strategies and assuring that there are finally support mechanisms for sustainable LCM.

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