

LOCAL KNOWLEDGE FRAMEWORK FOR
SUSTAINABLE UTILIZATION OF MANGROVE FOREST:
A CASE STUDY OF KLONG KHONE SUB-DISTRICT,
MUEANG DISTRICT, SAMUT SONGKHRAM PROVINCE,
THAILAND

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A Dissertation Submitted in Partial Fulfillment of the Requirements
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วิภาพรรณ อดุลย์เจริญ : กรอบองค์ความรู้ท้องถิ่นเพื่อการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืน
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การพัฒนาองค์ความรู้ท้องถิ่นหรือวิถีการองค์ความรู้ท้องถิ่นเพื่อการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืนและเหมาะสมต่อบริบทท้องถิ่นนั้น ได้รับอิทธิพลมาจากปัจจัยที่ซับซ้อนซึ่งเฉพาะเจาะจงกับระบบนิเวศ สภาพทางสังคมและวัฒนธรรม และแปรเปลี่ยนไปตามนิเวศบริการของป่าชายเลนที่ต้องการใช้ประโยชน์ การศึกษานี้จึงมีวัตถุประสงค์เพื่อ 1) ระบุถึงปัจจัยที่มีอิทธิพลต่อการพัฒนาองค์ความรู้ท้องถิ่นที่เกิดขึ้นในช่วงที่เกิดการพัฒนาาระบบนิเวศป่าชายเลนได้แก่ ช่วงที่ป่าชายเลนเริ่มฟื้นฟูป่า และช่วงที่ป่าชายเลนเริ่มเติบโต ที่ตำบลคลองโคน จังหวัดสมุทรสงคราม ประเทศไทย และ 2) เพื่อเสนอกรอบองค์ความรู้ท้องถิ่นเพื่อการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืนและการถอดบทเรียนผ่านการพัฒนาองค์ความรู้ท้องถิ่นในพื้นที่ที่ศึกษา เก็บรวบรวมข้อมูลโดยการสังเกตการณ์ภาคสนาม การทำแบบสอบถามกับทั้งหมด 160 คน โดยเป็นชาวประมงจำนวน 140 คน และสัมภาษณ์เชิงลึกกับ 20 คน ซึ่งมีบทบาทและความรับผิดชอบเกี่ยวข้องกับวิถีการองค์ความรู้ท้องถิ่นที่เกิดขึ้นในช่วงที่เกิดการพัฒนาาระบบนิเวศป่าชายเลน ได้แก่ ผู้ใหญ่บ้านทั้งคนในอดีตและปัจจุบัน หน่วยงานรัฐท้องถิ่น ราษฎรวิสาหกิจชุมชน ราษฎรชาวบ้าน และกลุ่มอนุรักษ์ป่าชายเลนในชุมชน ทำการวิเคราะห์ข้อมูลด้วยสถิติเชิงบรรยายและการวิเคราะห์เหตุการณ์ตามเรื่องราว ผลการศึกษาพบว่า วิถีการองค์ความรู้ท้องถิ่นในสองช่วงเวลาได้รับอิทธิพลหลักมาจากปัจจัยด้านสิ่งแวดล้อม การจัดการ อารมณ์ของผู้คน และสังคม การลดลงของสัตว์น้ำอันเนื่องมาจากการเสื่อมโทรมของป่าชายเลนส่งผลกระทบต่อรายได้และวิถีชีวิตของคนในชุมชน ซึ่งผลกระทบต่อกล่าวกระตุ้นการรับรู้ของคนในชุมชนซึ่งนำไปสู่การฟื้นฟูป่าชายเลนเพื่อเพิ่มปริมาณสัตว์น้ำ แก้ไขปัญหาความยากจน และดำรงไว้ซึ่งวิถีชีวิตของคนในชุมชน ความเชื่อใจและจงรักภักดีต่อสมเด็จพระกนิษฐาธิราชเจ้า กรมสมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี และอดีตผู้ใหญ่บ้าน มีอิทธิพลหลักต่อการเข้ามามีส่วนร่วมอย่างเต็มใจของคนในชุมชนในวิถีการองค์ความรู้ท้องถิ่นในสองช่วงเวลาของการพัฒนาาระบบนิเวศป่าชายเลน การให้สิทธิชุมชนในการใช้ประโยชน์ป่าชายเลนเป็นปัจจัยที่มีอิทธิพลมากที่สุดที่กระตุ้นให้เกิดการรับรู้และการมีส่วนร่วมของคนในชุมชน เนื่องจากการให้สิทธิชุมชนช่วยสร้างความรู้สึกรับรู้ความเป็นเจ้าของและความมั่นคงในการถือครองที่ดินและทรัพยากร โดยอ้อม การแบ่งพื้นที่การใช้ป่าชายเลนและการประยุกต์ใช้องค์ความรู้ท้องถิ่นและวิถีชีวิตของคนในชุมชนช่วยตรวจสอบและติดตามการใช้บริการของป่าชายเลน ปัจจัยเหล่านี้เป็นปัจจัยหลักของการพัฒนาองค์ความรู้ท้องถิ่นที่นำมาใช้สร้างกรอบองค์ความรู้ท้องถิ่นซึ่งสามารถนำมาปรับใช้เพื่อเสริมสร้างความเข้มแข็งให้ชุมชนสามารถดำรงวิถีชีวิตอยู่ได้ภายใต้การเปลี่ยนแปลงบริบททางสิ่งแวดล้อม สังคม วัฒนธรรม และเศรษฐกิจต่อไป

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Wipapan Adulcharoen : LOCAL KNOWLEDGE FRAMEWORK FOR SUSTAINABLE UTILIZATION OF MANGROVE FOREST: A CASE STUDY OF KLONG KHONE SUB-DISTRICT, MUEANG DISTRICT, SAMUT SONGKHRAM PROVINCE, THAILAND. Advisor: Kallaya Suntornvongsagul, Ph.D.

A development of local knowledge or local knowledge life cycle for locally appropriate sustainable utilization of mangrove ecosystem services was influenced by factors that were specific to ecological and social-cultural conditions and varied relying a change of the targeted mangrove ecosystem services for utilization. This study aims 1) to identify the factors in the local knowledge life cycle during two phases of mangrove stand initiation and young forest regrowth at Klong Khone sub-district, Samut Songkhram province, Thailand and 2) to propose the local knowledge framework for the sustainable utilization of mangrove ecosystem services and lessons learned through the local knowledge life cycle in the study area. The data was collected by field observation, questionnaires survey totally 160 respondents who were 140 fishermen, and in-depth interview with 20 key stakeholders who had roles and responsibilities involving the local knowledge life cycle during the mangrove forest development. They included former and current village chiefs, local governmental agencies, community enterprises, local philosophers, and mangrove forest conservation groups. Descriptive statistical analysis and event analysis were employed to analyze the collected data. The results showed that the factors in local knowledge life cycle during two phases were ecological, managerial, emotional, and social factors. The ecological factors, especially a reduction of aquatic animals which affected the local people's income and livelihood motivated the local people's perception and led them to restore mangrove forest for accruing aquatic animals, solving poverty and sustaining their livelihood. A trust and faith of local people in HRH Princess Maha Chakri Sirindhorn and former village chiefs majorly influenced the local people's voluntary participation in the local knowledge life cycle during two phases of mangrove forest development. A common property right was a key factor motivating local people's perception and participation as it indirectly created the local people's sense of ownership and land tenure and resources security. A mangrove use zoning, and an application of local knowledge and local livelihood also found in a plan validation and monitoring the local people's utilization of the Field of Study:

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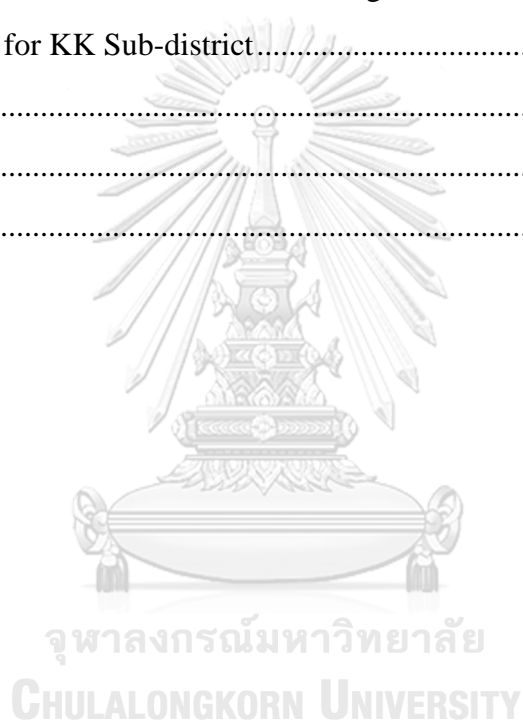
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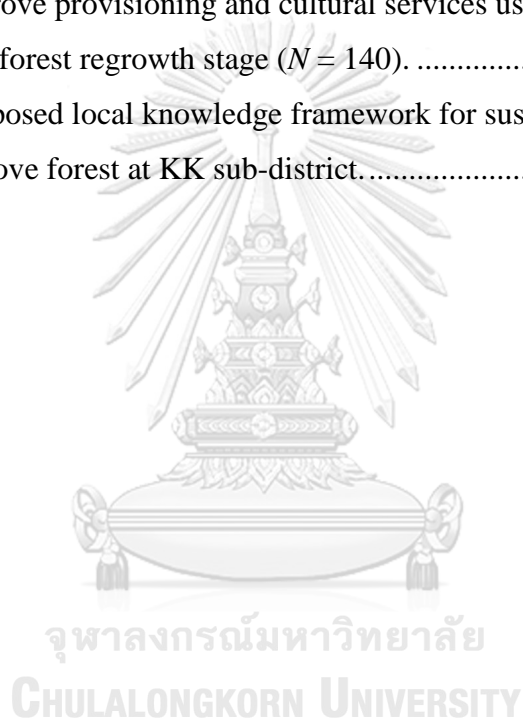
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LIST OF ABBREVIATIONS AND ACRONYMS

AAPSUBD	Addis Ababa Principles of Sustainable Use of Biological Diversity
CBD	Convention on Biological Diversity
DMCR	Department of Marine and Coastal Resources
FAO	Food and Agriculture Organization
FRA	Forest Resources Assessment
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
KK	Klong Khone
KKCCMFC	Klong Khone Coordination Center for Mangrove Forest Conservation
KKMFCC	Klong Khone Mangrove Forest Conservation Center
KKSAO	Klong Khone Sub-district Administration Organization
KM	Knowledge Management
KRKK	Khon Rak Klong Khone
LINKs	Local and Indigenous Knowledge Systems
LKLC	Local Knowledge Life Cycle
MDGs	Millennium Development Goals
MA	Millennium Ecosystem Assessment
MFF	Mangroves for the Future
MGES	Mangrove Ecosystem Services
MGFDS 7	Mangrove Forest Development Station 7
PSE	Philosophy of Sufficiency Economy
Ramsar	Ramsar Convention on Wetlands
SDGs	Sustainable Development Goals
SU	Sustainable Utilization
TEI	Thailand Environment Institute
UNCED	United Nations Conference on Environment and Development

UNCSD	United Nations Conference on Sustainable Development
UNDP	United Nations Development Programme
UNSD	United Nations Division for Sustainable Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNESCO-MAB	UNESCO Man and Biosphere Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation



CHAPTER I

INTRODUCTION

1.1 Background

A local knowledge was regarded as an effective tool for sustainable utilization (SU) of ecosystem services at community level (Bélair *et al.*, 2010; Berkes *et al.*, 1993; Convention on Biological Diversity [CBD], 1992b; Workineh *et al.*, 2010). It was specifically developed from long histories of interactions among the environmental and societal surroundings such as resource use practices, social interactions, ritual and spirituality (Food and Agriculture Organization [FAO], 2004; United Nations Educational Scientific and Cultural Organization [UNESCO], 2003). It was transferred from generation to generation (Kothari, 2007) and coherently embedded in culture and beliefs of a community (Berkes *et al.*, 1993; Santasombat, 2003). It can be changed over time and adapted to the local cultural and environmental dynamic (FAO, 2004). It was integrated in a local practice aiming the SU and ecological production capacity to fulfil the social, economic, and cultural needs of local people without disturbing the ecological production. As a result, it became an important foundation for locally-appropriate sustainable use of ecosystem services (Farooquee *et al.*, 2004; Mazzocchi, 2006; Workineh *et al.*, 2010).

The local knowledge was mentioned and promoted in several international agreements and framework and Thailand's laws and policies for a conservation and sustainable resources management. In 1992, it was widely accepted as a tool contributing the sustainable forest management (Mauro *et al.*, 1999). It was raised in the Agenda 21 from the Rio Earth Summit agenda (United Nations Division for Sustainable Development [UNSD], 1992) and Article 8 (j) of Convention on Biological Diversity (CBD) (CBD, 1992b). In Thailand, the local knowledge was also mentioned in laws and policies. For example, the Section 57 of Constitution of the Kingdom of Thailand 2017 indicated that the local knowledge shall be conserved, revived and promoted both local and national levels through supporting the local people's participation ("Constitution of The Kingdom of Thailand, B.E. 2560," 2017). It could be concluded that the local knowledge was widely recognized both in

international and national level in maintaining the ecosystem health and promoting the biodiversity (Das Gupta, 2011; Santasombat, 2003).

A development process of local knowledge or local knowledge life cycle (LKLC) encompasses interconnected actions of learning, practicing, and monitoring to create the site-specific knowledge for sustainable resource utilization. Originally, it was implemented in a business organization called as a knowledge management (KM) to improve a performance, productivity and quality of services and to find novel solutions responding to competitive consumption (Alavi *et al.*, 2001; Awad *et al.*, 2004; Karadsheh *et al.*, 2009; King, 2009; Omotayo, 2015). At community level, the local knowledge on natural mangrove management and utilization was also developed with the same cycle as KM, but it involved with a dynamic changing environment and a different range of community culture and livelihoods (FAO, 2004; Hill *et al.*, 2010; Nakashima *et al.*, 2002; UNESCO, 2003). It was integrated in the local culture and social values which showed in a form of local people's sustainable utilization of ecosystem services (Farooquee *et al.*, 2004) with aiming to maintain the ecosystem services for the future use and sustain the local livelihood (Berkes *et al.*, 2000; FAO, 2004). However, the process of LKLC depends on various interrelated factors which was very specific to the biogeographic, physical, social, and cultural contexts (Bélair *et al.*, 2010; Failing *et al.*, 2007; Workineh *et al.*, 2010) and have not been well documented or identified. These complex factors in the LKLC had to be identified to simplify the LKLC bridging the ecosystem services and the sustainability of community utilization,

Klong Khone (KK) sub-district in Samut Songkhram province was well-known in restoring the mangrove forest and utilizing restored MGES for an ecotourism (Paphavasit *et al.*, 1996; Sangchumnong, 2018) by developing and applying the local knowledge. The development process of local knowledge at this community involved with several interconnected factors which specific to ecological, social, cultural, economic and legal conditions. As a result, it was important to identify these factors and their interrelated functions in the LKLC to reveal how the local knowledge at KK sub-district was developed into an effective local tool for restoring mangrove ecosystem and SU of restored MGES. The major factors found in

the LKLC were used to create a local knowledge framework for SU of MGES which can be applied for capacity building to sustain local livelihood under the change of ecological, social, cultural and economic conditions.

1.2 Research Questions

- 1) What are factors that influence the local knowledge development processes including the creation, transfer and refinement for sustainable utilization of mangrove forest in the study area?
- 2) How is the local knowledge system life cycle implemented for the sustainable utilization of mangrove forest in the practice level?
- 3) What is the local knowledge framework refined under the change of mangrove forest required for an application in policy and plans in community level?

1.3 Research Objectives

- 1) To identify the factors that influence the local knowledge development which include the creation, the transfer and the refinement process in the study area.
- 2) To propose the local knowledge framework for the sustainable utilization of mangrove forest and the lessons learned, through the process of local knowledge development in the study area.

1.4 Scope of Study

A scope of this study focuses on the factors in the local knowledge development or LKLC to propose the local knowledge framework for the SU of MGES at KK sub-district in Samut Songkhram province, Thailand.

Target information of the study consisted of 1) demographic information of respondents, 2) a changing utilization of mangrove provisioning and cultural services during two phases of mangrove stand initiation stage and young forest regrowth, 3) factors and their functions in the LKLC during two phases of mangrove stand initiation stage and young forest regrowth, and 4) major factors in the LKLC enabling the SU of MGES at KK sub-district. Field observation and questionnaire survey with dichotomous questions, multiple choices, and checkboxes were conducted to collect

the target information from stakeholders selected by using a purposive sampling and multi-stage random sampling. Furthermore, internal and external threats such as overfishing (Alongi, 2002; Van Lavieren *et al.*, 2012), water pollution (Baran *et al.*, 1998; Macintosh *et al.*, 2002a), and law violations that affect to the mangrove forest were also gathered by document reviews and in-depth interviews in order to evaluate their influence on the development of local knowledge.

The results were analyzed by a descriptive statistical analysis and event analysis. Then, the analyzed results were validated by a focus group discussion with experts who experienced in mangrove restoration and involved with the factors in the LKLC that influence the SU of MGES. All validated data were used to illustrate a complex relationship network of factors and their functions on each step of the LKLC for creating local knowledge framework for the SU of MGES. The analyzed and discussed results and developed local knowledge framework were finally proposed to local communities, local governmental agencies, and educational institutions for using as a framework to build the local community's capacity for the SU of MGES under the change of ecological, social, cultural, economic and legal conditions.

1.5 Significance of Study

A significance of the study was a disclosure of factors, their functions and relationship in the LKLC during two phases of mangrove stand initiation stage and young forest regrowth stage at KK sub-district. The factors in the LKLC can provide an overall image of local community's culture, values, perception, and actions toward mangrove stand initiation stage and young forest regrowth stage. They can reflect an adaptation of local people's cognition and practices in harmony with a change of ecological, social-cultural, and legal conditions. They were deployed to create a local knowledge framework which can be applied in other communities for capacity building regarding the major factors in the LKLC.

CHAPTER II

LITERATURE REVIEW

Two parts of information including a sustainable utilization (SU) of mangrove ecosystem services (MGES) and factors involving local knowledge life cycle (LKLC) of community that influence the SU of MGES were reviewed to create common understanding on a specific meaning used in the study. Key terms used in these two parts were commonly used in a very broad meaning in sustainability. The relevant key terms of the study were generally defined following citations, and then were narrative to the study. They across multiple dimensions of the SU and integrated in a natural resource management particularly, services that mangrove forest contributes to human community. They were also used in the international movements and national laws and policies, principles, indicators of sustainable natural resources use, and process of LKLC.

For more practical details of the study, the Klong Khone (KK) sub-district was selected to understand how the local knowledge has been developed through the changes of environmental, economic, and social aspects. At international level, the local knowledge was regarded as a key driver of the SU of natural resource. It was also recognized as an essential tool imprinted in a step of community practices in Thailand and around the world. It was reviewed through many case studies which were regarded as community-based natural resources management and practices, especially the mangrove management in Thailand and other countries. It drove an approach of targeted MGES and evolved its cycle in harmony with the changes of sustainable utilization of mangrove forest.

2.1 Definitions

2.1.1 Local Knowledge

A knowledge was mostly described as a know-how of a person (Alexopoulos, 2008; Nonaka *et al.*, 2006) generated from a processing of information which finally became a mixed experience, values, contextual information, and expert insight that provides a framework for an individual to evaluate and incorporate new experiences and information (Davenport *et al.*, 1998). It was distinguished into two types

including a tacit and explicit knowledge. The tacit knowledge was hidden inside an individual person and specific to the context; thus, it was difficult to express and convey the information to others (Nonaka *et al.*, 1995). On the other hand, the explicit knowledge referred to the knowledge that can be collected and transmitted in a formal and systematic language such as books, documents, reports, and journals (Nonaka *et al.*, 1995).

A local knowledge was defined as a cumulative experience that was developed from long histories of interactions between people and natural environment (United Nations Educational Scientific and Cultural Organization [UNESCO], 2003). It developed specifically as an integral part of human capital (Food and Agriculture Organization [FAO], 2004). It was associated with various sectors such as agriculture use and cultivation of natural resources, resource management and forest conservation (FAO, 2004), beliefs and rituals (Santasombat, 2003; UNESCO, 2003). It was transferred in a form of social attitudes, beliefs, rituals, norms and values (Berkes *et al.*, 1993). Besides, it can be adapted and developed in harmony with the changing environment to support local people's livelihood (FAO, 2004; Hill *et al.*, 2010; Nakashima *et al.*, 2002). It was also regarded by several names such as traditional knowledge (International Council for Science, 2002), indigenous knowledge (FAO, 2004; UNESCO, 2003; Workineh *et al.*, 2010), traditional ecological knowledge (Berkes *et al.*, 1993; UNESCO, 2003), and local ecological knowledge (Gerhardinger *et al.*, 2009). This study used a term local knowledge as its meaning covers those classified as traditional and indigenous knowledge (FAO, 2004).

In case of this study, the local knowledge was termed as a cumulative experience of local people on a site-specific information of mangrove ecological production. It was a factual knowledge which reflected local values and interaction of managerial, environmental and social resources. It can be developed from an integration between tacit and explicit knowledge. It was applied in restoring and using mangrove provisioning and cultural services from restored mangrove forest.

2.1.2 Ecosystem Services

Ecosystem services was defined as a direct and indirect benefits provided by ecosystems to humans well-being (Millennium Ecosystem Assessment [MA], 2005b).

It was categorized into four categories based on their functions including provisioning services, regulating services, cultural services, and supporting services (MA, 2003) as shown in Figure 2.1.

The mangrove ecosystem services provided lots of benefits to local people such as fishery resources, fuelwood, herbal medicine, carbon storage and sequestration, coastal erosion protection, recreational area for ecotourism (Van Lavieren *et al.*, 2012). In case of supporting services of mangrove which was necessary for a production of all other ecosystem services, they refer to nutrient cycling, soil stabilization and sedimentation, primary production, nursery grounds and breeding sites (Craft, 2016; Giesen *et al.*, 2007; Macintosh *et al.*, 2002a; Melana *et al.*, 2000; Van Lavieren *et al.*, 2012).

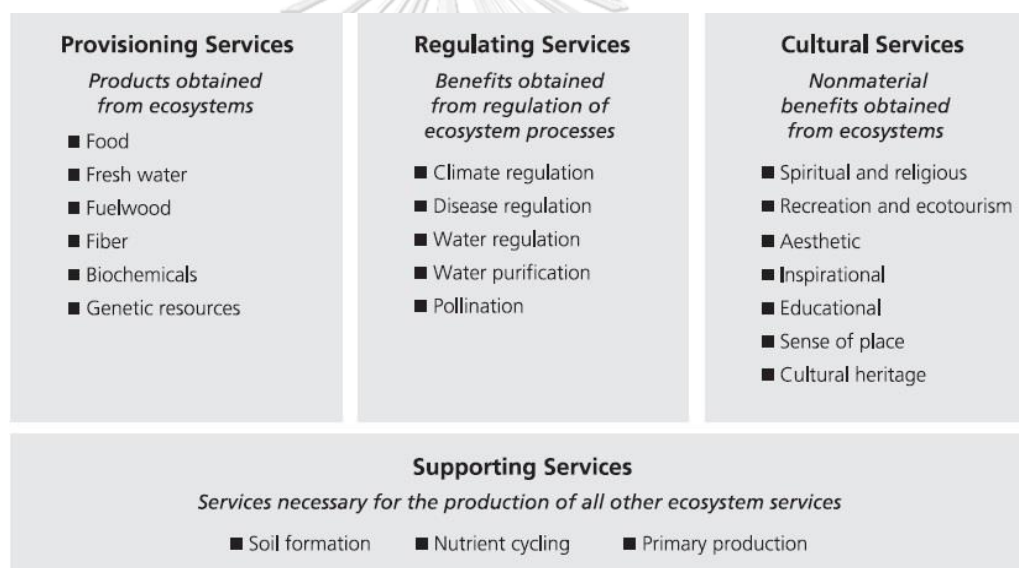


Figure 2.1 Ecosystem services.

Source: Millennium Ecosystem Assessment [MA] (2003)

The MGES at KK sub-district were identified based on their changing ecological production during two phases of mangrove stand initiation and young forest regrowth. During the mangrove restoring, a recovery of mangrove ecological functions such as a nursery ground and habitat for juvenile aquatic organisms, sedimentation, and growth and distribution of benthic communities (Paphavasit, 2002) resulted in a gradual return of provisioning services such as seafood to local people (Poonkratok *et al.*, 2013). As a result, the MGES from restored mangrove forest was used as a food for household consumption and trade, and ecotourism to

increase local people's income (Poonkratok *et al.*, 2013; Rungsirattanawong, 2011; Udomsilp, 2012). The provisioning services (aquatic animals such as krill, blood cockle, and fishes) and cultural services (ecotourism) were utilized sustainably to avoid any disturbances to the restored mangrove ecological production. These MGES were focused in this study because they were found beneficial to the local people's income and mean of daily subsistence.

2.1.3 Sustainable Utilization

A definition of SU of natural resources was rooted in a definition of sustainable development. According to the Brundtland Report, sustainable development was a development that meets a need of a present generation without compromising an ability of future generations to meet their own needs (United Nations World Commission on Environment and Development, 1987). This definition was confirmed in the Rio Declaration in 1992 (Drexhage *et al.*, 2010) and was especially accepted in the natural resource management (Culture Identity and Resources Use Management, 2012). A broad definition of sustainable development was interpreted in various areas and applied to suit with a local context.

A definition of SU was defined by the Convention on Biological Diversity [CBD] (1992a) as a use of biological diversity that does not lead to a long-term decline, thereby maintaining its potential to meet the needs of present and future generations. An implication of this definition focuses on a use of biodiversity for socio-economic benefits while also conserving a biological diversity.

In term of SU in the study, it refers to a use of mangrove provisioning services (fishery resources) and cultural services (ecotourism) to fulfill social, economic, and cultural needs of local people with a maximum protection of complex biomass structure. The SU of MGES for seafood consumption and trade, and ecotourism was conducted based on the local people's knowledge which was developed specifically to the mangrove ecological, social, economic, and cultural conditions.

2.1.4 Restoration and Reforestation

A restoration referred to a return from a disturbed condition to a pre-existing condition by some actions of human (Lewis, 1990). It did not necessary to restore a

disturbed condition to a pristine condition as it depended on a determined goal of restoration.

A reforestation was defined as a re-establishment of forest through planting seeding on land classified as forest (The Forest Resources Assessment (FRA), 2015). It referred to human-induced planting activities to converse a non-forested land into forest on the lands that used to be forest (United Nations Framework Convention on Climate Change (UNFCCC), 2006). It excluded a plantation following a clear-cutting of timber (Intergovernmental Panel on Climate Change (IPCC), 2000) and natural regeneration (FRA, 2015).

In case of KK sub-district, a mangrove restoration referred to a plantation of mangrove saplings on an intertidal zone for restoring mangrove ecological production. In other words, the mangrove ecological production was restored by a mangrove reforestation through a mangrove planting. The mangrove reforestation at KK sub-district can be divided into two phases based on a change of targeted MGES for utilization. An initial phase of mangrove reforestation focused on a restoration of mangrove ecological production by planting pioneer mangrove species named *Avicennia* sp. on the extended mudflats. After restoring the mangrove ecological production, the mangrove reforestation was used as a part of ecotourism activities instead by additional planting mangrove species named *Rhizophora* sp. on a foreshore and inner landward zone. Even though the target of mangrove reforesting activities was shifted, it still indirectly assisted in expanding the mangrove forest and maintaining local people's daily subsistence.

2.2 Current Status and Trend of Local Knowledge for Natural Resources Management in International and National Levels

A local knowledge was increasingly recognized in a general public as a tool contributing to a sustainable natural resource management (Berkes *et al.*, 1993; Kothari, 2007; Santasombat, 2003; Treacle *et al.*, 2014). Its value was recognized because of environmental problems which urgently required an integrated knowledge for problem solving.

Over the past several decades, a forest degradation stemmed from anthropological activities such as an overuse of ecosystem services, urban and industrial development (Chaiphar *et al.*, 2013), waste disposal, and pollutant emission (MA, 2005a; United Nations Environment Programme [UNEP], 2009). Similarly, the mangrove had also been destroyed and lost since 1980 (Abdullah *et al.*, 2014) due to the shrimp farming and urban, infrastructure and tourism development (Craft, 2016; Dasgupta *et al.*, 2013; Van Lavieren *et al.*, 2012). The worldwide mangrove forest areas decreased from 18.8 million hectares in 1980 to 15.2 million hectares in 2005 (FAO, 2007) and to 8.34 million hectare in 2016 (Romañach *et al.*, 2018) as shown in Figure 2.2.

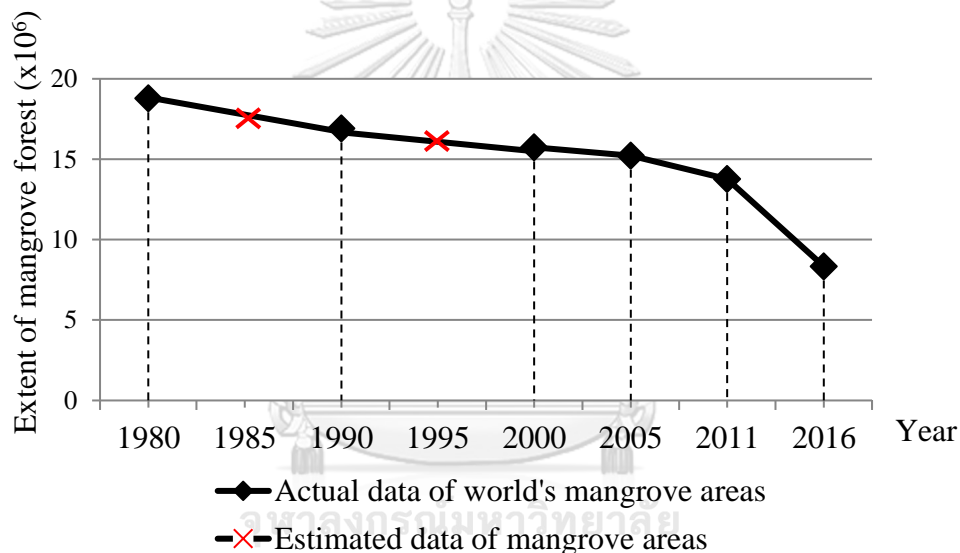


Figure 2.2 The world's mangrove forest areas.

Source: Adapted from Food and Agriculture Organization [FAO] (2007) and Romañach *et al.* (2018)

Laws, policies and regulations were formulated to address the natural resources and environmental problems. For example, an establishment of protected areas to conserve the forest, ecosystem services and cultural values from a deforestation (Dudley *et al.*, 2006). Despite an implementation of conservation laws and policies, the mangrove protected areas still be poorly managed due to limited stakeholder participation (Abdullah *et al.*, 2014; Randy *et al.*, 2015) and lack of local knowledge integration (Farooquee *et al.*, 2004; Mauro *et al.*, 1999; Phuthego *et al.*, 2004; Varte, 2012). As a result, many international and national agencies attempted to

integrate and document the local knowledge and traditional practices (Farooquee *et al.*, 2004; Kothari, 2007) and empowered the local people's right to take parts in decision-making for natural resources management (Isager *et al.*, 2001; Mauro *et al.*, 1999).

2.2.1 International Conventions on Local Knowledge for Conservation and Sustainable Utilization of Natural Resources

A local knowledge was mentioned in several international conventions as a potential tool for conservation and sustainable utilization of natural resources. Several international agreements and frameworks were formulated to respect, protect, and promote an application of local knowledge and traditional practices in sustainable resource management by encouraging the local people's participation in decision-making, implementing and monitoring of natural resource management (Table 2.1).

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework

Issues	International agreement/framework
Conservation and sustainable use of wetlands	<ul style="list-style-type: none"> • Ramsar Convention on Wetlands (1975) (169 contracting parties*) <p>Ramsar's goal is to provide a framework for national action and international cooperation for the conservation and sustainable use of wetlands and the resources they provide. Ramsar members are committed to designating different sites according to several categories that assign 'international importance'. This encourages parties to undertake more comprehensive reviews of their wetlands, thus facilitating their designation as protected sites. In 2009, there were 215 reported Ramsar sites (in 65 countries and territories), that included mangroves, and presently, over 15 million hectares of mangrove wetlands were under protection and sustainable use as part of the Ramsar Convention.</p>

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework (Cont.)

Issues	International agreement/framework
<p>Promotion of local knowledge application and participation of indigenous people in natural resource management</p>	<ul style="list-style-type: none"> • The United Nations Conference on Environment and Development [UNCED] (1992) (194 contracting parties*) <p>It also known as the Earth Summit, took place in Rio de Janeiro, Brazil, from June 2-14, 1992. An importance result from this conference which related to a local knowledge and an involvement of indigenous people and local communities can be summarized as following:</p> <ul style="list-style-type: none"> - Agenda 21 <p>An international plan of action or implementing tool to sustainable development. In Chapter 26 of this plan, it mentioned about the recognition in the role of indigenous people and their communities in managing their own natural resources.</p> - The Rio Declaration on Environment and Development <p>A set of 27 non-legal binding principles that recognize the importance of preserving the environment. The participation of local people in environmental management were mentioned in 2 principles including:</p> <p>Principle 10: the public awareness and participation of all stakeholders in the decision-making processes in order to handle with the environmental problems and access to the information.</p> <p>Principle 22: the indigenous people and their local communities have a vital role in environmental management and development because of their knowledge and traditional practices.</p>

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework (Cont.)

Issues	International agreement/framework
	<ul style="list-style-type: none"> <li>• United Nations Conference on Sustainable Development [UNCSD] (2012) (194 contracting parties*) <p>The United Nations Conference on Sustainable Development (UNCSD) which is also known as Rio+20, took place in Rio de Janeiro, Brazil from 13 to 22 June 2012. One of the main outcomes of this conference was the development of Sustainable Development Goals (SDGs) to become a new framework for working toward sustainable development.</p> <ul style="list-style-type: none"> <li>- Sustainable Development Goals (SDGs) <p>A broad international sustainable development agenda including 17 goals which developed from the Millennium Development Goals (MDGs). It serves as a tool for countries to measure their progress as well as further cooperation between countries. On September 2015, the draft set of 17 SDGs were officially adopted and became applicable on 1 January 2016 (United Nations [UN], 2015).</p> <p>The important goals related to the respect and promotion of the use of local knowledge and the participation of the indigenous people in decision making process for natural resources management include as follows:</p> <ul style="list-style-type: none"> <li>Goal 2: End hunger, achieve food security and wholesome nutrition, and shift to sustainable agriculture respect traditional indigenous knowledge <li>Goal 5: Achieve gender equality, the full realization of women and girls' human rights and the empowerment of all women and girls everywhere

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework (Cont.)

Issues	International agreement/framework
	<p>Goal 12: Achieve sustainable consumption and production practices and systems</p> <p>Goal 13: Promote actions at all level to tackle the causes of climate change and its impacts</p> <p>Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development</p> <ul style="list-style-type: none"> ● United Nations Framework Convention on Climate Change [UNFCCC] (1994) (195 contracting parties*) is one of three adopted at the Rio Earth Summit in 1992. An important outcome from this convention related to indigenous people and local community for conservation and sustainable management of forest is the REDD+. <ul style="list-style-type: none"> - Reducing Emission from Deforestation and Forest Degradation in Developing Countries (REDD+) <p>REDD+ is a framework to mitigate the climate change by using a policy approach and financial incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. It was developed from Reducing Emission from Deforestation and Forest Degradation (UN-REDD Programme) in 2008 at the fourteenth session of the Conference of the Parties (COP-14) in order to expand a scope and improve the potential of REDD for biodiversity conservation, protection of eco-services, and poverty alleviation.</p>

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework (Cont.)

Issues	International agreement/framework
	<p>In 2010, the Cancun Agreement, at the sixteenth session of the Conference of the Parties (COP-16), firstly mentioned and highlighted the effective and full participation of relevant stakeholders including indigenous people and local communities in developing the national action plans and strategies for REDD+.</p> <p>A goal of this program is to assist the developing countries to build capacity so as to reduce emission and to participate in a future REDD+ mechanism. One of UN-REDD's work areas is related with the engagement of indigenous people and other stakeholders. This program offer technical and methodological support to implement this work area by (1) developing the operational guidelines, standards and procedure in stakeholders engagement for national and international REDD+ processes, (2) supporting the capacity of indigenous people and other forest dependent communities to engage in national and international REDD+ processes and (3) supporting co-ordination and communication to implement REDD+ effectively through knowledge sharing (UN-REDD Programme, 2010).</p>
<p>Conservation, sustainable use, and fair and equitable distribution of benefits arising from a utilization of biodiversity.</p>	<ul style="list-style-type: none"> • Convention on Biological Diversity (CBD) (1992) <p>CBD's objectives are biodiversity conservation, sustainable use of biodiversity, and fair and equitable distribution of benefits arising from the utilization of genetic resources. It involves with the mangrove protection in some of its seven thematic programs including: Forest Biodiversity and Marine and Coastal Biodiversity as well as through cross</p>

Table 2.1 Local Knowledge and Participation for Forest Conservation an Sustainable Utilization in International Agreement and Framework (Cont.)

Issues	International agreement/framework
	cutting themes such as Protected Areas, Sustainable Use, Biodiversity for Development and Climate Change and Biodiversity. Furthermore, the Aichi Targets, agreed at the 10th Conference of the Parties of the CBD in Nagoya, Japan (2010) to have some relevance to habitat protection, and directly or indirectly to the protection of mangrove ecosystems.

Remark: *as of 2014 unless indicated

Source: Macintosh *et al.* (2002a); UN-REDD Programme (2010); United Nations [UN] (2015); United Nations Division for Sustainable Development [UNSD] (1992); Van Lavieren *et al.* (2012).

According to Table 2.1, many international frameworks were developed from a recognition of a potential of local knowledge for conservation and sustainable use of natural resources and a unique relationship that the local people have to their traditional land.

Some following international frameworks and action plans were specifically formulated to protect and promote the local knowledge and traditional practices, while also empowering the local people's rights to fully participate in a decision-making, implementing and monitoring process of natural resources management.

- **Agenda 21 of United Nations Conference on Environment and Development**

The United Nations Conference on Environment and Development (UNCED) which was known as the Rio Conference or Earth Summit. It was held on 2-14 June 1992 in Rio de Janeiro, Brazil. A significant outcome of this summit includes the Rio Declaration on Environment and Development, Agenda 21, and major international agreements on climate change, biological diversity, deforestation, and desertification.

- **The Article 8 (j), Article 10 (c), Nagoya Protocol, and Aichi Biodiversity Targets of United Nations Convention on Biological Diversity**

Agenda 21 was an action plan regarding social and economic dimensions of sustainable development, conservation and management of natural resources. It mentioned about a local knowledge of indigenous people in a Chapter 26 (Recognizing and strengthening the role of indigenous people and their communities) (CBD, 1992b; United Nations Division for Sustainable Development [UNSD], 1992). It acknowledged that a local knowledge was a valuable tool of indigenous people in utilizing the eco-services which was developed from a historical relationship between the indigenous people, and their natural resources and environment. It also promoted a participation of indigenous people in a decision-making process for expressing and transferring their local knowledge on ecosystem to others. Some of objectives and activities of this action plan were contained in international legal instruments such as the Indigenous and Tribal Peoples Convention (No. 169) of an International Labour Organization Convention (ILO). They were also incorporated into the Declaration on the right of indigenous people which prepared by the United Nations working group on indigenous populations (UNSD, 1992).

A Convention on Biological Diversity (CBD) was founded in 1992 as an international treaty with legal binding to conserve biological diversity, use natural resources sustainably, and distribute the benefits arising from the use of genetic resources fairly and equitably (CBD, 1992a). It set up goals and policies as well as provided technical and financial cooperation to Parties or joined countries. These goals and policies were used as a framework for developing or adapting national biodiversity strategies and action plans for the conservation and sustainable use of biodiversity by highlighting a public consultation and participation of stakeholder (Convention on Biological Diversity [CBD], 2001). This convention also recognized a close dependence of indigenous people on ecosystem services.

Article 8 (j) and Article 10 (c) were cross-cutting issues which were initiated by Convention on Biological Diversity [CBD] (1992a). The Article 8 (j) focused on the local knowledge, innovations and practices of local people, while the Article 10 (c) aimed to protect and encourage customary use of biological resources in accordance with traditional cultural practices.

Article 8 (j) was initiated to support all contracting party to legislate the national policies by aiming to respect, preserve, and maintain local knowledge, innovations and practices of indigenous people and local communities for the conservation and sustainable utilization of biological diversity (Charnley *et al.*, 2007; CBD,1992b; CBD, 1992c). It also promoted an application of local knowledge with an approval and involvement of local knowledge holders and encourages an equitable sharing of benefits from a utilization of local knowledge. A working group for specific implementation of Article 8 (j) was established which opened chances to all Parties and indigenous people's representatives to take an active role in the work. In conclusion, the Article 8 (j) emphasized on a preservation and application of local knowledge for a conservation and sustainable utilization of biological diversity by enhancing a participation of local people in transferring the local knowledge.

Article 10 (c) stated that Parties shall: (...) protect and encourage customary use of biological resources in accordance with traditional cultural practices that were compatible with conservation or sustainable use requirements. It means that CBD recognized a potential of traditional practices of local people in using the biological resources as it contributed to sustainable utilization and conservation of biodiversity. To disseminate the traditional practices of local people to governmental agencies or insert it into national biodiversity strategies and action plans, the local people had to be encouraged to participate into the decision-making process and natural resources management. A full and effective participation of indigenous people and local communities was a strategic way to maintain biodiversity and cultural values as well as achieve human well-being.

Convention of Biological Diversity also created the Nagoya Protocol, the Aichi Biodiversity Targets in the tenth meeting of the Conference of the Parties, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan.

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) was a supplementary agreement to the Convention on Biological Diversity (CBD). It was adopted on 29 October 2010 in Nagoya, Japan and entered into force on 12 October 2014 (CBD, 2010). It provided a legal framework for an implementation of a fair and equitable sharing of benefits arising out of a utilization of genetic resources which contributed to a conservation and sustainable use of biodiversity (CBD, 2010; 2011).

The Nagoya Protocol recognized an interrelationship between genetic resources and local knowledge. The local knowledge and rights of local communities were mentioned in the Nagoya Protocol because they were associated with an access to genetic resources and a benefit-sharing arising from a utilization of genetic resources. To implement the obligations under the Nagoya Protocol, all contracting parties had to establish measures to ensure the local communities' prior informed consent, and fair and equitable benefit-sharing with a respect to local laws, community protocol, and customary use of community (CBD, 2011). They shall have measures to inform the local communities about the obligations in order to support an effective participation of local communities. Moreover, they shall have measures to raise an awareness of local community related to the importance of genetic resources and local knowledge associated with genetic resources (CBD, 2011).

The Nagoya Protocol was adopted and implemented by many contracting parties including Thailand. A Plant Genetic Conservation Project under the Royal Initiatives of Her Royal Highness Princess Maha Chakri Sirindhorn (RSPG) was established in accordance with the Nagoya Protocol. The project aims to develop the personnel and conserve the plant genetics resources for provision of benefits to Thai people (RSPG, 1996). It created the database system to collect an information and knowledge related to plant

genetics found in Thailand for a conservation of plant genetics. It also encouraged a participation of various organizations, including government agencies, private sectors, and local communities to collect the data of plant genetics (RSPG, 1996). Moreover, it developed mechanisms to raise awareness of people on plant genetics, especially the young generation (RSPG, 1996) by educating them through formal and non-formal education system. It could be said that this project supported the conservation and dissemination of local knowledge from local community to governmental agencies.

The Aichi Biodiversity Targets was also created and adopted as the Strategic Plan for Biodiversity 2011-2020 in the tenth meeting of the Conference of the Parties, held on October 2010 in Nagoya, Japan. It provided 20 targets under 5 strategic goals including:

- **Strategic Goal A:** Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society
- **Strategic Goal B:** Reduce the direct pressures on biodiversity and promote sustainable use
- **Strategic Goal C:** Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity
- **Strategic Goal D:** Enhance the benefits to all from biodiversity and ecosystem services
- **Strategic Goal E:** Enhance implementation through participatory planning, knowledge management and capacity building

The strategic goals of Aichi Biodiversity Targets focused on a conservation, restoration and sustainable use of ecosystem services and biological diversity by a participation of stakeholders at all level. A local knowledge of local people was also mentioned in the Target 18 of Strategic Goal E which was in line with the Article 8 (j) and Article 10 (c) of the Convention of Biological Diversity. It indicated that the local knowledge,

innovation, and practices should be respected, protected, maintained and promoted and used for ecosystem management with an approval of local people. Besides, it should be fully integrated in national legislation and relevant international obligation with an effective participation of indigenous and local communities (CBD, 2012a; 2012b).

- **Local and Indigenous Knowledge Systems (LINKS) of United Nations on Educational, Scientific and Cultural Organization**

The United Nations Educational, Scientific and Cultural Organization (UNESCO) was established in 1945 to build a peace which must base on the moral and intellectual solidarity. An objective of UNESCO was a creation of solidarity by mobilizing for education, building intercultural understanding, pursuing scientific cooperation, and protecting freedom of expression. In particular, a sustainable development nowadays became the world's issue which urgently required an integrated knowledge including social, environmental and economic dimension for supporting the sustainable development.

The UNESCO recognized that a local knowledge of indigenous people was a priority area which can be an appropriate foundation for sustainable development of local communities. It resulted in an establishment of an interdisciplinary program called Local and Indigenous Knowledge Systems (LINKS) which was initiated in 2002. This program aimed to secure an active and equitable role for local communities in resource management and strengthen knowledge transmission. It purposed to explore pathways to balance community-based knowledge with global knowledge both in formal and non-formal education. Moreover, it also supported an inclusion of local knowledge in biodiversity conservation and management, and climate change assessment and adaptation. To achieve the objectives of this program, a cooperation with others relevant conventions and organizations such as the Convention on Biological Diversity, the UN Framework Convention on Climate Change, the Intergovernmental Panel on Climate Change (IPCC) and

the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) was also significant.

In summary, the LINKS program would like to promote a use and transmission of local knowledge for sustainable conservation and management of ecosystem services. It supported the local people to address current and future challenges such as climate change. Additionally, it also accepted a significant role of local people in sustaining a biodiversity through persuading the local people's involvement in natural resource and biodiversity management.

An adoption and implementation of these international agreements and frameworks for the local knowledge integration were difficult due to a fact that the local knowledge was complex and very specific to the ecological, social and cultural conditions of each community (Bélair *et al.*, 2010). It was a long term process as it relied on a relationship among the people, personal characteristics and appearance, communication skills, trust building, and commitment of stakeholders (Hiwasaki *et al.*, 2014).

An encouragement of local people's participation was also challenged because there were some social and cultural values that influenced the willingness of local people to participate in the natural resource management process (Stone *et al.*, 2008). A full and effective participation of local people was still limited due to an ignorance of national government (Mauro *et al.*, 1999). Limitations of the international agreements, laws and policies resulted in the failure of natural resources management in community scale.

In case of KK sub-district, a direct adoption of these international frameworks in policies at local level was challenged due to a specificity of local knowledge, community's social values, and ecological contexts. However, it can be applied in a discussion of results relating factors in the LKLC that led to the SU of MGES.

2.2.2 Thailand's Laws and Policies

In tropical countries including Thailand, an ecosystem diversity ranged from a tropical rain forest to a mangrove forest. In term of mangrove forest in Thailand, it serves as habitat for juvenile aquatic animals and provides food and fuelwood for local communities (Dasgupta *et al.*, 2013). It reduces tidal flows and induces sedimentation of soil particles at low tide. However, the mangrove forest in Thailand was heavily degraded due to a conversion of mangrove forest into shrimp farming and coastal development (Dierberg *et al.*, 1996; Macintosh *et al.*, 2002b). As a result, the mangrove forest areas in Thailand reduced from 372,300 hectares in 1961 to 167,500 hectares in 1996. They increased to 252,900 hectares in 2004 because of a cancellation of mangrove forest concessions. In 2013, the mangrove forest areas in Thailand was around 229,600 hectares (Figure 2.3).

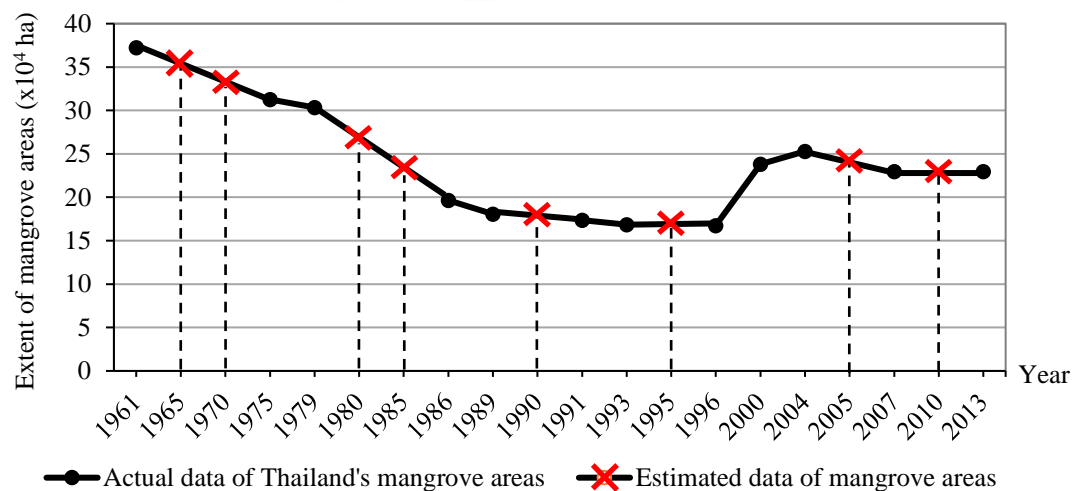


Figure 2.3 Thailand's mangrove forest areas.

Source: Adapted from Dasgupta *et al.* (2013); Mangrove for the Future [MFF] (2011)

With a growing concern of mangrove forest degradation, the Thailand's laws and policies for a conservation and management of mangrove forest were formulated. These laws recently integrated a local knowledge and public participation in natural resources conservation.

- **The Forest Act, B.E. 2484 (A.D. 1941) (Amended in 1948, 1982 and 1989)**

The Forest Act of 1941 consists of five chapters including introduction, marking hammer for controlling a logging and movement of forest products, control of lumber, forest clearance, and penal provisions. This act provided measures for protecting reserved timber species and forest products which most of provisions involved with a prohibition of deforestation. However, there was no legal provision specifying an extent of areas to be governed by the Royal Forest Department (RFD) in protecting a forest encroachment (Sinthipong, 2014). A local knowledge and participation of local communities for an environmental management were not identified. Besides, the measures of this act did not include a mangrove forest encroachment.

- **The Enhancement and Conservation of National Environmental Quality Act, B.E. 2535 (A.D. 1992)**

The Enhancement and Conservation of National Environmental Quality Act of 1992 was considered as one of the most comprehensive environmental laws in Thailand. It consists of seven main sections including introduction, approaches to national environmental act, environmental protection, pollution control, promotion measures, civil liability and penal provisions (Pollution Control Department, 2004).

A main outcome of the Enhancement and Conservation of National Environmental Quality Act of 1992 was an appointment of a National Environment Board (Mangrove for the Future [MFF], 2011). The National Environment Board have power and responsibilities in submitting policies and plans for an enhancement and conservation of national environmental quality to the Cabinet for approval. They can make recommendations to the cabinet regarding financial, fiscal, taxation, and investment to promote measures for an implementation of policies and plans and supervise a management and administration of environmental fund. Additionally, this act emphasized on an

encouragement of public participation both individual and non-governmental organizations in a promotion and conservation of environmental quality.

Another important outcome of the Enhancement and Conservation of National Environmental Quality Act of 1992 was a designation of any area as an environmentally protected area by virtue of Section 43 - 45 of this Act. An environmental protected area was a legal instrument to prohibit any activities that may be harmful or adversely affect or change an ecosystem. It enhanced any acts to conserve and restore the ecosystem for sustainable conservation and utilization of its environmental quality, natural resources, and aesthetic values. To designate an environmental protected area, a Minister shall be empowered to issue ministerial regulation designating such area with an advice of the National Environment Board. A selection of area for designating the environmental protected area relied on the Minister's consideration and a characteristic of such area. It had to be characterized as watershed area, or characterized by unique natural ecosystems, or fragile ecosystems. It was worthy to conserve due to its natural or aesthetic values. Moreover, such area still did not designate as a conservation area. After determining the environmental protected area, the Minister shall determine protective measures and duration of effectiveness. Finally, the ministerial regulations on environmentally protected area will be notified by publishing in the Government Gazette.

In case of KK sub-district, the cabinet approved in principle of a draft ministerial regulations on June 21, 2016 to designate the mangrove forest at KK sub-district as an environmental protected area. However, the details relating protective and managerial measures for environmental protection and a creation of natural resources and environmental restoration plan to conserve Don Hoi Lod wetland (Ramsar site) are still developing.

The Enhancement and Conservation of National Environmental Quality Act changed a pattern of environment and natural resources management in Thailand. It enhanced a capacity of governmental authority to

control and implement environmental protection and conservation in accord with sustainable development principles.

- **The National Parks Act of B.E. 2504 (A.D. 1961) (Amended in 1989 and 2019)**

The National Parks Act of 1961 purposed to protect and maintain natural resources and environment for a benefit of public education and recreation. It prescribed a determination of national park land, national park committee, protection and maintenance of a national park, and penalties. Although some mangrove forest were announced as a national and forest park such as Khao Sam Roi Yot National Park and Pranburi Forest Park, this act just merely formulated measures for protecting reserved timber species which was similar to the Forest Act of 1941 (Sinthipong, 2014). Additionally, it did not mention about a participation of local communities to work jointly with the governmental organizations.

Recently, this act was amended in March 2019 to allow forest dwellers and local communities to continuously live in forests under certain preservation restrictions. It purposed to meet a compromise between the local people's utilization of natural resources and environmental protection through designating a utilization zone and increasing a power of authorities and penalties against those who violate the law. It also assisted to reduce conflicts between the forest-dependent local people and governmental agencies by allowing the local people to participate in designating new protected areas and increasing a protection and regulations for some certain harmful species.

- **The Reforestation Act of B.E. 2535 (A.D. 1992)**

The Reforestation Act was promulgated to respond a forest overexploitation, to support a national forest policy target to expand forest cover areas, and to help in supplying timber due to a ban of logging in natural forests and high numbers of timber imports (Emmanoch, 2015). It also encouraged a private sector to invest on a reforestation with an aim to expand the planted forest areas and raises an environmental awareness (Ongprasert,

n.d.). Indirect outcomes of this act were a participation of private sectors in natural resource management and a knowledge and technological transfer.

- **The Marine and Coastal Management Promotion Act B.E. 2558 (A.D. 2015)**

The Marine and Coastal Management Promotion Act aimed to provide a legal protection framework for marine and coastal resources and to promote a participation of local communities and local governmental agencies for management, rehabilitation, preservation, and utilization of marine and coastal resources. It established the Coastal Resources Policy and Planning Committee which has authority and responsibility to issue a ministerial regulation designating mangrove area as an environmentally protected area (Department of Marine and Coastal Resources [DMCR], 2015). Moreover, it also formulated measures for conserving, rehabilitating and utilizing of marine and coastal resources and imposed a penalty for punishing lawbreaker.

A participation of local community which was emphasized by this act was regarded as an important step of local knowledge development. It enabled the local people to share and transfer their knowledge to manage, conserve, and utilize their natural resources regarding their objectives and a specificity of ecological, social, economic and cultural conditions of community.

- **Thailand's Cabinet Resolutions**

Several cabinet resolutions were formulated to conserve a mangrove forest. For instance, a cabinet resolution which was approved on 15th Dec 1987 indicated that a national mangrove forest had to be classified into three zones including conservation zones, economic zone A, and economic zone B (Department of Marine and Coastal Resources [DMCR], 2009; MFF, 2011). A cabinet resolution which focused on a formulation of mangrove management plan at provincial level, reforestation and conservation measures for controlling a utilization of coastal resources and preventing mangrove encroachment was also adopted on 4 June 1991 (Mangrove for the Future [MFF], 2011; Paphavasit *et al.*, 1997b; Pongtharapanich, 2010). A cabinet

resolution related to a cancellation of mangrove forest concessions which was approved on 19th Nov 1996 (DMCR, 2009) reduced a mangrove deforestation and encroachment. A formulation of these cabinet resolutions resulted in an increase of mangrove forest areas between 1996 to 2004 (Department of Marine and Coastal Resources [DMCR], 2009).

Regarding these national laws and cabinet resolutions, they provided a legal protection for local people's participation and promotion of a local knowledge and practices for conservation and sustainable use of natural resources. However, there were challenges of applying these laws in promoting the local knowledge for sustainable resource management and utilization at a community level in Thailand. These challenges included 1) lack of secure land and resource rights, 2) lack of recognition and respect of local knowledge, traditional practices, customary laws, and local institutions for sustainable utilization of natural resources, and 3) formal educational system and assimilation policies (Bélair *et al.*, 2010), and 4) lack of full and effective participation of local people (Ongprasert, n.d.; Sinthipong, 2014; Varte, 2012). To apply these national laws at local level, these challenges have to be addressed. Moreover, a site-specific information related to ecological condition, social and cultural values, and local people's livelihood has to be prior studied to facilitate an application of national laws in appropriate with community. However, several reviewed cases of community-based natural resource management in Thailand showed that the local people naturally applied their local knowledge in natural resource management before the national laws were formulated.

The reviews of national laws and cabinet resolutions related forest conservation and participation revealed that a mangrove restoring at KK sub-district carried out based on a local people's knowledge related mangrove ecological production and a bottom-up participation without any support from national laws. The Enhancement and Conservation of National Environmental Quality Act and the Reforestation Act were legislated in 1992 after an initiation and implementation of mangrove reforestation at KK sub-district in 1990 (Udomsilp, 2012). It can be said that the national laws only served as legal mechanisms encouraging a participation of

local people to facilitate local knowledge transmission and integration for sustainable mangrove management.

2.3 Sustainable Utilization of Natural Resources by Communities

Many local people had an intimate relationship with local environment and natural resources over many generations or centuries (Berkes et al., 1993; FAO, 2004; Kothari, 2007; Santasombat, 2003). Their identities, livelihoods and cultures were tied to those places and ecosystem services surrounding them. Their dependence on ecosystem services resulted in a site-specific ecological knowledge with a deep sense of responsibility to conserve and use of natural resources for mutual living (Santasombat, 2003). Their accumulative experiences and knowledge were applied to utilize the ecosystem services without disturbing ecological production (Joa *et al.*, 2018).

Many reviewed cases both in Thailand and neighboring countries showed that the local knowledge of mangrove ecosystem enabled local people to efficiently manage and sustainably use of the MGES. For example, the local knowledge and social institutions which were regarded as cultural capitals were applied to conserve a mangrove forest at coastal communities in Ambon Dalam Bay, Indonesia (Salampessy *et al.*, 2015). In Thailand, the local people's knowledge related to a reproductive season of sesarmid crabs at Pred Nai Community, Trad province was applied to control the local people's practices in suspending their collection of crabs during this period (Thailand Environment Institute [TEI], 2008d; United Nation Development Programme [UNDP], 2012). The local knowledge and a consensus under a concept of coexistence between human and forest were also used at Baan Hnongsamarn Community in Trang province to sustainably use, conserve and rehabilitate the mangrove forest (Arunbergfah, 2010). The application of local knowledge resulted in the local people's willingness to participate in the mangrove management. The local knowledge was also embedded in a religious doctrine and beliefs of Muslims at Baan Bang Rong community in Phuket province. It was applied to govern the local people's practices in harvesting the MGES (TEI, 2008a). According to these examples, the local knowledge and social mechanisms were applied to manage and utilize the MGES sustainably at community level.

To understand an interrelation between ecological conditions and local knowledge development for SU of natural resources, an involvement between human and a development of ecosystem or ecological succession were reviewed. In term of ecology, the human involved with the ecological succession in term of an energy flow. The ecological succession was described as a flow of energy and a movement of materials and organisms between compartments by recognizing that the human is an organism in an ecosystem as a consumer (Odum, 1969). A concept of the ecological succession was used to create a compartment model. It focused on a maximum protection of stabilized ecosystem in which maximum biomass and symbiotic function between organisms were maintained (Odum, 1969). The compartment model was classified into four zones based on a basic biotic-function criterion consisting of a non-vital system, growth system, mature system and multiple-use system as shown in Figure 2.4.

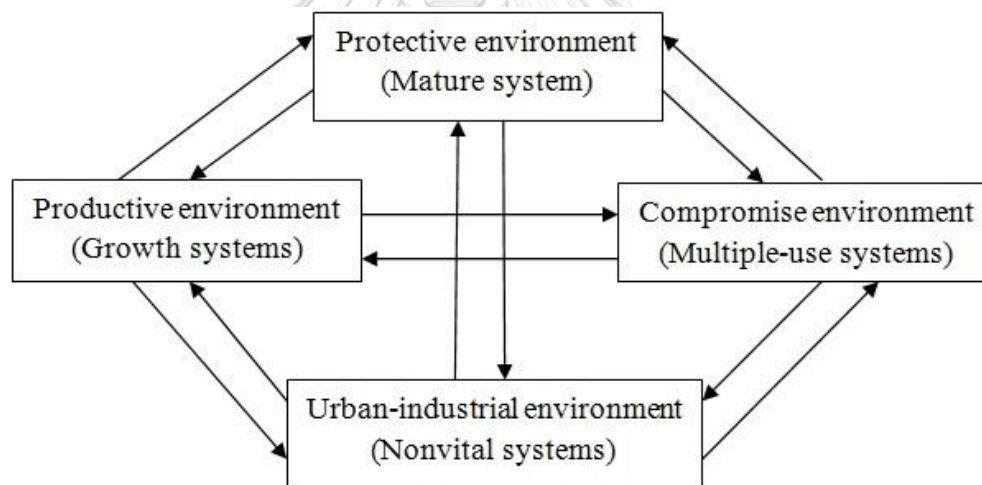


Figure 2.4 Compartment model of the basic kind of environment required by man, partitioned according to the ecosystem development and life-cycle resource criteria.

Source: Odum (1969)

- **Productive environment or growth system**

It refers to a condition that producers convert sunlight energy to chemical energy through a process of photosynthesis and respiration. An obtained energy is utilized for producers' growth, reproduction, and other life

processes. A rate of photosynthesis in this system exceeds a rate of community respiration (Odum, 1969). Organic materials are increased in order to produce the energy for a growth system of producers. As a result, a net community production or yield of this system is high (Odum, 1969).

- **Protective environment or mature system**

A mature system refers to a condition that the producers focus on an accumulation of biomass. An energy is transferred to an environment through a food chain which is more complex than a growth system.

- **Compromise environment or multiple-use system**

A multiple-use system is a condition focusing on an energy which is more consumed by consumers. A transmission of energy from autotrophs (producers) to heterotrophs (primary consumers, secondary consumers, tertiary consumers and decomposers) is implemented through a complex food web.

- **Urban-industrial environment or non-vital system**

A non-vital system refers to a condition that an energy was used up by the heterotrophs which over the producers' carrying capacity to produce energy for consumers' consumption.

The concept of compartment model can be applied to describe and analyze a development of mangrove ecological succession at KK sub-district.

A dynamic change of ecological conditions and production affected an evolution or development and application of local knowledge (Joa *et al.*, 2018). The mangrove ecological change at KK sub-district was classified into three stages. It included a mangrove degradation stage (non-vital system), mangrove stand initiation stage for restoring mangrove forest by tree planting, and young mangrove forest regrowth stage for using the MGES from restored mangrove forest (multiple-use system). Each stage of mangrove ecological conditions implied a local knowledge which was developed and refined in response to the changing conditions of mangrove forest. Those stages of mangrove ecological conditions included as follow:

(I) Degradation of mangrove ecosystem

During 1975-1989, the mangrove forest was severely degraded due to a conversion of mangrove forest into shrimp farming, urban settlement, coconut and *Casuarina* plantations (Paphavasit *et al.*, 1997b). The degradation of mangrove forest affected an absorption of solar energy and carbon dioxide by producers. It resulted in a loss of nursery grounds and habitat functions for many aquatic animals such as blood cockle, sea bass and krill which were gradually disappeared from KK sub-district (Paphavasit *et al.*, 1997a). It finally affected to the local people's decreasing income, losing occupation, and changing livelihood.

(II) Mangrove stand initiation for restoring mangrove forest

A mangrove restoring through tree planting activities was initiated and implemented by the former village chiefs, his kinship and close friends who had a same perception aiming to restore the MGES (1991-2007). Throughout the stage of mangrove stand initiation, the local knowledge for mangrove restoring was continuously accumulated from trials and errors and observation. It was applied to select appropriate pioneer mangrove plant species namely *Avicennia* sp. and *Sonneratia* sp., suitable timing, and site for tree planting, and to conserve the mangrove forest from any human disturbances. An application of local knowledge through a participation of local people resulted in an increase of mangrove forest areas from 1.44 km² in 1990 (Suwannat *et al.*, 1996) to 2.86 km² in 2002 (Poonkratok *et al.*, 2013) and 5.492 km² in 2012 (Klong Khone Subdistrict Administrative Organization, 2016) respectively. A mangrove ecological conditions was also changed such as an increase of a primary production, detritus, phytoplankton, and zooplankton. A gradual development of mangrove ecological communities implied a sufficient net primary production for transferring organic carbon to heterotrophs and a flow of energy from producers to a higher trophic level through food chain. It also reflected that there were no or less disturbances from human activities.

(III) Young mangrove forest regrowth for using the restored MGES

After the mangrove forest at KK sub-district was restored, the heterotrophs including primary, secondary, tertiary consumer and decomposer obtain more energy from producer by consuming organic materials. Human who is a consumer in an ecosystem also obtained the benefits from restored mangrove ecological production in term of ecosystem services.

At KK sub-district, the MGES were normally utilized for sustaining the local people's livelihood and well-being. Particularly, the mangrove cultural services were increasingly used as an ecotourism after the mangrove forest was restored to gain a diversified income (Udomsilp, 2012). In 2007, an ecotourism business was initiated and implemented by the Klong Khone Mangrove Forest Conservation Center (KKMFCC) (Rungsirattanawong, 2011). It was conducted to generate more income and created various occupations to the local people (Poonkratok *et al.*, 2013). It also integrated a local people's livelihood, practices, and knowledge related a mangrove planting, a collection of blood cockle, and local food in an ecotourism program. An outcome from an integration of local knowledge and livelihood in the ecotourism package was a transfer of local knowledge and social values and a raising of an environmental awareness of tourists. Additionally, it also established an ecotourism network and cooperation with other adjacent community conservation centers.

Regarding a goal of conservation of restored mangrove forest to maintain local people's subsistence, a local governmental agency namely Mangrove Forest Development Station 7 (MGFDS 7) in cooperated with village chiefs and volunteering local people played important role in regulating local people's utilization of restored mangrove forest based on national laws. They did not only protect the mangrove forest from illegal cutting and encroachment the mangrove forest, but also nursed the mangrove forest by enrichment planting and thinning. Furthermore, they also exchanged and transferred their knowledge related to mangrove restoring to young generations and visitors.

During these three stages of the development of mangrove ecological conditions or ecological succession, the local knowledge was evolved in response to the ecological change. It was demonstrated in a form of local people's adaptation of their utilization of the MGES without making any disturbances on the restored mangrove forest. This characteristic of local knowledge was important to ensure that the restored mangrove forest continuously provided the MGES for present and future generations.

To reveal a potential of local knowledge for mangrove restoring and the SU of MGES at KK sub-district, the international and national principles and indicators of sustainable resource management and utilization were reviewed and indicated. These principles and indicators were created by the international organizations and governmental agencies. They cannot be fully applied in community level due to a specificity of biophysical, social and cultural conditions of each community. However, they can be used as a guideline for identifying the SU of the MGES.

2.3.1 Principles of Sustainable Utilization

- **Addis Ababa Principles of Sustainable Use of Biological Diversity (AAPSUBD)**

Regarding a concept of sustainable use, 14 interdependent practical principles called as the Addis Ababa principles and guidelines for a sustainable use of biodiversity were developed by the CBD (Table 2.2). These principles were developed based on an assumption that it was possible to use biological diversity in a manner that did not exceed a capacity of ecological production to provide eco-services (Convention on Biological Diversity [CBD], 2004). They served as a framework for advising governmental agencies, local communities, private sectors and other stakeholders to achieve the sustainable use of biodiversity. These principles were interdependent; therefore, they had to be considered together. They were general and cannot be applied equally to all situations. Their application was vary depending on particular social, cultural and institutional conditions. They had to be adapted appropriately to different contexts. (Convention on Biological Diversity

[CBD], 2004). They can be applied as a guideline for the study because they can be adapted to be used in various levels and different context.

Table 2.2 Addis Ababa Principles of Sustainable Use of Biological Diversity

Practical Principles	Details
Practical principle 1	Supportive policies, laws, and institutions.
Practical principle 2	Empowerment of people's right to be responsible and accountable in using natural resource by formulating a governing framework which is consistent with international/national laws, local users of biodiversity components.
Practical principle 3	Identification, removal or mitigation of international, national policies, laws and regulations related to the economic aspect which generate negative impacts to natural resources or undermine conservation and sustainable use of biodiversity.
Practical principle 4	Adaptive management should be practiced, based on: <ul style="list-style-type: none"> a) Scientific knowledge and local knowledge; b) Iterative, timely and transparent feedback derived from monitoring procedures, environmental, socio-economic impacts, and the status of the resource being used.
Practical principle 5	Sustainable use management goals and practices should avoid or minimize adverse impacts on ecosystem services, structure and functions.
Practical principle 6	Promotion of interdisciplinary research for the use and conservation of biological diversity.
Practical principle 7	The spatial and temporal scale of management should be compatible with the ecological and socio-economic scales of the use and its impact.
Practical principle 8	An arrangement for international cooperation.
Practical principle 9	Application of an interdisciplinary, participatory approach in the management and governance of the use.

Table 2.2 Addis Ababa Principles of Sustainable Use of Biological Diversity (Cont.)

Practical Principles	Details
Practical principle 10	International, national policies should take into account: <ul style="list-style-type: none"> a) Current and potential values derived from the use of biological diversity b) Intrinsic and other non-economic values of biological diversity c) Market forces affecting the values and use
Practical principle 11	Users of biodiversity components should <ul style="list-style-type: none"> - Minimize waste and adverse environmental impact - Optimize benefits from uses.
Practical principle 12	The needs of local communities should be reflected in the equitable distribution of the benefits from the use of the biodiversity.
Practical principle 13	Internalization and reflection of the costs of management and conservation of biological diversity within the area of management in the distribution of the benefits from the use.
Practical principle 14	<ul style="list-style-type: none"> - Implementation of an education and public awareness programs on conservation and sustainable use. - Development of an effective methods of communications between and among stakeholders and managers.

Source: Convention on Biological Diversity [CBD] (2004)

During two phases of mangrove stand initiation and young forest regrowth at KK sub-district, a mangrove restoring and harvesting of the MGES were conducted in line with the principles of sustainable use. The mangrove restoring activity was initiated and implemented by former village chiefs and volunteering local people. It was financially and technological supported by a provincial governor of Samut Songkhram (Rungsirattanawong, 2011). Moreover, it also was funded by governmental agencies, NGOs, private sectors, religious institutions, and foreign organizations (Suwannat et al., 1996). It means that the mangrove restoring

at KK sub-district was conducted by a participation of various groups of people in response with the practical principle 9 of AAPSUBD. Furthermore, the mangrove restoring was also conducted by an application of local knowledge related to mangrove ecological production which responded to the practical principle 4 and 6 of AAPSUBD.

After restoring the mangrove forest, a utilization of restored mangrove provisioning and cultural services was conducted based on an application of developed local knowledge and local people's recognition of mangrove ecological, social, and economic values. It was carried on sustainably to avoid or minimize adverse impacts on mangrove ecological production. A local knowledge and practices involving two phases of mangrove stand initiation stage and young forest regrowth stage were also transferred to visitors to raise a perception and awareness of mangrove forest's benefits (Poonkratok *et al.*, 2013). In addition, they were shared and exchanged with governmental agencies, NGOs, academic institutions, and local communities for applying in other mangrove restoring areas. It can be said that the local people's utilization of MGES from restored mangrove forest were consistent with practical principle 4, 5, and 14 of AAPSUBD.

- **The Philosophy of Sufficiency Economy (PSE)**

In Thailand, the Philosophy of Sufficiency Economy (PSE) was proposed by His Majesty King Bhumibol Adulyadej The Great to people of Thailand on 4 December 1997. It aimed to guide people to sustain their living based on a middle path. It supported the people to be more resilient and be able to meet incoming challenges and impacts arising from internal and external changes such as a rapid change of economic development and climate change. It can be applied at all level including individuals, families, community and national level. Its concept was mostly applied to improve human well-being though reducing poverty and empowering the people by education and knowledge sharing. It was also applied for sustainable natural resources management.

The PSE concept consists of three interlinked elements of moderation, reasonableness and self-immunity together with two conditions of knowledge and morality (Figure 2.5) (Chaipattana Foundation, 2013). The moderation guides the people to live on a middle path. This way of living occurs when the people have a reasonableness which was relied on an accumulated knowledge and experience, analytical skill, self-awareness, foresight, and empathy. The self-immunity was the people's ability to protect themselves from external disturbances and to cope with unpredictable or uncontrollable situations. It becomes a foundation of self-reliance. The knowledge was an accumulative experience and information with an insight to understand its meaning and a prudence to apply it. The morality referred to an integrity, trustworthiness, ethical behavior, honesty, and diligence. It was considered as a social capital embedded in society. It comprised of two main components including government social capital and civil social capital. The government social capital represents formal institutions such as laws and regulations and good governance. The civil social capital referred to informal institutions such as trust, reciprocity, altruism, and norms.

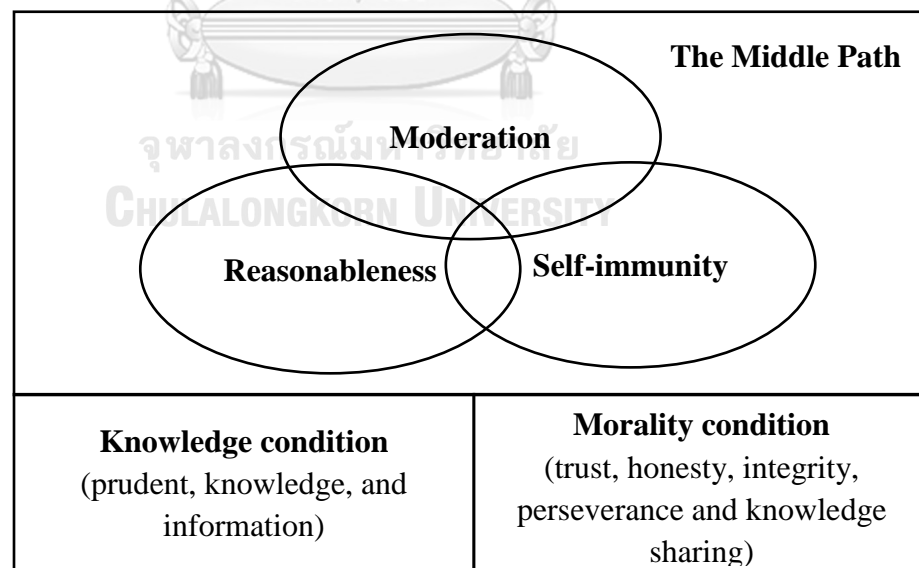


Figure 2.5 Elements and conditions of the Philosophy of Sufficiency Economy.
Source: Chaipattana Foundation (2013)

The PSE principle can be applied for sustainable resource management at community level because it supports the community's self-reliance and a

creation of a community's immunity to deal with impacts arising from changing ecological, social-cultural and economic conditions. It also encourages the local community to initiate and develop their community and manage their own natural resources based on their knowledge and morality. It also focuses on a participation of local people because it requires a sharing of local knowledge, experiences, and skills to create a sustainable resource management with regard to their social geography condition. This condition was termed by His Majesty King Bhumibol Adulyadej The Great as an explosion from within.

From reviews of KK sub-district, it showed that a mangrove restoring was conducted in consistent with the PSE concept. For example, the mangrove restoring activities was initiated and implemented by the local people. It was conducted based on a local knowledge related to mangrove ecological production and local fishery livelihood. It was also implemented by a participation of various groups of people including village chiefs, villagers, governmental agencies, NGOs, and academic institutions. It can be said that the mangrove restoring at KK sub-district was conducted based on the PSE mindset of local people.

2.3.2 Indicators of Sustainable Utilization

Criteria and indicators of sustainable utilization in the study derived from reviews of several case studies of community-based sustainable mangrove management as shown in Table 2.3. The reviewed criteria were mainly divided into 5 criterion including ecological, social, economic, cultural, and legal and institutional aspects. Each criterion consisted of various indicators which were different in each community depending on a specificity of ecological, social and cultural conditions. A difference of reviewed criteria and indicators revealed a unique strategy of each local community for mangrove forest management and utilization.

Table 2.3 Reviewed Criteria and Indicators of Sustainable Mangrove Management

Criteria	Indicators	Case studies													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Criterion 1: Ecological aspect (Dizon <i>et al.</i> , 2011)	- Mangrove forest management for the ecological production and protection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Mangrove forest management for the forest production	✓	✓		✓			✓			✓				
	- Mangrove degradation caused by humans	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	- Mangrove degradation caused by natural causes	✓	✓	✓	✓		✓				✓				
	- Recovery of coastal and marine life (Arunbergfah, 2010; Green Globe Award, 2004; Kairo, 2007; Watcharapol, 2015)			✓		✓					✓				✓
Criterion 2: Social aspect	- Implementation of solution findings (Dizon <i>et al.</i> , 2011)	✓					✓		✓						
	- Creation of occupations and employment (Chothong & Aksornkoae, 2008; Kairo, 2007; Thailand Environment Institute [TEI], 2008b, 2008e)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Communities' rights on land (Dizon <i>et al.</i> , 2011)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Application of local knowledge for mangrove management planning and implementation (Dizon <i>et al.</i> , 2011)	✓		✓	✓		✓		✓	✓	✓	✓	✓	✓	✓
	- Availability of strong community leader (Thailand Environment Institute [TEI], 2008a, 2008b, 2008c, 2008d, 2008e)						✓		✓	✓	✓	✓	✓	✓	✓
	- Return of local people to their hometown and work in community (Green Globe Award, 2004; Thailand Environment Institute [TEI], 2008d; Watcharapol, 2015)									✓				✓	✓

Table 2.3 Reviewed Criteria and Indicators of Sustainable Mangrove Management

Criteria	Indicators	Case studies													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
Criterion 5: Legal and institutional (Dizon <i>et al.</i> , 2011)	- Policies, laws and regulations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Funding in form of financial support and labors	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Structures and staffing of institutions	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Plans for harvesting mangrove resources	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Availability of control mechanisms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	- Long-term projections, strategies and plans for mangrove production	✓			✓										
	- Implementation of procedures for biodiversity conservation	✓	✓	✓	✓		✓	✓			✓				
	- Zoning for a protection of habitat of fishes and other beneficial aquatic flora and fauna	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

Sources:

1. Banacon Island, Bohol province, Philippines (Dizon *et al.*, 2011).
2. Tanakeke Island, South Sulawesi province, Indonesia (Brown *et al.*, 2014).
3. Soc Trang province, Vietnam (Schmitt, 2012).
4. Matang Mangrove Forest Reserve, Malaysia (Goessens *et al.*, 2014; Macintosh *et al.*, 2002a; Malaysia Timber Council, 2009; Van Lavieren *et al.*, 2012).
5. Gazi Bay, Msambweni District, Kenya (Kairo, 2007).
6. Pred Nai community, Trad province, Thailand (Choithong *et al.*, 2008; Green Globe Award, 1999; Senyik, 2005; Thailand Environment Institute [TEI], 2008j); United Nation Development Programme [UNDP], 2012).
7. Thung Tase village, Trang province, Thailand (Choithong *et al.*, 2009; Thailand Environment Institute [TEI], 2008g).
8. Lilet community, Surat Thani province, Thailand (Thailand Environment Institute [TEI], 2008f).
9. Ban Bang Rong community, Thalang district, Phuket province, Thailand (Thailand Environment Institute [TEI], 2008i).
10. Ban Bang Tib community, Kuraburi District, Phang Nga province, Thailand (Choithong *et al.*, 2008; Thailand Environment Institute [TEI], 2008h).
11. Baan Hongsamarn Community, Tambon Hardsumran, Amphoe Hardsumran, Trang Province (Arunbergfah, 2010).
12. Bang Khunsai Community, Ban Laem district, Phetburi province, Thailand (Choithong *et al.*, 2008).
13. Ban Thapru-Ban Ao Thalane Community, Khao Thong sub-district, Muang district, Krabi province, Thailand (Choithong *et al.*, 2008).
14. Klong Khone sub-district in Samut Songkhram province (Jintana, 2015; Poonkratok *et al.*, 2013; Rungsrirattanawong, 2011; Udomsilp, 2012; Watcharapol, 2015)

Many local communities both in Thailand and other neighboring countries had various factors that supported their sustainable mangrove management and utilization. At Ban Pred Nai in Trad province, Thailand, the mangrove forest was degraded due to logging and intensive shrimp farming. To solve these problems, the village leaders and local people initiated a mangrove conservation and reforestation project (TEI, 2008d). They formed a Community Forestry Group and informal patrol groups to conserve and protect the mangrove forest from a corporate destruction of mangrove plants for charcoal production (TEI, 2008d). Moreover, they formulated the community's rules to govern the local people's utilization of mangrove forest (TEI, 2008d). They learned to adapt their practices to sustainably use of mangrove resources (Senyk, 2005). A local Buddhist monk also assisted the local people by establishing a village savings group in order to be a mechanism for local people to save money and earn some interest (Senyk, 2005). The monk used the savings group as a platform to educate the local people about a conservation of mangrove forest (Senyk, 2005). The community also developed a network including a number of communities in Trad and became the Community Coastal Resource Management Network (UNDP, 2012). This network facilitated these communities to exchange and share their local knowledge and experiences. It provided channels for communities to learn from each other's successes and failures for adapting their management plans and actions to deal with new threats such as a climate change. According to reviews of mangrove reforestation and conservation of this community, it reflected several factors that indicated the local people's sustainable utilization and management of mangrove forest. These factors included a perception and awareness of local people, participation of various groups of people (such as local people, village chiefs, and monk), volunteering, strong community leaders, community rules, and non-formal education.

In a neighboring country, the local community in Soc Trang Province of Viet Nam cooperated with several international organizations to initiate a project for restoring and protecting mangrove resources. The mangrove forest of this community was threatened by a conversion of mangrove forest into shrimp farming and climate change (Schmitt, 2012). According to a perception of local people on values of the

MGES, a mangrove planting project was initiated to restore a mangrove ecological production for a protection of coastal erosion, floods and rising sea levels. This project was funded by international agencies and implemented by a co-management between the local communities and local authorities. It was carried on based on a participatory approach, joint decision-making, empowerment, and fair distribution of benefits to all stakeholders (Schmitt, 2012). Furthermore, it also applied a local knowledge related to mangrove ecosystem to select suitable species, restoration site, and time for planting (Schmitt, 2012). An implementation of mangrove planting in this community showed several mechanisms indicating their sustainable mangrove management. It consisted of the local people's awareness and their participation, financial and technical support, and application of local knowledge.

These examples of community-based mangrove reforestation and management, they showed that there were various indicators of sustainable mangrove management and utilization. They were varied as they depended on a specificity of ecological, social-cultural, economic and political conditions of communities.

A time frame was also considered as an indicator of sustainable utilization of natural resource (Kates *et al.*, 2005). In case of this study, a time indicating the SU of MGES was a time-consuming for restoring and maintaining mangrove ecological production. According to reviews, they showed that a complete restoration of mangrove structure and function requires 25-50 years (Craft, 2016). Some mangrove functions spent at least 5 years to recover such as an algal production and diversity, shrimp and finfish, and nitrogen fixation (Table 2.4). In this regard, the study used 25 years as a time frame of the SU of MGES.

Table 2.4 Ecosystem Development of Mangrove Forests Following Planting or Restoration

Ecosystem development of mangrove forest following planting	Time (years) to equivalence to natural forests
Productivity and habitat functions	
• Forest primary production	10-20
• Forest stand structure and species richness	25-50
• Algal production	5-10
• Algal diversity	5-10
• Epifauna density	10-20
• Epifauna diversity	5-20
• Benthic infauna density	5-20
• Benthic infauna diversity	5-20
• Shrimp and finfish	3-5 for hydrologic restorations 5 to > 10 for planting
Regulation functions	
• Soil organic matter and bulk density	> 20
• Decomposition	> 10
• N fixation	5-10
• Nutrient (N) cycling	> 10
• Denitrification	> 10-20

Source: Craft (2016)

In case of KK sub-district, the mangrove restoring was initiated in 1991 (Green Globe Award, 2004; Poonkratok *et al.*, 2013). For 28 years of mangrove restoring, the mangrove ecological productivity, nursery and habitat functions as well as regulating functions were restored. The restoration of mangrove ecological production evidently showed the local people's SU of MGES. It also reflected a potential of local people's knowledge development and application in restoring and using the MGES from restored mangrove forest. As a result, the study selected the KK sub-district as a case study.

2.4 Local Knowledge Development Underlying Sustainable Utilization

2.4.1 Conceptual Process of Local Knowledge Development

A knowledge management (KM) was an emerging concept which was originated in a field of academia and business organization (Davis *et al.*, 2005; Debowski, 2006; Donate *et al.*, 2015). It was implemented to improve an organizational performance, increase a productivity and quality of their services, and find new solutions and products for their customers (Chaiphar *et al.*, 2013; Donate *et al.*, 2015; Workineh *et al.*, 2010). It aimed to build sustainable competitive advantage for an organization (Alavi *et al.*, 2001; Awad *et al.*, 2004; Debowski, 2006; King, 2009).

The KM was seen in various perspectives due to different views of knowledge such as a state of mind, an object, a process, a condition of having access to information, or a capability (Alavi *et al.*, 2001). The different views of knowledge led to different perceptions of the KM and different strategies for managing knowledge.

The KM was largely regarded as a process rather than other perspectives. It referred to a process applied to identify and leverage an organizational collective knowledge for a long-term competitive advantage and profitability of an organization (Alavi *et al.*, 2001; Awad *et al.*, 2004; Debowski, 2006; Karadsheh *et al.*, 2009). It mainly focused on knowledge flows and four interdependent basic processes including knowledge creation, knowledge refinement, knowledge transfer, and knowledge application (Alavi *et al.*, 2001; Omotayo, 2015).

- **Knowledge Creation**

A knowledge creation was considered as the first step of the KM process (Workineh *et al.*, 2010). It was a process of creating new knowledge which can be analyzed and used as a basic information for making a decision (Stevens *et al.*, 2010).

The knowledge created and captured from an experience of individual and environment (tacit knowledge) or document and database (explicit knowledge) (Debowski, 2006; Stevens *et al.*, 2010). It was developed from an accumulation of information through a learning process. According to a

Bloom's learning taxonomy (Anderson *et al.*, 2001), a purpose of this taxonomy was to improve communication and a design of educational curriculum. It divided learning objectives into three different domains. These learning domains includes cognitive, affective and psychomotor domains. A cognitive domain aims to create a knowledge and develop a critical thinking skill. An objective of affective domain focuses on attitudes and emotions. A psychomotor domain aims to develop ability of people to physically manipulate objects. Each domain consists of various levels from lowest to highest levels. For the cognitive domain, it moves from basic to more complex demand including remember, understand, apply, analyze, evaluate, and create respectively. In term of affective domain, it consists of receiving, responding, valuing, organizing, and characterization by a value set respectively. The lowest to highest levels of psychomotor domain include imitation, manipulation, precision, articulation, and naturalization respectively (Figure 2.6) Regarding this learning theory, it revealed a development of local knowledge of an individual which can be applied to analyze the LKLC at KK sub-district.

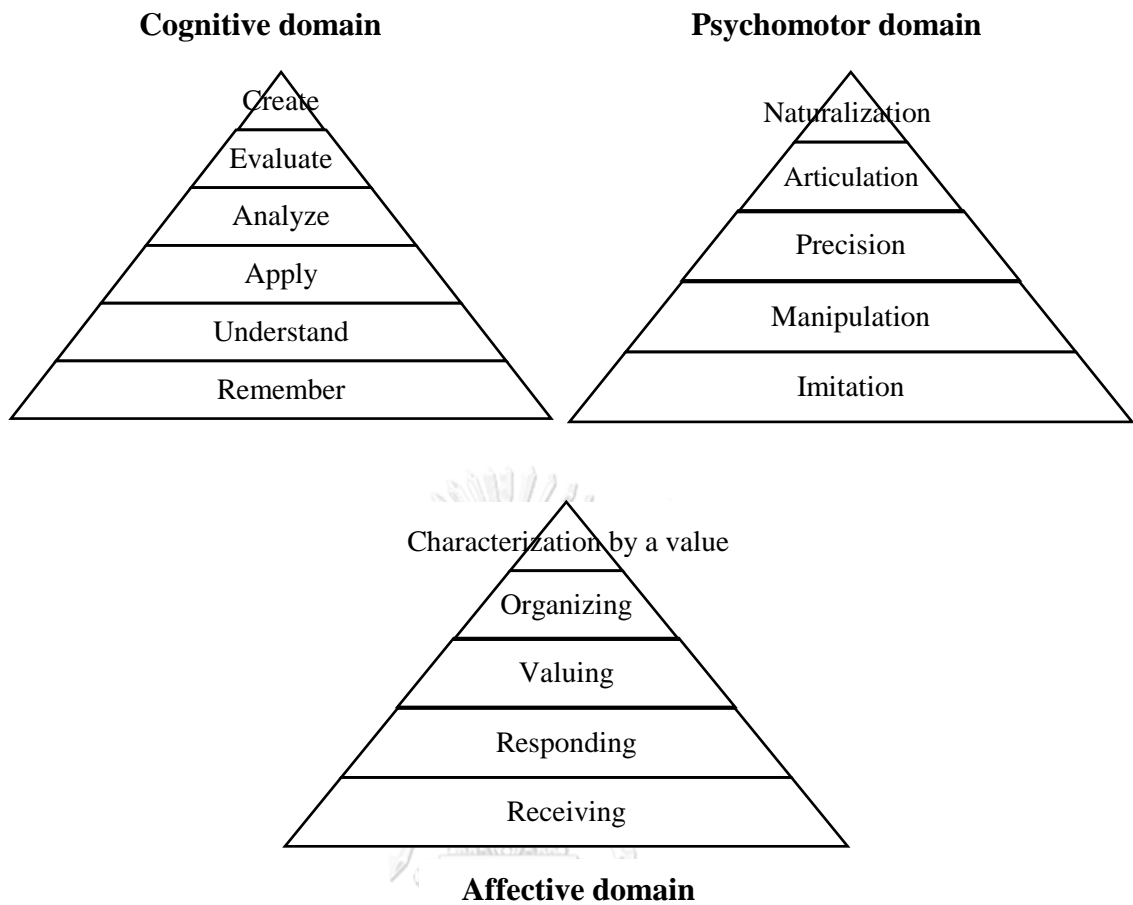


Figure 2.6 Three domains of Bloom's learning taxonomy.

Source: Anderson *et al.* (2001)

In term of a local knowledge in local community, it was developed from the interaction among the human or between human and their environment (Workineh *et al.*, 2010; World Bank, 2004). It was derived from four sources including the prior knowledge that stems from previous experience (Debowski, 2006; Lwoga *et al.*, 2010), trial and error and observation (Eyong, 2007; Nonaka *et al.*, 2006; Workineh *et al.*, 2010), knowledge sharing and transfer (Debowski, 2006; Frost, 2010; Lwoga *et al.*, 2010; Stevens *et al.*, 2010) and document reviews (Awad *et al.*, 2004; Debowski, 2006; Frost, 2010). Additionally, the local knowledge can be created from a conversion between tacit and explicit knowledge and vice versa (Workineh *et al.*, 2010) as it was described with four different modes proposed by Nonaka (1994) (Figure 2.7). It resulted in an extent of local knowledge

which was associated with epistemological and ontological dimensions and was embedded in local communities' livelihood and culture (Santasombat, 2003).

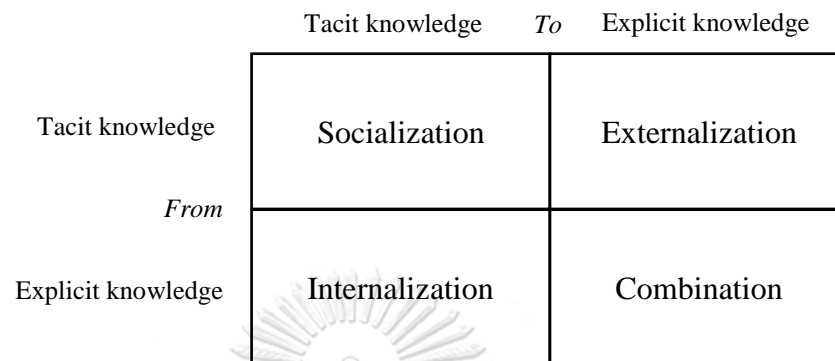


Figure 2.7 SECI model of knowledge creation.

Source: Nonaka (1994)

In case of KK sub-district, the local knowledge on mangrove ecosystem was created to support the local people's utilization of the MGES for food consumption and ecotourism. It was embedded and embodied in a local people's cognition and social values which determined the local people's utilization of the MGES. From reviewing the local people's knowledge during two phases of mangrove stand initiation and young forest regrowth, the local knowledge covered three areas. It consisted of 1) mangrove biophysical conditions such as a tidal current (Chotthong *et al.*, 2009), direction of wind, soil structure, salinity (Ratanavilaisakul, 2010), and mangrove plant species (Chotthong *et al.*, 2009), 2) mangrove production services such as the nutrition, medicine, and biomass energy (Chotthong *et al.*, 2009; Kongprasertamorn, 2007), and 3) mangrove cultural services such as recreation, historical area, education, and ecotourism. The local knowledge related to biophysical services was developed from the local people's learning on natural process of mangrove ecological structures and functions to support their livelihood (Macintosh *et al.*, 2002c; Tanawat *et al.*, 2012). The local knowledge on production services was created from a demand of local people to consume or harvest mangrove products both plants and aquatic animals (Ratanavilaisakul, 2010). To utilize mangrove ecological products, it required

an integration of local knowledge on production services and biophysical conditions. For example, the local knowledge related neap tide and ebb tide were required to identify a suitable time to collect blood cockles on mudflat area (Thailand Environment Institute [TEI], 2008c, 2008e). For the local knowledge on cultural services, it was generated from an evolution and adaptation of local people's way of life to survive under a change of mangrove ecological production. It was presented in a form of people's thoughts, ways of living, religious beliefs and rituals, culture, and local occupation (Kongprasertamorn, 2007; Lwoga *et al.*, 2010; Santasombat, 2003). Apparently, these three types of local knowledge on the MGES were all integrated and supported each other.

- **Knowledge Refinement**

A knowledge refinement was regarded as a key feature of knowledge management as it can ensure that the knowledge remains current and still be useful to support an organization or community (Debowski, 2006). According to an increasing experience and feedbacks, the knowledge was constantly tested and reformed in order to evaluate its value and relevance to organization or community before it will be further developed, retained and shared (Karadsheh *et al.*, 2009). If the knowledge was assessed and considered as an unusable knowledge, it will be discarded (Karadsheh *et al.*, 2009). As a result, there would be only valuable knowledge left to support the organization or community's performance.

For a local knowledge on mangrove ecosystem, it was continuously refined and developed under a dynamic of mangrove ecosystem which was generated by natural factors such as tide, wind and salinity of the water (Food and Agriculture Organization [FAO], 2007; Van Lavieren *et al.*, 2012; Vishwanathan *et al.*, 2010) and human activities (Dasgupta *et al.*, 2013; Van Lavieren *et al.*, 2012). The refined local knowledge was validated to ensure that it enabled to support the local community's survival under the changing mangrove ecosystem (Awad *et al.*, 2004).

A local knowledge at KK sub-district was refined based on a development of mangrove ecological condition and production. It was classified into two phases including the developmental phases of mangrove stand initiation for mangrove restoring and young forest regrowth stage for the SU of MGES. Commonly, the local knowledge was created, refined and applied in harvesting mangrove plants and fishery resources to support their daily subsistence. It was also applied in a phase of mangrove stand initiation such as a selection of pioneer plant species and site for reforestation. An application of local knowledge resulted in a development of mangrove ecosystem from non-vital to mature state and contributed more ecosystem services to the community. After restoring the mangrove forest from non-vital state to productive state, the local knowledge was developed in response to a change of mangrove ecological condition. It was refined through a local knowledge sharing and transfer with other people to support the local people's adaptation of their utilization of the MGES without disturbing the restored mangrove ecological production.

- **Knowledge Dissemination/Transfer**

A knowledge transfer was considered as a core process of the KM. It was a main objective of the KM which aims to promote a knowledge sharing, collaboration, and networking among individuals (Awad & Ghaziri, 2004; Karadsheh et al., 2009). This was a process of conveying knowledge from one source or local knowledge holder to another source or other people (Awad & Ghaziri, 2004). During the process of knowledge transfer, a new knowledge could be created through a combination between a shared knowledge and prior knowledge (Karadsheh et al., 2009).

To disseminate the local knowledge effectively, there were three components that should be taken into consideration including (1) sources of knowledge such as printed matters, lessons learned, or programs, (2) tools or pathways used in transferring knowledge such as face-to-face discussion, demonstration (Alavi *et al.*, 2001; Frost, 2010; Stevens *et al.*, 2010), mentoring, and apprenticing (Alexopoulos, 2008; Awad & Ghaziri, 2004;

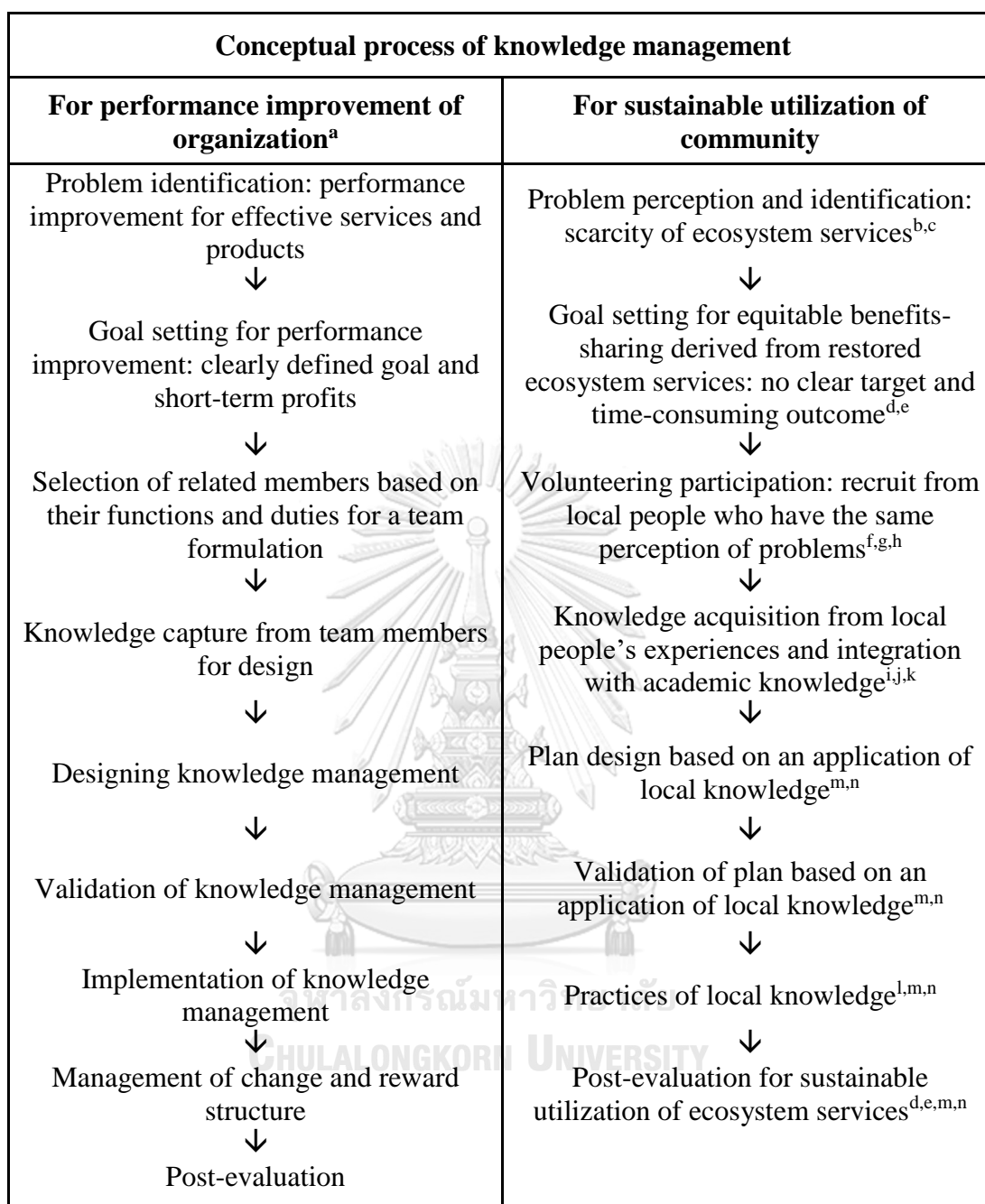
Boiral, 2002; Cumming, 2003; Debowski, 2006; Lubit, 2001), and (3) a recipient (Awad & Ghaziri, 2004). In addition, an organizational or community's culture such as social ties and trust becomes an important factor facilitating the knowledge dissemination.

- **Knowledge Application**

A knowledge application was the most necessary process of the KM as it leads to enhance an organization's or community's performance (Alavi *et al.*, 2001). A purpose of knowledge application was to apply and present knowledge to knowledge seekers so that the recipients can use the knowledge to support their decision making and performance (Karadsheh *et al.*, 2009).

An organization or community's performance often rely on a capability of individuals to translate a knowledge received from a process of knowledge transfer into effective practices or actions (Karadsheh *et al.*, 2009). It will be risk if an individual depends only on sole source of knowledge and may not apply a derived knowledge due to a distrust of sources of knowledge, lack of time or opportunity to apply it, or a scare of punishment from mistakes (Alavi *et al.*, 2001). To address this risk, the organization or community required to establish a surrounding environment or condition encouraging an employee or local people to reciprocally share their experience and apply their knowledge (Awad *et al.*, 2004; Probst, 1998; Reed *et al.*, 2014).

To facilitate four basic processes of KM (creation, refinement, transfer and application) in an organization, a conceptual process of KM for performance improvement was identified (Awad *et al.*, 2004). At community level, the local knowledge development also focuses on these four processes, but its process was not well documented, or identified. According to reviews of many communities using local knowledge for natural resource management, they showed that the fragmented steps of local knowledge development were different from those of business organization (Figure 2.8).



Note:

- | | |
|--|----------------------------------|
| a Awad <i>et al.</i> (2004) | h Stone <i>et al.</i> (2008) |
| b Crona <i>et al.</i> (2013) | i Chaiphar <i>et al.</i> (2013) |
| c Hopping <i>et al.</i> (2016) | j Charnley <i>et al.</i> (2007) |
| d Reyes-García <i>et al.</i> (2019) | k Lwoga <i>et al.</i> (2010) |
| e Uprety <i>et al.</i> (2015) | l Camacho <i>et al.</i> (2012) |
| f Coulibaly-Lingani <i>et al.</i> (2011) | m Chotthong <i>et al.</i> (2009) |
| g Lise (2000) | n Chun <i>et al.</i> (2009) |

Figure 2.8 Conceptual process of local knowledge development in organization and community.

To encourage a conceptual process of KM for performance improvement, a knowledge management system (KMS) was developed in an organization. It referred to an information system applied to create, store, transfer, and apply to enhance organizational KM processes (Awad *et al.*, 2004). It started from an evaluation of current knowledge infrastructures to identify missing gaps or problems within an organization. After evaluating the organizational existing infrastructure, a goal and objective of KM was identified. The objective was set up by key stakeholders who have a unique knowledge related to the objective in order to establish the KM team. Then, the knowledge capture was carried out with regard to types of knowledge (explicit and tacit knowledge) for identifying a source of knowledge. An explicit knowledge was captured from documentation and files, while a tacit knowledge was captured from knowledgeable people in organization. This step provided chances to employee in the organization to share and transfer their tacit knowledge to other team members. After sharing and collecting knowledge, a blueprint of KMS or solution was designed and tested through two steps including a verification procedure and a validation procedure. A verification procedure was to ensure that a function of designed KMS or solution can respond to the objective. The validation procedure was to check reliability and to ensure that the system or solution can response the people's needs and expectations. Then, the KMS was implemented in an organization or a community. An implementation of KMS means a changing situation which can generate a psychological resistance among people in organization. For example, the people may be anxious because they did not know how the implementation of KMS or solution will affect to their jobs and decision-making (Awad & Ghaziri, 2004). Finally, the KMS or solution had to be assessed for its long-term effects on people, procedure and performance of the business (Figure 2.8).

In term of local knowledge for sustainable utilization of natural resources at community level, a conceptual process of local knowledge development was reviewed from many community-based mangrove management which also include the KK sub-district (Arunbergfah, 2010; Chotthong *et al.*, 2009; Suwannatat *et al.*, 1996; Thailand Environment Institute [TEI], 2008b, 2008c, 2008d, 2008e). The local knowledge development or LKLC for mangrove stand initiation was generated from a perception

of local people on a scarcity of fishery resources which affected a household income. It resulted in a goal setting for restoring mangrove nursery and habitat function for aquatic organisms and equitable sharing of benefits derived from restored MGES. After the goal setting, a participation of local people was required to discuss and share an experience and knowledge for designing a mangrove restoring plan. The designed mangrove restoring was validated by trials and errors and observation to test its effectiveness. If the mangrove restoring plan can restore the mangrove ecological production, it will be approved and adopted to be applied as common practices of local people. However, the mangrove restoring practices was continuously monitored for its long-term consequence (Figure 2.8).

At KK sub-district, the local knowledge development or LKLC was classified into two phases based on a change of targeted MGES for utilization. It consisted of the phase I of mangrove stand initiation stage and the phase II of young forest regrowth stage.

- **Phase I: Mangrove stand initiation stage for mangrove restoring**

To restore mangrove ecological production, the local knowledge related to mangrove ecosystem was applied throughout a process of mangrove restoring. It was firstly applied after a plantation of *Rhizophora* sp. seedlings on mudflats which was introduced by governmental agencies was failed. It was used for a selection of pioneer plant species namely *Avicennia* sp. and *Sonneratia* sp. to reforest instead because these plant species can resist to the barnacles and trap sediment better than the *Rhizophora* sp. (Green Globe Award, 2004; Suwannatat *et al.*, 1996). It was also applied in a selection of an appropriate site and timing for planting mangrove saplings. It was also shared among the local people and transferred to governmental agencies, academic institutions and other coastal communities. In addition, it was continuously developed under a changing ecological, social-cultural, economic, and legal conditions for conserving of restored mangrove forest.

- **Phase II Young forest regrowth stage for the SU of restored MGES**

After restoring the mangrove ecological production, the local knowledge was developed with an objective to increase the local people's income by utilizing the mangrove cultural services for ecotourism. It was refined by integrating with a concept of the PSE and an affective relationship of Thai people to a royal family (Udomsilp, 2012). The PSE concept was adopted and integrated in this phase of LKLC to guide the local people's livelihood and practices for sustainable utilization of restored mangrove resources (Udomsilp, 2012). From reviews and pre-survey, it showed that royal visits of Her Royal Highness Princess Maha Chakri Sirindhorn to plant mangrove saplings at KK sub-district encouraged the local people to conserve the mangrove forest.

According to two phases of the LKLC at KK sub-district, they showed that the local knowledge was dynamic and can be refined under a changing environment. Its development process can be illustrated in a form of loop or cycle as shown in Figure 2.9. It consisted of various steps including perception of problems, objective setting, participation of local people, knowledge acquisition, plan design, plan validation, practices of local people, and post-evaluation respectively. Each step in the LKLC was influenced by several factors such as trust and leadership (Awad *et al.*, 2004; Debowski, 2006; Frost, 2010), social relationship, and beliefs and rituals (Abdullah *et al.*, 2014; Chotthong *et al.*, 2009). Similar factors could be found in every step of the LKLC with a different implication. It resulted in an identification of the factors in the LKLC during two phases of mangrove stand initiation and young forest regrowth to create a local knowledge framework of this study area.

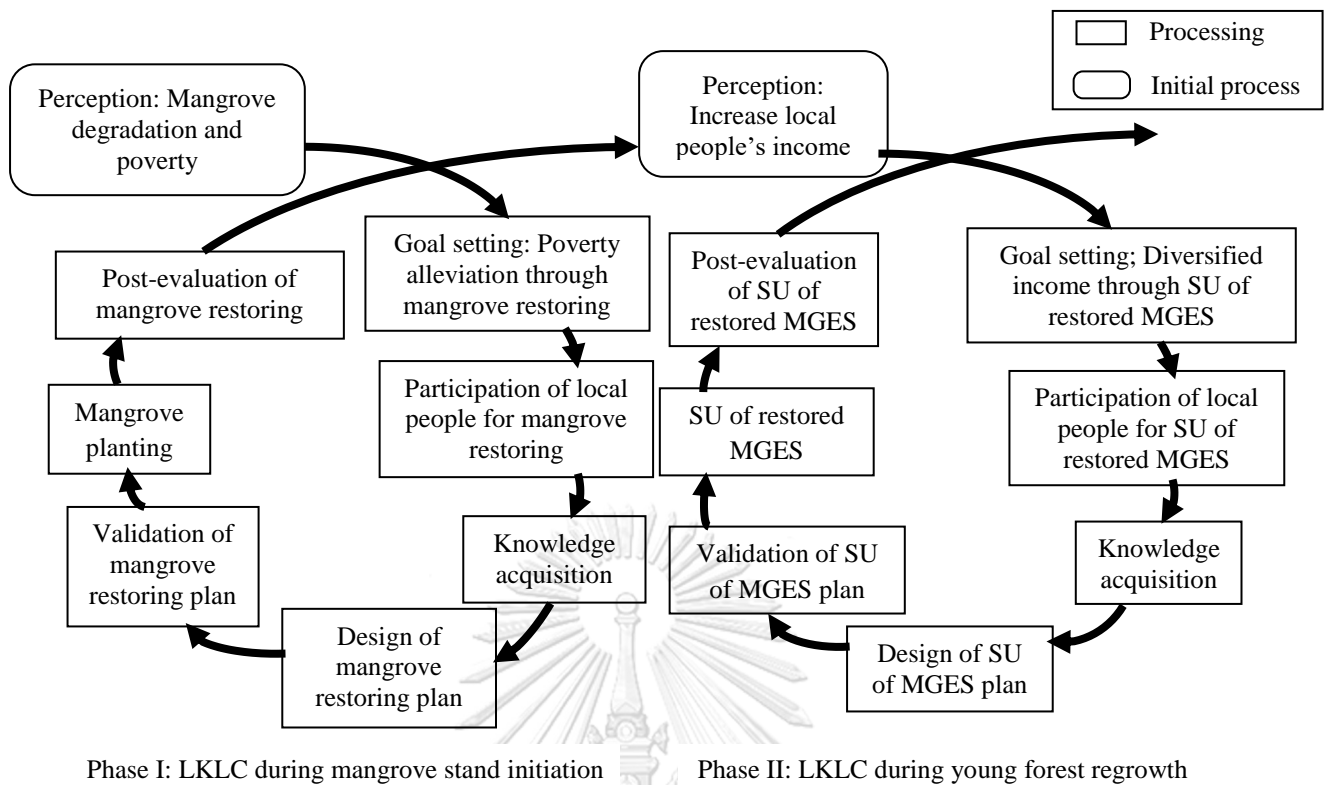


Figure 2.9 Conceptual process of local knowledge life cycle during two phases of mangrove forest development at KK sub-district.

2.4.2 Local Knowledge Structures and Functions

To develop a process of KM in a business field, it involved three main structures. These structures include managerial structure, social structure, and technological structure (Debowski, 2006). They were grouped based on their different functions in supporting a process of KM.

- **Management Structures**

1) *Managerial Structure*

A managerial structure provided resources needed for supporting a management of local knowledge to achieve a goal. Its structures included policies and plans, laws and regulations, human resources, institutions, financial and technical support (Debowski, 2006).

2) *Social Structure*

A social structure assisted the KM and processes especially, the knowledge transfer through encouraging a social interaction between and among several sectors. It comprised of a relationship network, culture, trust, participation, and social values and beliefs. This structure presented a social context of each area which affects the development of KM.

3) *Technological structure*

A technological structure refers to mechanisms supporting a knowledge transfer. In a context of business organization, the technological structure mainly focuses on an Information Technology (IT). The IT was applied to store, retrieve, transfer and manipulate data, information and explicit knowledge (Debowski, 2006; Frost, 2010). However, the IT had a limitation in managing a tacit knowledge. It can only assist the tacit knowledge sharing by locating a source of tacit knowledge and providing communication channels for a socialization and externalization (Frost, 2010). To encourage the socialization for facilitating a tacit knowledge sharing, it required an environmental conditions or culture of community such as trust, norms and beliefs (Frost, 2010).

From reviewing the local knowledge development at KK sub-district, the IT was not found as a factor in the LKLC influencing local knowledge transfer. As a result, this study focused only on a culture of KK community as it influenced a socialization among local people.

- **Management functions**

The KM had four basic functions including intermediation, externalization, internalization, and cognition (Frappaola, 1998; Frappaolo, 2002). An intermediation was a fundamental step which had a role in matching a knowledge seeker with the best source of knowledge provider to support the effectiveness of knowledge transfer. For an externalization, it referred to a process of capturing knowledge from the knowledge holders into an external repository and organizing it according to a classification

framework or taxonomy. This function aimed to digest the knowledge into the most usable form for knowledge seeker which was useful for sharing the knowledge. In term of an internalization, it was a process of extracting a knowledge, usually explicit, from an external repository and filtering it to identify a relevance to a user's needs. This function reshaped the knowledge into the most suitable form for its understanding. It involved with a mapping and categorizing skills and experiences of a community or organization in order to address a query or solve problems. A cognition was the last function of knowledge management which was an ultimate goal of knowledge management. It was an application of knowledge which was exchanged through the preceding three functions for supporting a decision-making process. This function was the most difficult because it relied on human cognition to recognize where and how knowledge can be used (Hussain *et al.*, 2004).

2.4.3 Factors in Local Knowledge Life Cycle

The LKLC for a sustainable resource management at community level was also involved and influenced with several factors such as trust (Awad *et al.*, 2004; Lwoga *et al.*, 2010), leadership (Awad *et al.*, 2004; Debowski, 2006), social relationship, beliefs and rituals (Abdullah *et al.*, 2014; Chotthong *et al.*, 2009), and norms and values (Abdullah *et al.*, 2014; Salampessy *et al.*, 2015).

- **Trust**

A trust was considered as a key factor in the local knowledge development. It referred to a willingness of an individual to act on a basis of another person's words, behaviors or judgement (Debowski, 2006; Leahy *et al.*, 2008). It supported the local knowledge development by encouraging an interaction and participation among the people (Düspohla *et al.*, 2014) and enhancing an individual and group motivation and commitment (Debowski, 2006). It can establish an environment where people feel free to share their experience and know-how (Awad *et al.*, 2004; Lwoga *et al.*, 2010; Phasukyud, 2550). It encouraged the local people to willingly participate in community's activities and follow suggestions from their trusted people. In turn, the

participation also built trust among the local people. Therefore, the trust was a prerequisite element which should be built and embedded in an organization's and community's culture to support the local knowledge development (Awad *et al.*, 2004; Farley *et al.*, 2010; Frost, 2010; Lwoga *et al.*, 2010).

The trust should be built in an organization and community in order to support the process of local knowledge development. It can be built from an experience with an individual and a reputation, actions and role of a person (Debowski, 2006). Besides, there were various factors that should be taken into account in building trust such as social relationship (Misiko, 2010; Yang *et al.*, 2009), leadership characteristics (Awad *et al.*, 2004; Debowski, 2006; Donate *et al.*, 2015), and norms and values (Abdullah *et al.*, 2014; Lwoga *et al.*, 2010) because they had direct impact on trust. A surrounding environment such as incentives and culture should be also adjusted appropriately and provided to support the dissemination of local knowledge in order to increase an organization or community's competitiveness (Karadsheh *et al.*, 2009; Lwoga *et al.*, 2010).

- **Volunteerism**

A volunteerism of local people can influence the local knowledge development especially, the local people's perception, and participation. It was defined as a helping action of an individual with a free will without material rewards or mandated or coerced by other people and aimed on a long term or in a formal setting (Burns *et al.*, 2006; Hski-Leventhal, 2009). It consisted of four main components including 1) free will behavior, 2) no material rewards or economic incentives, 3) help strangers, and 4) long-term basis.

The volunteerism was generated both at an individual and community level. The volunteering of a person was generated from a combination of several motives including personal factors (such as demography, attitudes, values, empathy, morality, self-esteem and sense of community), situational, and social factors (social norms and culture) (Burns *et al.*, 2006; Hski-Leventhal, 2009; Unger, 1991). It also relied on an availability of time and

financial resources as well as physical and psychological readiness (Kahana *et al.*, 2013; Unger, 1991). At a community level, the volunteering was generated from an affiliation of local people in group's or community's activities (Hski-Leventhal, 2009). It developed a community's norms which influenced and regulated the local people's behavior. It also strengthened a social relation and interaction which resulted in an increasing of a sense of community. The local people were likely to engage in community's activities in order to comply with the social norms and maintain their relationship with others (Hski-Leventhal, 2009). As a result, the volunteerism motivated the volunteering behavior of local people to participate in local knowledge development.

- **Leadership**

A leadership of an individual was considered as an important element to the local knowledge development in an organization and community. The leadership referred to an individual characteristic such as benevolence, competence, diligence, integrity, fairness, enthusiasm, visionary, and farsightedness (Alexander, 2008; Boies *et al.*, 2015; Burke *et al.*, 2007). It can build a trust among people which further motivated the participation of people in local knowledge development (Boies *et al.*, 2015; Salampessy *et al.*, 2015). A leader who had a leadership characteristic can determine a vision, generates motivation, has an effective communication, and acts as a coordinator, coach, mentor, and model (Debowski, 2006). Moreover, that leader can provide staffs, financial and technical support as well as formulated policies and plans to support the development of local knowledge. In this regard, the leadership characteristic of leader was required to motivate the local people's engagement in sharing their knowledge for creating a knowledge.

- **Social Relationship**

A social relationship or social connection among people or institutions was a social capital that influenced a participation of local people for effective knowledge sharing and transfer (Alexopoulos, 2008).

The social relationship was divided into various levels including kinship, friends and colleagues, and neighborhood. A kinship was defined as the relationship that was based on blood or marriage (Porter, 2001). It was considered as the most reliable sources of local knowledge (Misiko, 2010). Consequently, the local knowledge was mostly shared and transferred only to family members (Misiko, 2010; Yang & Farn, 2009). In term of a social connection among friends and neighborhood, it was influenced by a sense of community which motivated a participation of local people. It also affected a level of trust between or among people (Yang *et al.*, 2009).

- **Sense of community**

A sense of community was related with a feeling of people that tied to each other with some bonds which required a frequent personal contact as a basic need to maintain their relationship. It was categorized into four aspects (Bruhn, 2011) including as follow:

- 1) a sense of membership or being a part of a team,
- 2) a recognition as a team member because that person has some degree of power and affect to an outcome,
- 3) an integration and fulfillment of needs which refers to a person who can complete a task of team through an individual skill, and
- 4) a shared emotional connection, where people are willing to participate in a joint activity and enjoy the acceptance of other team members.

This sense of community contributed a willingness of local people to participate in community's activity which was a key step of local knowledge development.

- **Communication**

A communication was a key element for local knowledge development. It encouraged an exchange, sharing and transfer of information

and knowledge among people. An effective communication can be identified by considering an individual skill in listening, providing feedback, negotiating and presenting (Debowski, 2006). Today, an internet was a powerful technology which provided a wide range of communication tools such as email, video conferencing, and social media to facilitate the knowledge sharing and transfer (Awad *et al.*, 2004; Debowski, 2006). However, a security and privacy of users were limitations of using internet for knowledge sharing and transfer (Awad *et al.*, 2004).

The effective communication can support a trust and relationship building. It encouraged the local people to trust other people or their leaders through providing channels for people to access and obtain information of those people (Lee *et al.*, 2015). It led the people to make a judgement about other people's trustworthiness (Boies *et al.*, 2015). When the trust was formed among the people and embedded in a community culture, it was easier to motivate the local people to participate in community's activities.

- **Religious beliefs and rituals**

Religious beliefs and rituals were informal factors which had an influence on the local knowledge development by governing the local people utilization of natural resources (Mokhahlane *et al.*, 2011; Salampessy *et al.*, 2015). A religion was defined as a belief in supernatural being aiming to help people to solve problems that cannot be resolved by a scientific and technology (Ferraro *et al.*, 2010, p. 346). The beliefs and rituals regarding the religion had social and psychological functions which were important to local knowledge and practices of local people (Porter, 2001). The social function of religious belief referred to a social control, conflict resolution, reinforcement of group solidarity while the psychological function includes cognitive function and emotional function (Ferraro *et al.*, 2010). For example, the Muslim community at Ban Bang Tib in Phang Nga province, Thailand applied their religious belief in God and Islamic doctrines to be principle in managing and utilizing MGES sustainably (Thailand Environment Institute [TEI], 2008b). They believed that the God creates a universe environmental system and all

living creatures; thus, the human had responsibilities to conserve and protect the environment (Thailand Environment Institute [TEI], 2008b). This showed that the religious belief of Muslim people had a social function in term of controlling the local people's utilization and strengthening an individual's sense of group identity which resulted in a creation of solidarity in a community. An impact of religious beliefs and rituals on local people's way of life and sustainable use of natural resources (Salampessy *et al.*, 2015) indicated that they had an influence on the local knowledge development of community.

- **Social norms and values**

Social norms and values were considered as psychological factors which were defined as a general standard or expectation of behaviors based on shared beliefs and specific culture (Feldman, 2001). The social norms were developed by social institutions including political, educational and family institutions which can be classified into two types including prescriptive and proscriptive norms (Bicchieri, 2006). A prescriptive norm means a positive behavior that was expected by other people to act, while a proscriptive norm referred to the action that must be abstain or avoid. They were used as local rules to govern the behavior, opinion, and personal characteristics of group members (Bicchieri, 2006; Elster, 2007; Miller *et al.*, 1996).

The beliefs, norms and values were able to generate personal values which served as a guideline to evaluate a situation in order to make a decision and take actions (López *et al.*, 2008). These factors were applied to regulate the local people's livelihood and behavior in managing and utilizing the natural resources (Mokhahlane *et al.*, 2011; Salampessy *et al.*, 2015). They also influenced a willingness of local people to participate in the natural resources management (Abdullah *et al.*, 2014) which was a key step of local knowledge development (Chotthong *et al.*, 2009; Lwoga *et al.*, 2010). For example, the social norms of local community in Ambon Dalam Bay in Indonesia were used to prohibit the local people from cutting the mangrove trees because they believed that the mangrove forest was their source of life

(Salampessy *et al.*, 2015). The people who abstained to act or disobeyed could be punished by other people in society through informal sanctions or gossip (Elster, 2007). According to behaviors and practices of local people that were influenced by social values and norms, it implied their local knowledge which was specifically developed under an expectation of other people and local rules of that society. The social norms and values of a community should be taken into account to understand the social conditions that influenced the local people's knowledge and practices.

- **Education**

An education was considered as a tool in creating, disseminating, accumulating, and transforming the local knowledge (World Bank, 2004). It was categorized into three types including formal, non-formal and informal education (Coombs *et al.*, 1974). A formal education referred to an institutionalized, structured, and organized education system which guided by a formal curriculum, ranging from primary school through the university. A non-formal education refers an organized, systematic educational activity carried on outside a framework of formal system. It has more flexibility in determining aims, management procedures, duration, assessment and evaluation responding to a requirement of particular groups of learners. An informal education was a lifelong learning process of person who learns by themselves according to their interest and opportunities from daily experiences and exposure to the environment.

According to the study of Abdullah *et al.* (2014), it showed that an education level had a significant positive correlation with a willingness of local people to participate in a reforestation of mangrove forest. The highly educated people were more likely to participate because they had more scientific and environmental knowledge and were raised awareness for volunteering (Abdullah *et al.*, 2014; Gesthuizen *et al.*, 2012).

World Bank (2004) stated that the education was a vehicle for local knowledge. An inclusion of local knowledge into formal school curricula

assisted in maintaining and transferring the local knowledge and local people's practices (McCarter *et al.*, 2011). An integration of local knowledge in training programs and a conversion of local knowledge into an explicit knowledge to be easily accessible and applicable were methods of non-formal education and informal education respectively (World Bank, 2004). In this regard, the study took different types of education into consideration because they involved with the LKLC for the SU of MGES.

- **Common property right**

A common property right was recognized as an important factor influencing the development of local knowledge in community level. It was one of four types of property right which included open access resources (no one's property), private property (individual), state or public ownership, and common or communal property (Von Benda-Beckmann *et al.*, 2017). It referred to the right for using the common-pool resources including access, withdrawal, management, exclusion and alienation (Ostrom *et al.*, 2007; Schlager *et al.*, 1992). It assisted to control the local knowledge development by regulating and monitoring behaviors and performances of local people. It also increased land tenure and food security by promoting an access and a fair and equitable sharing of benefits arising from the utilization of natural resources. (Rao *et al.*, 2017; Von Benda-Beckmann *et al.*, 2017). As a result, it indirectly created a sense of ownership and raised the local people's responsibility for conservation and sustainable utilization of natural resources (Adhikari *et al.*, 2014). Based on the sense of ownership, it motivated the local people's participation which provided opportunities to the local people to share and transfer their local knowledge for natural resource management and utilization. In turn, the participation of local people in the decision-making, implementing and monitoring process also strengthened the common property right (Chen *et al.*, 2015; Chiaravalloti *et al.*, 2017; Lambrecht *et al.*, 2016; Ondetti, 2016; Robinson *et al.*, 2014).

A lack of common property right regimes affected a land tenure and food insecurity as well as a loss of a local knowledge, traditional culture and

practices (Chen *et al.*, 2015). The laws related to common property right and efficient national and local institutions were required to secure land tenure and food and sustain the local knowledge. A well-defined and enforced property right provided the local people's authority to control and utilize natural resources and created the local people's sense of ownership on natural resources (Adhikari *et al.*, 2014). Therefore, the common property right was more recognized as efficient mechanism for sustainable resource and forest management at local scale (Von Benda-Beckmann *et al.*, 2017).

- **Land use zoning**

A land use zoning was the most common form of land-use regulation which was used by governmental agencies to control a land development. It became an influencing factor on local knowledge development for natural resource management and utilization at the community scale. It influenced the process of planning, determining and implementing in local knowledge development. Moreover, it took the local knowledge into consideration for designating an appropriate area for preservation and utilization (Baker *et al.*, 2006). It should be conducted harmoniously with a community's character and local people's interest in order to preserve the character of specific areas and respond the local people's need (Baker *et al.*, 2006).

These reviewed factors in the LKLC were specific to ecological, social-cultural, economic, and legal conditions of each community. Their functions and relationship influenced functions and interaction of social institutions - family, political, religious, educational, and economic institutions in community which facilitated the local knowledge development. In this regard, these factors were necessary to be identified in order to create and propose a local knowledge framework for SU of MGES.

2.5 Related Researches of Mangrove Restoring and SU of Restored MGES at KK Sub-district

2.5.1 Chronological background of mangrove restoring and SU of MGES

- **Effects of mangrove degradation on local livelihood**

A mangrove forest at KK sub-district was recognized for its abundance of ecosystem services such as food, fuelwood, medicinal plants, and natural habitat for juvenile aquatic animals. Its ecological functions supported an ecological production of Don Hoi Lod wetland where was announced as a Ramsar site on July 5, 2001 (Convention on Wetlands, 2014). However, the mangrove ecological production at KK sub-district was gradually degraded in 1957 according to a permission of government for personal occupancy of mangrove forest areas (Suwannatat *et al.*, 1996). Without any measures to protect the mangrove forest, it was heavily depleted during 1984 – 1990 due to an encroachment and deforestation of mangrove forest for shrimp farming. As a result, the mangrove forest areas were drastically reduced from 32 km² to 1.44 km² in 1986 (Suwannatat *et al.*, 1996). The mangrove nursery grounds and habitat function for aquatic animals were lost because of a deforestation and wastewater from an improper production method of shrimp farming (Rittichai, 2012). It resulted in an extreme reduction of fishery resources such as blood cockles and fishes which affected a decrease of income and disappearance of local people's livelihood (Poonkratok *et al.*, 2013; Rittichai, 2012). Several people were penniless (Suwannatat *et al.*, 1996) and had to leave their hometown to seek for jobs in neighboring provinces (Poonkratok *et al.*, 2013) (Table 2.5).

- **Participation of local people for mangrove restoring**

The mangrove restoration project was initiated in 1990 due to the a perception of former village chiefs and local people on values of mangrove forest and requirement to solve a poverty (Poonkratok *et al.*, 2013; Suwannatat *et al.*, 1996). It was implemented by the former village chiefs and their volunteering kinship and friends based on an application of local knowledge and participation of local people (Mek Piboon *et al.*, 1998; Suwannatat *et al.*, 1996).

The mangrove restoring activity through mangrove planting was implemented on a mud flat area which was extended along a coast for 4 kilometers or covered areas approximately 24 km² (Suwannatat *et al.*, 1996). It launched on August 12, 1991 to celebrate on the Auspicious Occasion of Her Majesty Queen Sirikit The Queen Mother's 60th Birthday with an active participation of local people, governmental organizations and private sectors. (Mek Piboon *et al.*, 1998) (Table 2.5).

A goal of project, human resources, and financial support were determined and established for mangrove restoration project. The goal of mangrove restoration project was to solve a poverty by restoring the mangrove ecological production through increasing the mangrove forest areas and preventing an imbalance of mangrove ecosystem (Mek Piboon *et al.*, 1998; Suwannatat *et al.*, 1996). Several stakeholders including village chiefs, local people, governmental agencies, non-governmental organizations (NGOs), academic institutions, private sectors, foreign agencies (Australia and Denmark), religious institutions, and mass media involved in this mangrove restoration project. They had various functions. For example, the governmental agencies provided mangrove seedling and financial and technical support. Their participation demonstrated a public environmental awareness which was important to achieve the objectives of mangrove restoring project (Mek Piboon *et al.*, 1998). These stakeholders also provided financial and technical support for the project operation (Mek Piboon *et al.*, 1998; Suwannatat *et al.*, 1996).

- **Application of local knowledge for mangrove restoring and SU of restored MGES**

A key challenge during the mangrove stand initiation was a lack of local knowledge application and integration for mangrove restoration. In an early phase of mangrove restoring, the mangrove plants were introduced by academicians who lack of knowledge on mangrove ecosystem specifically to KK sub-district. The local knowledge on mangrove pioneer plant species, which was suitable with hydrological, geographical, and edaphic conditions of KK sub-district was ignored and did not integrate in the mangrove restoration plan As a

result, the mangrove restoration in an initial phase of mangrove stand initiation was fail because the mangrove trees survived only 20% (Mek Piboon *et al.*, 1998; Suwannatat *et al.*, 1996).

Based on an intensive accumulated experience of local people related to the mangrove forest, the former village chiefs and volunteering local people suggested to plant the local mangrove pioneer plant species, namely *Avicennia* sp. and *Sonneratia* sp. instead (Rittichai, 2012). These pioneer plant species were grown effectively on a foreshore zone and trapping, holding, and stabilizing intertidal sediments. As a result, the mangrove forest were gradually expanded from 1.44 km² in 1990 to 5.492 km² in 2012 (Department of Marine and Coastal Resources [DMCR], 2012). Macrobenthos such as polychaetes, brachyurans, and gastropods were gradually recovered and superseded opportunistic species as a forest aged (Wichitwarakhun, 2001). The recovery of mangrove ecological production represented an importance of local knowledge application and integration in mangrove restoration.

- **Consequences of mangrove restoring**

A consequence of mangrove restoring was a recovery of mangrove ecological production. For example, an accumulation of sediment both on mudflats and inner landward zone was increased after a restoration of mangrove forest (Paphavasit, 2002). Microbenthos such as polychaetes and crustaceans were also found increasingly and intensely on mudflats (Wichitwarakhun, 2001).

After restoring the mangrove ecological production, the goal was shifted from poverty reduction into an opportunity of diversified incomes through utilization of restored MGES for an ecotourism. The ecotourism was initiated in 2007 by the former village chief in order to generate more income to the local people (Jintana, 2015; Poonkratok *et al.*, 2013; Sangchumnong, 2018). It was implemented by KKM FCC in a form of a community enterprise. It was also used as a mangrove public non-formal education center for disseminating a local knowledge and benefits of MGES as well as raising awareness to governmental officers, academicians, students, and tourists (Paphavasit *et al.*, 1997b; Udomsilp,

2012). It also applied the local knowledge on mangrove ecosystem such as topography, wave and wind, and tidal currents in determining ecotourism activities regarding to a change of mangrove forest conditions and local people's livelihood and culture (Table 2.5).

The restoration of mangrove ecosystem did not only recover the mangrove ecological production and MGES, but also diversified income and maintained local people's livelihood. Moreover, it motivated many local people, who used to leave their hometown for working, came back to live with their family and work in their community (Green Globe Award, 2004; Poonkratok *et al.*, 2013; Ratanapongtara, 2016; Udomsilp, 2012; Watcharapol, 2015). It also stimulated an establishment of mangrove forest conservation groups and community enterprises to serve as a place for sharing and exchanging their knowledge, skills and information (Poonkratok *et al.*, 2013; Udomsilp, 2012). It indirectly created a social integration among the local people at KK sub-district.

Table 2.5 Chronological Pattern of Mangrove Utilization and Management at KK Sub-district

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
Before 1950	The mangrove was abundant with plant species, fauna species and community structures of benthic animals.	+ The mangrove was abundant with plant species, fauna species and community structures of benthic animals.
1950	Local people and private companies heavily reclaimed the mangrove forest which resulted to an unceasing reduction of mangrove forest areas.	+ The government formulated the policy and laid down legal measures to the governmental agencies for the mangrove forest protection. + The government assigned the Ministry of Agriculture and Cooperatives to protect and conserve the mangrove forest.

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

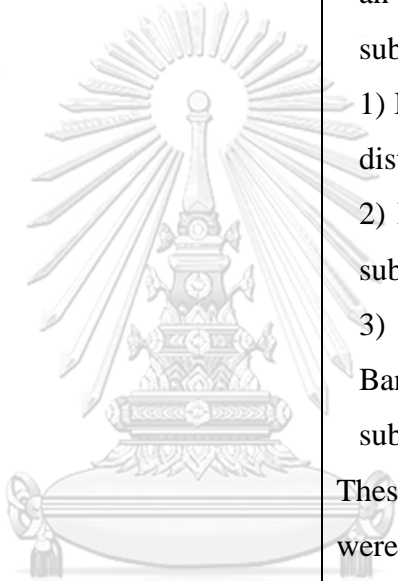
Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
		<p>+ Ministry of Agriculture and Cooperatives assigned the Royal Forest Department and provincial government to coordinately survey an existing mangrove area in three sub-districts including:</p> <ol style="list-style-type: none"> 1) Klong Chong village in KK sub-district (60 km²), 2) Klong Yi San village in Yi San sub-district (36 km²), and 3) Mab Jarakae Non vaillage in Bang Ja Kreng and Bang Kaew sub-district (38.2 km²) <p>These three mangrove forest areas were selected to be forest reserves.</p>
1951-1956	Mangrove forest in KK sub-district became forest reserves according to the Forest Reserve Decree formulated by Ministry of Agriculture and Cooperatives.	- Local people opposed the forest reserves of government because they worried about losing their own land which were already preempted
1957	RFD proposed a law for cancellation of mangrove forest reserve at Klong Yi San and Mab Jarakae Non	- The local people who lived originally in these areas and people from other areas came to occupy and purchase lands from landowner and reclaim the mangrove to improve the areas for settlement. Consequently, the natural mangrove forest was gradually decreased.

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
1968	The mangrove forest was destroyed approximately 33.7 percent from the whole mangrove forest areas covering three sub-district (134.24 km ²) or around 45.24 km ²	- The mangrove forest areas were left as flourishing stage only 88.99 km ² .
1975-1983	The mangrove forest areas where used to be fully covered with mangrove plants were diminished due to the forest clearance and land reclamation for shrimp farming, urban settlement, coconut plantations, and <i>Casuarina</i> plantations.	- The mangrove forest areas were left only 64 km ² .
1984	Intensive shrimp farming was introduced to KK sub-district by private companies. It attracted the local people to converse the mangrove into shrimp farming with high return benefits. It was an external threat which was difficult to control. It resulted in an illegal encroachment and clearance of mangrove for shrimp farming.	- Local people obtained lots of income from shrimp farming production which attracted them to invest on extending areas for shrimp farming.
1985-1986	The mangrove along the coasts was diminished due to forest	- The mangrove forest areas in Samut Songkhram provinces were

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
	clearance, land reclamation for intensive shrimp farms, urban settlement and coconut plantation	<p>reduced from 64 km² to 21.33 km²-</p> <p>The mangrove forest areas in KK sub-district were drastically reduced from 32 km² to 1.44 km²</p> <ul style="list-style-type: none"> - The main natural mangrove stands were <i>Rhizophora</i> apiculate and <i>R. mucronata</i> which had been vanished due to heavy forest clearance.
1987-1988	The intensive shrimp farms discharged wastewater from shrimp pond which did not pass the process of wastewater treatment to the seawater.	<ul style="list-style-type: none"> - A seawater along the coast was polluted. - A polluted seawater that was pumped into shrimp ponds negatively affected to a growth of shrimp. - The shrimps were died due to the wastewater and shrimp disease which were widely dispersed around those areas. - The shrimp production was declined and ineffective to provide longer profit due to a periodic pollution from extensive shrimp farming.
1989	The intensive shrimp farms were collapsed in KK sub-district and other areas in Samut Songkhram province because of a polluted seawater and bacterial disease	<ul style="list-style-type: none"> - The mangrove ecological production was deteriorated. - Many shrimp ponds were abandoned - Many natural aquatic animals such as blood cockles, sea crabs, krills

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
	outbreaks which affected a reduction of shrimp production.	<p>and some fish species disappeared from the coast of Samut Songkhram province.</p> <p>- Local people who used to sustain their subsistence from harvesting MGES were in trouble because they lacked resources and income.</p>
1990	The governmental organizations attempted to increase the mangrove forest areas and to prevent an imbalance of mangrove ecological production by mangrove reforestation	<p>+ The mangrove reforestation activities were conducted on mud flat which were extended along the coast as far as 4 kilometers or cover the areas approximately 24 km².</p> <p>+ The mangrove restoration project was initiated and led by a former provincial governor, former village chiefs, and local people in KK sub-district.</p> <p>+ The local community participated with governmental agencies to plant the mangrove seedlings for increasing the mangrove forest areas on mud flats and restore the mangrove ecological production.</p> <p>+ The mangrove forest which was replanted on mud flats was designated as mangrove forest reserves according to the laws.</p>

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
1991- 2006	<ul style="list-style-type: none"> • The mangrove reforestation project was launched on August 12, 1991 to celebrate on the Auspicious Occasion of Her Majesty the Queen's 60th Birthday with an active participation of local people, governmental organizations and private sectors. • The mangrove reforestation was continuously implemented by village chiefs and local people of KK sub-district. 	<p>- In an early stage of mangrove stand initiation, the mangrove restoration was failed because the governmental agencies used</p> <p>- In an early stage of mangrove stand initiation, the mangrove restoration was failed because the governmental agencies used <i>Rhizophora</i> sp. which was unsuitable to replant on a foreshore zone due to a tidal fluctuation.</p> <p>+ The pioneer plant species named <i>Avicennia</i> sp. and <i>Sonneratia</i> sp. were suggested by the local people to plant instead of using <i>Rhizophora</i> sp. because these pioneer species can resist the barnacles and can trap sediment better than <i>Rhizophora</i> sp.</p> <p>+ The local people learned a technique of seed production and reforestation and an appropriate timing for planting (May - September) to avoid the barnacle period, long exposure to sunlight during low tide in summer, and fruiting period of mangrove species.</p>

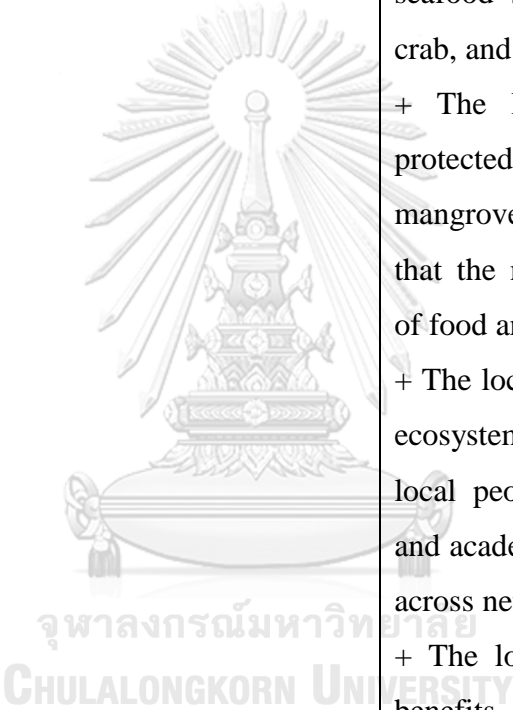
Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
		<p>+ Her Royal Highness Princess Maha Chakri Sirindhorn visited KK sub-district to plant mangrove for 5 times in 1997, 1998, 1999, 2002 and 2004.</p> <p>+ The royal visit of HRH Princess Maha Chakri Sirindhorn raised an awareness and motivated the local people to participate in mangrove restoration and conservation.</p> <p>+ Mangrove Resources Development Station 7 was established after the royal visit of HRH Princess Maha Chakri Sirindhorn.</p> <p>+ The mangrove forest areas were divided into two zones for conservation and utilization zones which were regulated by governmental agencies.</p> <p>+ A wood cutting was prohibited under the Forest Reserve Law.</p> <p>+ The mangrove forest areas at KK sub- district had increased gradually from 1.44 km² in 1990 to 5.492 km² in 2012.</p> <p>+ Phytoplankton, zooplankton and benthic animals were gradually</p>

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
		<p>restored in plantation area and in the inner forest which were found differently in each zone of mangrove ecosystem (mudflat, seaward fringe, middle zone, and landward fringe).</p> <p>+ Species richness of benthic animals generally increased in the plantation area.</p>
2007- present (2017)	<ul style="list-style-type: none"> • An ecotourism was initiated and promoted by the local people in order to create diverse occupations to generate more income to the local people. • The mangrove forest was monitored and safeguarded by local people and MGFDS 7 	<p>+ The mangrove succession affected to the distribution and richness of fauna species.</p> <p>+ The mangrove plantation activities were used to promote an ecotourism at KK sub-district.</p> <p>+ A mangrove ecotourism at KK sub-district was more well-known and became a tourist attraction.</p> <p>+ Several occupations involved ecotourism such as boat rental, homestay and resorts, restaurants were created to services tourists.</p> <p>+ Local people earned more income from providing services and selling local products such as shrimp paste and coconut palm sugar.</p> <p>+ Mangrove plantation became activities for tourists, private</p>

Table 2.5 Chronological Pattern of Utilization and Management of Mangrove Forest at KK Sub-district (Cont.)

Time period (A.D.)	Pattern of utilization and management of MGES	Impacts (+/-)
		<p>companies, and students to learn the benefits of MGES and local people's livelihood as well as enjoy the mangrove forest, animals and fresh seafood such as blood cockle, sea crab, and mussel.</p> <p>+ The local people continuously protected and conserved the mangrove because they were aware that the mangrove was their source of food and income.</p> <p>+ The local knowledge on mangrove ecosystem was transferred among local people, governmental officers and academicians through discussion across network.</p> <p>+ The local knowledge related the benefits of MGES were disseminated to tourists and students through narration and oral transmission.+ The mangrove plantation activities were used to transfer the local knowledge and practices in restoring the mangrove ecosystem to tourists through learning by doing.</p>

Source: Mek Piboon *et al.* (1998); Paphavasit *et al.* (1997b); Poonkratok *et al.* (2013); Rittichai (2012); Suwannat *et al.* (1996)

During two phases of mangrove stand initiation and young forest regrowth, a local knowledge was applied in restoring the mangrove ecosystem and utilizing the MGES from restored mangrove forest. It was shared and exchanged between local people and governmental agencies through a participation of local people in mangrove restoring process. After resolving a mangrove ecosystem crisis and alleviating poverty, the local knowledge was applied to utilize the MGES from restored mangrove ecosystem. A potential of local knowledge for mangrove restoration and SU of MGES was recognized. However, its development process was complex as it involved with several interrelated factors which were specific to the ecological, social and cultural conditions. To clarify the process of local knowledge development or LKLC for mangrove restoration and SU of restored MGES, the factors and their functions in the LKLC during those two phases of mangrove forest development had to be identified.

2.5.2 Expected factors in LKLC at KK sub-district

According to reviews and pre-survey at KK sub-district, several factors were expected to influence the LKLC during two phases of mangrove stand initiation and young forest regrowth. They were included as follow:

- **Trust**

At KK sub-district, a trust could be found among the local people and former village chiefs which encouraged the local people to participate in the mangrove restoring activities and local knowledge sharing and transfer. The trust of local people on their village chiefs can be created from three components including the cognitive component, emotional affective component, and behavioral components (Romano, 2003). It also had a correlation with a volunteerism of local people who were willing to unconditionally assist the village chief to restore the mangrove forest. If the people had more trust, they tended to be more volunteer and cooperative and vice-versa (Jarungrattapong *et al.*, 2014). It means that the trust interconnect with other factors in the LKLC which influenced the SU of MGES.

- **Volunteering**

From reviews of a volunteering of local people at KK sub-district, the volunteering of local people was found in the phase I of mangrove stand initiation stage (Suwannatat *et al.*, 1996). It encouraged the local people to participate in sharing and transfer their local knowledge, experiences, and skills for selecting pioneer plant species, site, and suitable time for mangrove planting. Moreover, it motivated the local people to adapt their behavior and practices for conserving and protecting the mangrove forest from human-induced disturbances, and sustainably utilizing the MGES from restored mangrove forest.

- **Leadership**

At KK sub-district, the former village chiefs had a leadership characteristic (Udomsilp, 2012). They had a vision and communication skills in encouraging the local people to participate in mangrove restoring activities. They also acted as a coordinator and coach to change the local people's perception and awareness to adapt their practices regarding the PSE concept. It can be said that the leadership of village chief was an important factor in the LKLC.

- **Social relationship**

In case of KK sub-district, the local people knew each other as they were kinship, friends, and neighborhood. They tended to participate in community activities that were recommended and conducted by their kinship or friends in order to maintain their social relationship.

- **Sense of community**

A sense of community strongly influenced the local people's perception at KK sub-district. It encouraged the local people to participate in the mangrove restoring activities and supported an engagement of local people to establish occupational groups (Udomsilp, 2012).

- **Communication**

A communication skill of a former village chief was an important factor for local knowledge development at KK sub-district. An effective communication skill of former village leader integrated with a suitable communication channels raised the local people's perception and awareness (Arpavate *et al.*, 2011) on a degradation of mangrove forest (Udomsilp, 2012). Therefore, the communication skill of former village chiefs at KK sub-district played an important role for the local knowledge development.

- **Religious beliefs and rituals**

According to field pre-survey at KK sub-district, the supernatural beliefs in spirits also influenced the local people at KK sub-district. For example, a guardian goddess of boats was respected by fishermen because they believed that this spirit has supernatural power to protect and bless them to sail and return home safely with lots of aquatic animals. It controlled and encouraged the local people's behavior to protect and utilize the MGES in sustainable manner. It was transferred and changed over generations to continuously influence the perception and awareness of local people for sustainable use.

- **Social norms and values**

At KK sub-district, the social values and norms were developed by a participation of local people based on their culture, religious beliefs, values and the PSE concept of His Majesty King Bhumibol Adulyadej The Great (Udomsilp, 2012) to govern the behaviors and practices of local people for sustainable utilization of mangrove resources.

- **Education**

According to the reviews and pre-survey at KK sub-district, it found that there were formal, non-formal, and informal education that involved with the local knowledge development especially, the local knowledge transfer. A school had a curriculum and out-of-class activities to educate and raise

students' awareness on the values of MGES. For non-formal education, the local knowledge on the values of MGES, mangrove planting techniques and utilization of mangrove forest in sustainable manner was transferred by the KKM FCC which served as a leaning center of mangrove forest. From field survey, The KKM FCC integrated the mangrove planting which was regarded as a non-formal educational activity into their ecotourism program. They aimed to share and transfer the local knowledge and experiences in mangrove restoration, traditional livelihood to governmental agencies, NGOs, academic institutions, private companies, and tourists (Rungsirattanawong, 2011; Udomsilp, 2012). In term of informal education or a lifelong learning, it referred to an accumulation of experience and knowledge of local people at KK sub-district for harvesting mangrove resources to sustain their livelihood. Their local knowledge and traditional practices were shared and transferred to their descendants through self-study, individual advise, and learning from a model person. It showed that the local knowledge on mangrove ecosystem at KK sub-district was transferred through all type of education system.

- **Common property right**

From reviewing a property right at KK sub-district, there was no common property right issued by laws because the mangrove forest along the foreshore line was a state ownership. It was mainly governed by the Department of Marine and Coastal Resources (DMCR) and other governmental agencies. It was designated as coastal land for public benefits allowing the local people to harvest the ecosystem services except the wood cutting. It provided the local people's opportunities to participate in safeguarding and managing the mangrove forest for tenure, food, and livelihood security. It enhanced the local people' sense of ownership and raise their responsibility to conserve and sustainably utilize ecosystem services (Adhikari *et al.*, 2014). As a result, it influenced the local people's decision to participate both two phases of mangrove stand initiation stage and young forest regrowth stage (Adhikari *et al.*, 2014; Jaafar *et al.*, 2015).

- **Land use zoning**

At KK sub-district, the mangrove forest was divided into two zones including a conservation zone and a utilization zone. The conservation zone was prescribed by the cabinet resolution. It was a part of Don Hoi Lod wetland which was announced as Ramsar site (Convention on Wetlands, 2014). It was governed by MGFDS 7 and was protected from any activities that could degrade the mangrove ecological production. A demarcation of mangrove forest for conservation regulated the local people's behaviors and utilization of mangrove forest. It indirectly controlled the local people practices in protecting and conserving the mangrove forest from wood cutting and illegal encroachment for building construction. For the utilization zone, it was an open access land for local people to harvest the MGES. However, it still prohibited the mangrove wood cutting. It also forbade the local people to use destructive fishing gears and allowed only a traditional fishing gear and local practices to harvest the fishery resources. This area was safeguarded by local people in collaborated with local governmental agencies. In addition, it also influenced the local people decision-making to participate in local knowledge development. It can be concluded that the land use zoning determined the local people's utilization of the MGES from restored mangrove forest.

The study expected to find these factors in the LKLC during two phases of mangrove stand initiation and young forest regrowth at KK sub-district. Moreover, it was possible to discover more factors that were specific to KK community. As a result, the study focused on an identification of factors in the local knowledge development to create a local knowledge framework for SU of MGES.

CHAPTER III

RESEARCH METHODS

3.1 Research Framework

A local knowledge was an accumulative experience derived from a process of community development. It was embedded in a customary laws, spiritual beliefs and rituals, and local uses of natural resources (Berkes *et al.*, 1993; Santasombat, 2003) of communities around the world including Thailand. It was integrated and applied in community's activities under the changes of land uses, threats on limited natural resources and fragile socioeconomics, but its structures and functions were not yet well documented and understood. Therefore, the structures and functions relationship in a process of local knowledge development at community level must be learned and structured in order to simplify the sustainable practices in the future.

The structures involving a local knowledge development refers to factors in the LKLC. They were grouped based on their similar functions in the local knowledge development. They were identified to create and propose a local knowledge framework for the SU of MGES from restored mangrove forest. They were identified based on an orderly development of mangrove forest conditions and productions or an ecological succession including a developmental stage (mangrove stand initiation) and mature stage (young forest regrowth).

- **Phase I Developmental stages of degraded mangrove ecosystem**

For seventeen years (1990-2007) (Udomsilp, 2012) of early stages of species succession and early stages of reforestation, the local people attempted to continuously provide maximum supports for the mature stages. They applied their local knowledge for nursing a growth of mangrove seedling and conserving organic substrate by considering a symbiosis between ecological production and development of human society such as civil rights, laws and regulations, education, and cultures.

- **Phase II Mature stage of stabilized ecosystem**

Resolving environmental crisis and providing ecosystem services such as provisioning and cultural services since 2007, the long-term evolutionary

interactions between and within species influenced an intricate biogeochemical cycling of major nutrients such as nitrogen, phosphorus and potassium. A concept of sustainable utilization was applied with the highest trust and loyalty in Her Royal Highness Princess Maha Chakri Sirindhorn. A PSE principle focusing on socio-economic development as well as bottom-up power were also applied and integrated in the mangrove restoration process (Jintana, 2015; Poonkratok *et al.*, 2013; Udomsilp, 2012). A participation of all involving sectors and networks including governmental agencies, private sectors, NGOs and etc. was a major driver in a natural restoration of mangrove ecological production.

According to the overall concepts involving a process of local knowledge development and its influencing factors bridging MGES utilization and SU components, it can be illustrated into a conceptual framework of this study. A conceptual framework of the study consisted of three main components. It included 1) mangrove provisioning and cultural services which were utilized during two phases of mangrove forest development, 2) conditions enabling or indicating the SU of MGES, and 3) process of the LKLC bridging between MGES and SU during two phases of mangrove forest development (Figure 3.1).

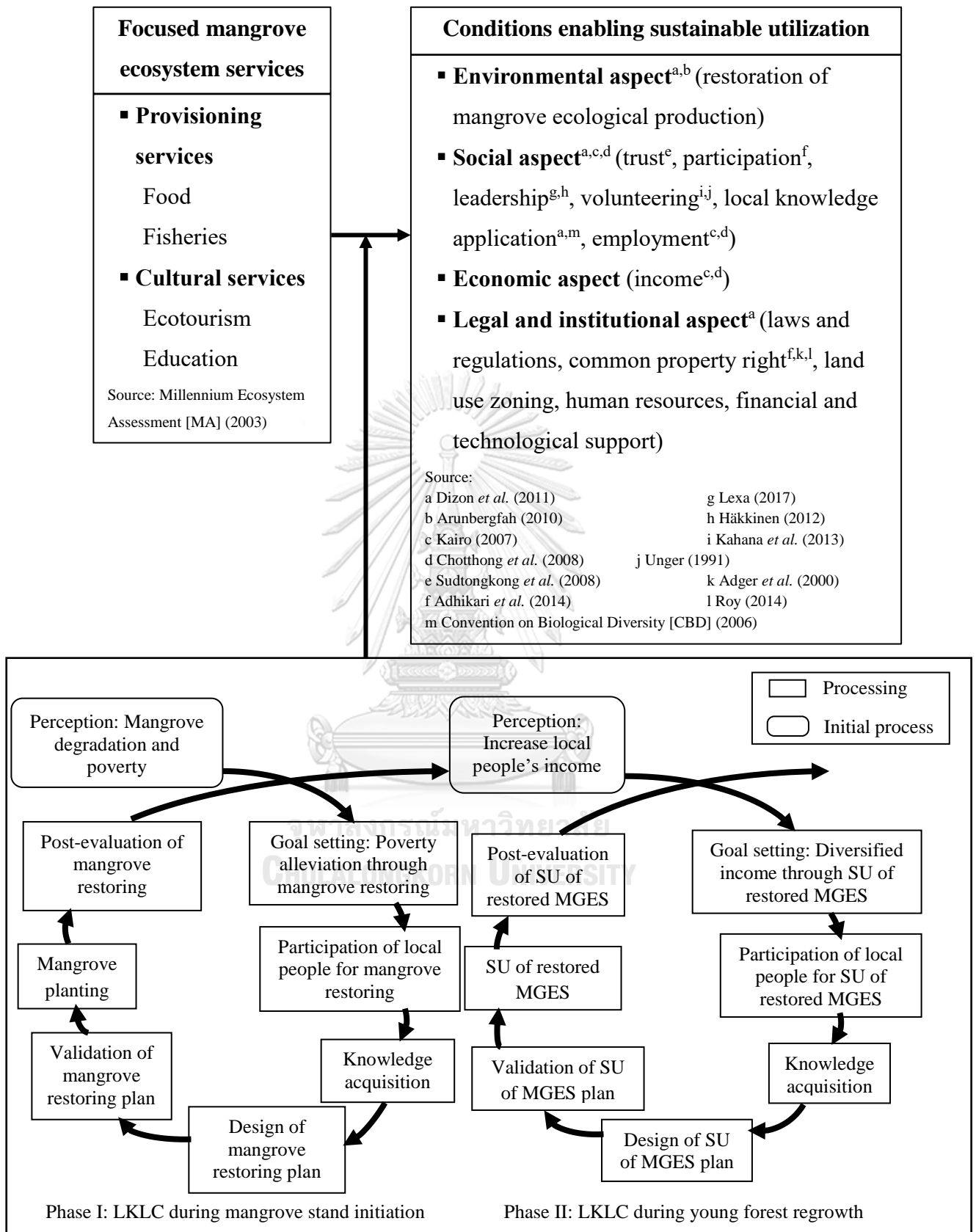


Figure 3.1 Conceptual framework of the study.

Consequences of a complex development of local knowledge during the changes of sustainable use of natural resources and environmental improvement were new practices and techniques for mangrove forest management such as land use zoning and strategies for benefits sharing. These new techniques were introduced for practices of community and became community agreements. Therefore, the baseline studies of local knowledge and other related available data related to forest development, social movement, and development of socioeconomic status were collected by different methods such as desk reviews and field survey.

The target information or datasets of the study including 1) demographic information of respondents, 2) factors and their functions in the LKLC, 3) changing utilization of mangrove provisioning and cultural services, and 4) the major factors in the LKLC enabling the SU of MGES. They were collected by field observation, questionnaire survey, and in-depth interview, while a secondary data was collected by reviewing from academic journals, governmental documents and reports, and published materials. The datasets were collected from two groups of respondents. The first group was fishermen whose income and livelihood were highly depended on harvesting mangrove provisioning services. The fishermen were randomized to answer the questionnaires. Another group was key stakeholders who had roles and responsibilities involving the LKLC during two phases of mangrove stand initiation stage and young forest regrowth. They included former and present village chiefs, a chief of Mangrove Forest Development Station 7, a headman of mangrove forest conservation groups, local philosophers, a headman of community enterprises of shrimp paste production and ecotourism. They were purposively selected to be interviewed. The collected data from questionnaire survey and in-depth interview was analyzed by descriptive statistical analysis and event analysis. The factors in the LKLC during the mangrove stand initiation stage and the young forest regrowth phases, and the major factors in the LKLC enabling the SU of MGES were prioritized based on their percentages from the highest to lowest influenced level. Finally, they were used for creating a local knowledge framework for the SU of MGES which was specific to KK sub-district.

3.2 Study Area

Klong Khone sub-district is situated in Mueang District in Samut Songkhram province covering areas around 33.69 km² (KKSAAO, 2016) as shown in Figure 3.2. It borders with other sub-districts of Samut Songkhram province and Phetchaburi province, and the Gulf of Thailand. This sub-district has territory land contacted with the following areas:

- Northern area: Connected to Ban Bang Khan Taek sub-district, Mueang district in Samut Songkhram province
- Southern area: Connected to Ban Ta Boon sub-district, Phetchaburi province
- Eastern area: Connected to Laem Yai sub-district, Mueang district in Samut Songkhram province and the Thai Gulf
- Western area: Connected to Yee Sarn sub-district in Amphawa district in Samut Songkhram province



Figure 3.2 Location of KK sub-district at Samut Songkhran province.

The study site was the KK sub-district where a local knowledge was developed and applied responding to a change of specific benefits of MGES for utilization during the mangrove stand initiation and young forest regrowth phases. In an initial phase of mangrove stand initiation stage, the local knowledge on mangrove ecosystem was developed to restore the MGES. It was applied in a selection of mangrove pioneer plant species, suitable site and timing for planting mangrove saplings as well as techniques for mangrove planting (Suwannatat *et al.*, 1996). After resolving mangrove ecological crisis and poverty, the local knowledge was developed and applied to diversify local people's income by utilizing the restored MGES for fishery resources and ecotourism. The development of local knowledge during two phases of mangrove forest development involved with several complex factors. These factors and their interrelated functions in the LKLC had to be identified to create a local knowledge framework for the SU of MGES.

3.3 Research Design

A research design of the study was based on an inductive reasoning and participatory approach (Figure 3.3). The study used both primary and secondary data to obtain information related to the utilized mangrove provisioning and cultural services, factors in the LKLC during two phases of mangrove forest development, and the major factors in the LKLC enabling the SU of MGES at KK sub-district. The data were collected by desk reviews, field observation, in-depth interview, and questionnaires survey with dichotomous questions, multiple choices, and checkboxes.

In an early step of data collection, the field survey was implemented several times between June to July, 2017 to meet the key stakeholders in the study area and observe the local people's livelihood. The stakeholders were appointed in advance to ask for their merciful assistance, available time, and convenient location to introduce the research purposes and benefits of the research to their community.

The questionnaire survey was implemented between August to October, 2017. The information in questionnaires was designed in four parts including 1) demographic information, 2) factors and their functions in the LKLC during two phases of mangrove stand initiation and young forest regrowth stage, 3) mangrove

provisioning and cultural services which were utilized during two phases, and 4) the major factors in LKLC enabling the SU of MGES at KK sub-district.

The in-depth interview was conducted with key respondents who had roles and responsibilities involved with the LKLC during two phases of mangrove stand initiation and young forest regrowth. These key respondents included former and current village chiefs, a chief executive of Klong Khone Subdistrict Administrative Organization (KKS AO), a chief of MGFDS 7, a chief of KKM FCC, a chief of Khon Rak Klong Khone (KRKK), a chief of Klong Khone Coordination Center for Mangrove Forest Conservation (KKCCMFC), ecotourism and shrimp paste production community enterprises, and local philosophers. They were also invited for a group discussion to validate the results.



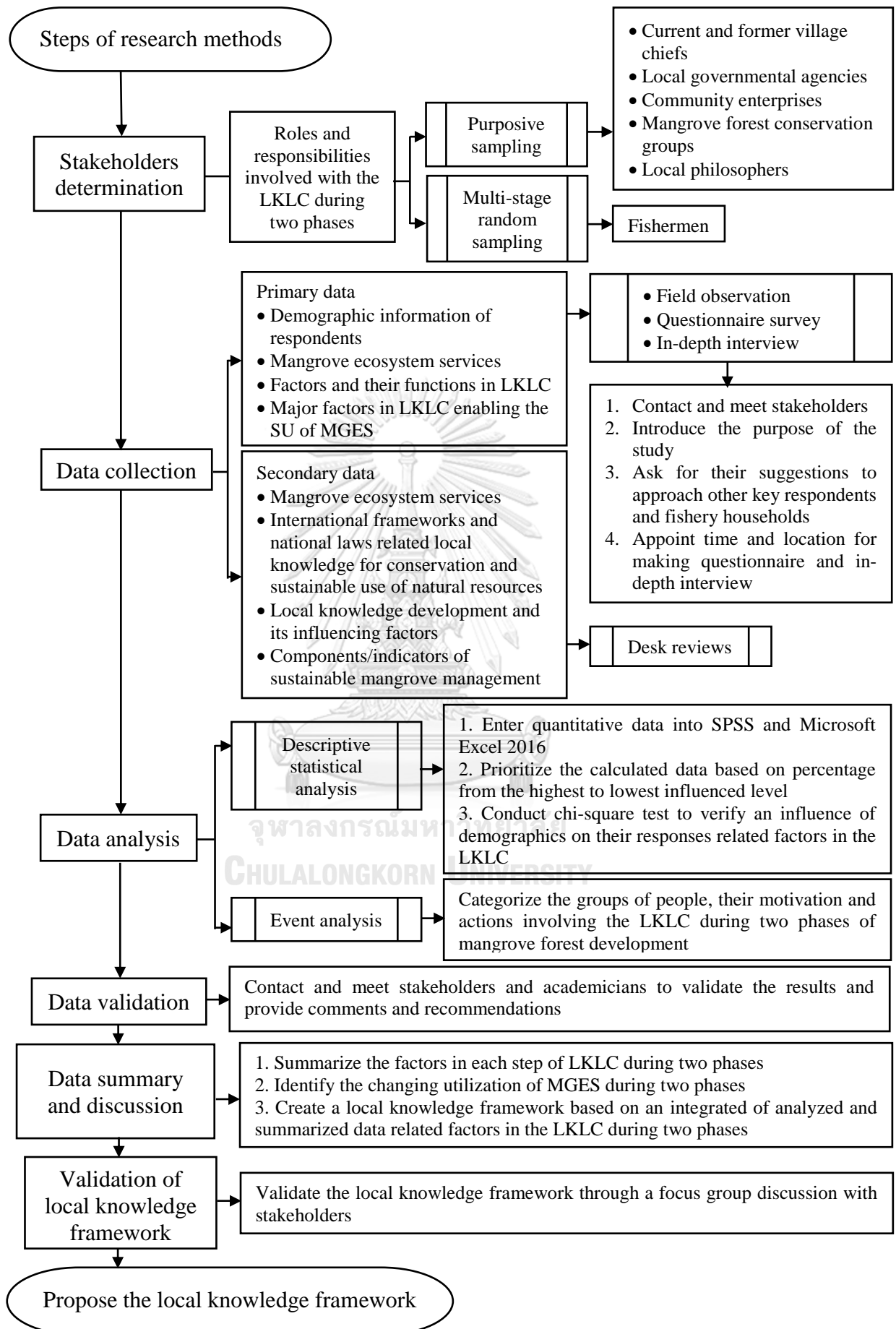


Figure 3.3 Research design of the study.

3.4 Data Collection

A field observation and questionnaires survey with dichotomous questions, multiple choices, and checkboxes were used to collect the datasets of the study as shown in Table 3.1. It was conducted to ensure that the questionnaires were clear to stakeholders and cover all interested topic of this study. Furthermore, it determined an effectiveness and searched for a weakness of questions for an improvement.

A technique of memo and voice recording were used throughout a process of questionnaire survey and field observation. The memo assisted in describing and identifying code labels and meanings (Babbie, 2010). It also supported the researcher to find a linkage of data (Chantavanich, 2013).

3.4.1 Demographic information of respondents

A demographic information of respondents including gender, age, birthplace, and educational level were collected by questionnaire survey with dichotomous questions and multiple choices. They were collected in order to examine their influence on factors in the LKLC.

3.4.2 Factors and their functions in local knowledge development

Factors in the LKLC that led to the SU was collected by questionnaires with dichotomous questions, multiple choices and checkboxes.

The respondents were asked about factors in each step of LKLC during two phases of mangrove stand initiation stage and young forest regrowth stage. Moreover, they were asked to identify institutions involved in the LKLC during two phases of mangrove stand initiation and young forest regrowth.

3.4.3 Changing utilization of mangrove provisioning and cultural services

A utilization of mangrove provisioning and cultural services during two phases of mangrove forest development were collected by questionnaires survey with checkboxes. The respondents were asked to check a list of mangrove provisioning and cultural services that utilized during two phases of mangrove stand initiation and young forest regrowth. The multiple responses were possible.

3.4.4 Major factors in the LKLC enabling the SU of MGES

Major factors in the LKLC enabling the SU of MGES at KK sub-district were collected through various sources of information such as journals, textbooks, reports, and news. The field observation, and questionnaires with multiple choices items were employed to gather opinions of fishermen on conditions that supported and indicated the SU of MGES specifically to the KK sub-district. The desk reviews on criteria and principle of sustainable use were also applied to compare with the results collected from a field observation and questionnaires for a discussion.

Table 3.1 Datasets and Data Collection Tools

Datasets	Details		Data collection tools
1. Demographic information of respondents	<ul style="list-style-type: none"> • Gender • Age • Birthplace • Education level 		Questionnaires with dichotomous questions and multiple choices
2. Factors and their functions in LKLC during the mangrove stand initiation and young forest regrowth	2.1 Perception and problem identification	<ul style="list-style-type: none"> • External factors <ol style="list-style-type: none"> 1) Intensity of wave and wind 2) Reduction of mangrove forest areas 3) Reduction of aquatic animals (provisioning services) 4) Location of house 5) Common property right 6) Occupation 7) Education 8) Position and responsibility • Internal factors <ol style="list-style-type: none"> 9) Social norms (customary laws) 10) Volunteering 11) Birthplace (sense of ownership) 12) Reduction of income due to a mangrove degradation 13) Age 14) Sex 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with dichotomous questions and checkboxes - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
	2.2 Goal setting	<ul style="list-style-type: none"> • Factors in a goal setting during two phases of mangrove forest development <ol style="list-style-type: none"> 1) State policies 2) Laws and regulations 3) Social norms 4) Budget and expense 5) Instruments and technological support 6) Mangrove zoning for restoration and utilization 7) Season 8) Tidal current 9) Participation of stakeholders 10) Local knowledge application 11) Expected income 12) Others • Involving institutions <ol style="list-style-type: none"> 1) Local people 2) Village chiefs 3) Governmental agencies 4) Schools or academic institutions 5) Private companies 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with dichotomous questions and multiple choices - In-depth interview
	2.3 Participation of local people	<ul style="list-style-type: none"> • External factors <ol style="list-style-type: none"> 1) Common property right 2) Communication and advertisement 3) Education level 4) Laws and regulations 5) Policy 6) Rewards and economic incentives 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with dichotomous questions and checkboxes - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
	<ul style="list-style-type: none"> • Internal factors <ol style="list-style-type: none"> 7) Trust and loyalty in HRH Princess Maha Chakri Sirindhorn 8) Trust in village chiefs or provincial governor 9) Public interest 10) Volunteering 11) Social norms 12) Persuasion from experts or respected and trusted people 13) Guilt 14) Self-esteem 15) Fear of censure 16) Spiritual beliefs and rituals 17) Sex • Trustworthy characteristic of leadership: competence, benevolence, integrity, diligence, enthusiasm and etc. 		
	2.4 Knowledge acquisition methods	<ul style="list-style-type: none"> • Self-observation • Dialogue or narration from other people • Books or documents • TV programs/radio/newspapers • Training or workshop • Internet and social media 	- Questionnaires with dichotomous questions and multiple choices
	2.5 Plan design	<ul style="list-style-type: none"> • Factors enabling a plan design during two phases of mangrove forest development <ol style="list-style-type: none"> 1) State policies 2) Laws and regulations 3) Budget and expense 4) Mangrove zoning for restoration and utilization 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with dichotomous questions and multiple choices - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
		5) Instruments and technological support 6) Quantity and types of mangrove seedlings for planting 7) Participation of stakeholders 8) Human resources 9) Season 10) Tidal current 11) Sediment 12) Wave and wind 13) Wastewater 14) Quantity and quality of freshwater and seawater 15) Livelihood of local people 16) Local knowledge application 17) Supernatural beliefs of community 18) Social norms 19) Expected income 20) Others <ul style="list-style-type: none"> • Involving institutions <ol style="list-style-type: none"> 1) Local people 2) Village chiefs 3) Governmental agencies 4) Schools or academic institutions 5) Private companies 	
	2.6 Plan validation	<ul style="list-style-type: none"> • Factors enabling a plan validation during two phases of mangrove forest development <ol style="list-style-type: none"> 1) State policies 2) Laws and regulations 3) Budget and expense 4) Mangrove zoning for restoration and utilization 5) Instruments and technological support 	- Desk reviews - Field observation - Questionnaires with dichotomous questions and multiple choices - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
		<ul style="list-style-type: none"> 6) Quantity and types of mangrove seedlings for planting 7) Participation of stakeholders 8) Human resources 9) Season 10) Tidal current 11) Sediment 12) Wave and wind 13) Wastewater 14) Quantity and quality of freshwater and seawater 15) Livelihood of local people 16) Local knowledge application 17) Supernatural beliefs of community 18) Social norms 19) Expected income 20) Others <ul style="list-style-type: none"> • Involving institutions <ul style="list-style-type: none"> 1) Local people 2) Village chiefs 3) Governmental agencies 4) Schools or academic institutions 5) Private companies 	
	2.7 Practices of local people	<ul style="list-style-type: none"> • Factors influencing practices of local people during two phases of mangrove forest development <ul style="list-style-type: none"> 1) State policies 2) Laws and regulations 3) Budget and expense 4) Mangrove zoning for restoration and utilization 5) Education system 6) Rewards or monetary incentives 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with dichotomous questions and multiple choices - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
		7) Communication and advertisement 8) Persuasion by family members/ close friends/ village chiefs/ provincial governor/ respected and trusted person 9) Sense of community 10) Volunteering 11) Trust and loyalty in HRH Princess Maha Chakri Sirindhorn 12) Trust in village chiefs 13) Social norms 14) Others <ul style="list-style-type: none"> • Involving institutions <ol style="list-style-type: none"> 1) Local people 2) Village chiefs 3) Governmental agencies 4) Schools or academic institutions 5) Private companies 	
	2.8 Post-evaluation of practices	<ul style="list-style-type: none"> • Factors enabling a post-evaluation of practices during two phases of mangrove forest development <ol style="list-style-type: none"> 1) State policies 2) Laws and regulations 3) Mangrove zoning for restoration and utilization 4) Budget and expense 5) Instruments and technological support 6) Education system 7) Rewards and monetary incentives 	- Desk reviews - Field observation - Questionnaires with dichotomous questions and multiple choices - In-depth interview

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details		Data collection tools
	8) Human resources 9) Local knowledge application 10) Social norms 11) Participation of stakeholders 12) Communication and advertisement 13) Persuasion by family members/ close friends/ village chiefs/ provincial governor/ respected and trusted person 14) Sense of community 15) Volunteering 16) Trust and loyalty in HRH Princess Maha Chakri Sirindhorn 17) Trust in village chiefs 18) Social norms 19) Others <ul style="list-style-type: none"> • Involving institutions <ol style="list-style-type: none"> 1) Local people 2) Village chiefs 3) Governmental agencies 4) Schools or academic institutions 5) Private companies 		
3. Changing utilization of mangrove provisioning and cultural services during two phases of mangrove forest development	<ul style="list-style-type: none"> • Provisioning services <ol style="list-style-type: none"> 1) Food (fishery resources) 2) Fuelwood 3) Biochemical 4) Fiber 5) Mangrove seedlings 6) Aquaculture • Cultural services <ol style="list-style-type: none"> 1) Spiritual beliefs and rituals 		<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with multiple choices

Table 3.1 Datasets and Data Collection Tools (Cont.)

Datasets	Details	Data collection tools
	2) Educational values 3) Ecotourism	
4. Major factors in LKLC enabling the LKLC for the SU of MGES	<ul style="list-style-type: none"> • Environmental aspect <ol style="list-style-type: none"> 1) Availability of marine animals for collection 2) Availability of seedlings for collection and plantation 3) Increase of sedimentation • Social aspect <ol style="list-style-type: none"> 4) Participation 5) Volunteering 6) Local knowledge application 7) Leadership 8) Community commitment 9) Communication 10) Return of local people to hometown 11) Employment and occupation 12) Education 13) Generation of community group 14) Partnership with various groups of people • Cultural aspect <ol style="list-style-type: none"> 15) Spiritual beliefs and rituals 16) Social norm (customary laws) • Economic aspect <ol style="list-style-type: none"> 17) Income 18) Economic enterprises 19) Rewards and economic incentives • Legal aspect <ol style="list-style-type: none"> 20) Laws and regulations 21) Policy 22) Human resources 23) Land use zoning 24) Common property right 25) Financial and technical support 	<ul style="list-style-type: none"> - Desk reviews - Field observation - Questionnaires with checkboxes - In-depth interview

3.5 Stakeholders

Criteria for selecting stakeholders at KK sub-district were determined based on their social and legal authorities and functions in the community during two phases of mangrove stand initiation and young forest regrowth. The different roles and responsibilities of each stakeholder resulted in a diverse of experience and knowledge related the factors in the LKLC during two phases of mangrove forest development. The stakeholders of the study were 160 respondents which consisted of two main groups. The first group was 20 key respondents including the former and current village chiefs, local governmental agencies, community enterprises, local philosophers, and mangrove forest conservation groups. Another group was 140 fishermen who had local knowledge on mangrove ecosystem and experiences in utilizing the MGES for sustaining their daily subsistence (Table 3.2).

Table 3.2 Number of Stakeholders and Sample Sizes of the Study

Stakeholders	Numbers of stakeholders	Sample sizes for the study	Citations
1. Current village chiefs	7 persons	7 persons	Babbie (2010); Bernard (2013)
2. Former village chiefs	2 persons	2 persons	
3. Local governmental organizations <ul style="list-style-type: none"> • Klong Khone Sub-district Administrative Organization (KKS AO) • Mangrove Forest Development Station 7 (MGFDS 7) 	2 organizations	2 persons	
4. Community enterprises <ul style="list-style-type: none"> • Shrimp paste production • Ecotourism 	3 groups	3 persons	
5. Local philosophers	3 persons	3 persons	
6. Mangrove forest conservation groups <ul style="list-style-type: none"> • Klong Khone Mangrove Forest Conservation Center (KKMFCC) 	3 groups	3 persons	

Table 3.2 Number of Stakeholders and Sample Sizes of the Study (Cont.)

Stakeholders	Numbers of stakeholders	Sample sizes for the study	Citations
<ul style="list-style-type: none"> • Kon Rak Klong Khone Group (KRKK) • Klong Khone Coordination Center for Mangrove Forest Conservation (KKCCMFC) 			
7. Fishermen	220 households	142 households (Number of sample sizes from each administrative zone)	Yamane (1967)

Source: Calculated sample sizes by using purposive sampling and Yamane formula

3.6 Sampling Methods

Sampling methods of the study consisted of a purposive sampling and multi-stage random sampling. The purposive sampling was employed to select the stakeholders who had an in-depth information (Babbie, 2010), roles and responsibilities involving two phases of mangrove stand initiation stage and young forest regrowth stage. These stakeholders were selected purposively including the former and current village chiefs, local governmental agencies, community enterprises, local philosophers, mangrove forest conservation groups.

The multi-stage random sampling was employed to sample fishermen whose daily subsistence depended on a utilization of MGES. The study sampled fishermen who were representatives from each fishery household based on administrative zones. This sample method consisted of two steps for calculating the sample sizes of fishermen as follows:

- 1) The sample sizes of fishery households at KK sub-district were calculated by using Yamane formula at a 95% confidence level. A total number of households where operate fishery was 220 households (Table 3.3). The number of sample sizes of households was 142 households.

Yamane formula: $n = \frac{N}{1+N(e)^2}$; where n = Sample size

N = Population size,

e = Level of precision

- 2) A second step was a calculation of proportional sample from 142 households by using a proportional stratified random sampling. A formula for calculation was shown as follows:

$$n_i = \frac{n \times N_i}{N}$$

where n_i = Sample sizes of household of each village
 n = Total sample size
 N_i = Numbers of household of each village
 N = Total numbers of households

The samples sizes of households of each village were shown in Table 3.3.

Table 3.3 Numbers of Households and Sample Sizes of Fishermen at KK Sub-district, Samut Songkhram Province in 2017

Village No.	Name of villages	Calculated sample sizes proposed in proposal	Total existing numbers of fishery households in 2017*	Calculated sample sizes for the study	Collected numbers of fishery households
1	Ban Klong Kot	32	20	13	12
2	Ban Klong Khone	49	47	30	24
3	Ban Klong Khone	34	32	21	13

Table 3.3 Numbers of Households and Sample Sizes of Fishermen at KK Sub-district, Samut Songkhram Province in 2017 (Cont.)

Village No.	Name of villages	Calculated sample sizes proposed in proposal	Total existing numbers of fishery households in 2017*	Calculated sample sizes for the study	Collected numbers of fishery households
4	Ban Prak Talay	40	39	25	33
5	Ban Klong Chong	60	32	21	28
6	Ban Pracha Chomchuen	37	3	2	2
7	Ban Klong Chong Noi	44	47	30	28
Total		296	220	142	140

Source: *Total fishery households derived from Samut Songkhram Provincial Fisheries Office (2017)

3.7 Existing Conditions of the Fieldwork

According to Table 3.3, the calculated sample sizes proposed in proposal was two hundred and ninety-six households. In a field work, there were only two hundred and twenty households which actually operated fishery and aquaculture in community. As a result, the new calculated sample sizes of the study were 142 households. However, there were only 140 questionnaires or 98 % were completed. A response rate in a social research which was over than 70 % was considered as very high of response rate (Babbie, 2008). It means that the response rate of the study was acceptable.

3.8 Data Analysis

The study used a ground theory to identify the major factors in the LKLC that enable the SU of MGES for creating a local knowledge framework. The ground theory was a set of systematic technique in discovering the people's experience. It

required inductive reasoning to develop a theory grounded in the empirical data by analyzing the patterns, themes, and common categories (Babbie, 2010; Bernard, 2013) found in the studied communities.

An amount of collected data was transcribed, extracted, interpreted and analyzed by event analysis and descriptive statistical analysis including percentage, and chi-square test (χ^2). Event analysis was applied to analyze qualitative data which was collected from in-depth interview and field observation. It was used to describe and explain a social interaction, motivations, and local people's practices associated with two phases of mangrove stand initiation stage and young forest regrowth stage. It categorized the local people's practices involved in the local knowledge development during two phases of mangrove stand initiation and young forest regrowth into an involving group of people, attitude, perception, motivation, actions, location, relationship, and interaction (Tirakanon, 2014).

A descriptive statistical analysis including percentage and χ^2 was employed to analyze a quantitative data collected by questionnaires with dichotomous questions, multiple choices, and checkboxes. The quantitative data was entered in computer software, SPSS version 17 for coding and Microsoft Excel 2016 to generate results by calculating into frequency and percentages.

The χ^2 test was employed to verify an influence of demographic information on their responses involved with the factors influencing LKLC.

The analyzed data including a utilized mangrove provisioning and cultural services and factors in the LKLC during two phases of mangrove forest development as well as the major factors in the LKLC enabling the SU of MGES at KK sub-district were prioritized based on their percentages from the highest to lowest percentage. A prioritization of mangrove provisioning and cultural services showed a change of utilizing activities of MGES and reflected the local people's interest and practices during two phases of mangrove stand initiation and young forest regrowth. The factors in the LKLC during two phases of mangrove forest development were also prioritized to reveal the most influential factors to the least influential factors on each

step of LKLC. A relationship between factors and steps of LKLC was illustrated to show their functions involved with the development of local knowledge.

The major factors in the LKLC enabling the SU of MGES were identified to reveal their potential in the local knowledge development and became indicators of the SU of MGES specifically to the KK sub-district. They also reflected the local people's opinions toward their current utilization and management of mangrove resources, existing problems, and incoming challenges.

An analyzed and prioritized data was validated by presenting to the former and current village chiefs, local governmental agencies, local philosophers, and academicians to examine an accuracy of findings and give comments. All validated data was integrated to create a local knowledge framework for SU of MGES specifically to KK sub-district.

Datasets, stakeholders, data collection methods, and data analysis methods were concluded as shown in Table 3.4 which was a guideline for further presenting results and discussion.

3.9 Limitations

Several challenges were found during implementing the data collection and analysis. For data collection, it took a long time to collect the data from questionnaires. The study conducted questionnaires with fishermen who harvested fishery resources during daytime and had a limited time period to fill the questionnaires, therefore it was difficult to meet them to gather the questionnaires.

The study obtained particular results with an in-depth information within a limited time planned because of using a case study. A specificity of data would be difficult to use in other community with different context. However, the local knowledge framework can be applied for capacity building to sustain the local people's livelihood under the change of ecological, social, cultural, and economic conditions.

Table 3.4 Target Information, Stakeholders, Data Collection, and Data Analysis Methods

Datasets	Stakeholders	Data collection methods	Data analysis methods
1. Demographic information of respondents	140 samples of fishermen	Questionnaires with dichotomous questions and multiple choices	Descriptive statistics analysis
2. Factors and their functions in the LKLC during two phases of mangrove stand initiation and young forest regrowth	140 samples of fishermen	Questionnaires with dichotomous questions, multiple choices, and checkboxes	Descriptive statistics analysis
	20 key respondents <ul style="list-style-type: none"> - Former village chiefs - Current village chiefs - Chief executive of KKSAO - Chief of MGFDS 7 - Chief of KKM FCC - Chief of KRKK - Chief of KKCCMFC - Headman of shrimp paste production community enterprises - Headman of ecotourism community enterprise - Local philosophers 	In-depth interview	Even analysis

Table 3.4 Target Information, Stakeholders, Data Collection, and Data Analysis Methods (Cont.)

Datasets	Stakeholders	Data collection methods	Data analysis methods
3. Changing utilization of mangrove provisioning and cultural services during two phases of mangrove forest development	140 samples of fishermen	Questionnaires with multiple choices	Descriptive statistics analysis
4) Major factors in the LKLC enabling the SU of MGES at KK sub-district	140 samples of fishermen	Questionnaires with multiple choices and checkboxes	Descriptive statistics analysis
	20 key respondents - Former village chiefs - Current village chiefs - Chief executive of KKSAAO - Chief of MGFDS 7 - Chief of KKMFC - Chief of KRKK - Chief of KKCCMFC - Headman of shrimp paste production community enterprises - Headman of ecotourism community enterprise - Local philosophers	In-depth interview	Even analysis

Table 3.4 Target Information, Stakeholders, Data Collection, and Data Analysis Methods (Cont.)

Datasets	Stakeholders	Data collection methods	Data analysis methods
5) Local knowledge framework for the SU of MGES of KK sub-district	Integration of two groups of results including: <ul style="list-style-type: none"> • Factors and their functions in the LKLC during two phases of mangrove forest development • Major factors in LKLC enabling or indicating the SU of MGES at KK sub-district 		Developed from the major factors found in the LKLC and conditions indicating the SU of MGES

CHAPTER IV

RESULTS AND DISCUSSION

Local knowledge found at KK sub-district was applied during two phases of mangrove stand initiation and young forest regrowth through a participation of stakeholders which was regarded as a bottom-up approach. Its development process involved with several complex factors which were specific to an ecological, social-cultural and economic conditions of community. To clarify specific conditions enabling and indicating the SU of MGES at KK sub-district, the factors in the local knowledge development which led to the SU of MGES were discovered and identified.

The results of study were categorized into five parts based on components involving the SU of MGES. They included as follow:

- 1) background information of KK sub-district,
- 2) verification of obtained data influenced by demographic information,
- 3) factors and their functions in the LKLC and changing utilization of mangrove provisioning and cultural services during two phases of mangrove forest development, and
- 4) changing utilization of MGES during two phases of mangrove forest development
- 5) the major factors in the LKLC enabling the SU of MGES at KK sub-district.

They were collected by document reviews, field observation, questionnaire survey and in-depth interview which were analyzed by event analysis and statistical descriptive analysis including percentage and χ^2 . The respondent's attitudes towards the factors in the LKLC were prioritized to identify the major factors in the LKLC which led to the SU of MGES at KK sub-district. The χ^2 test was conducted to assess an influence of demographics (gender, age, birthplace, and education level) on responses related to factors in the LKLC. These analyzed results were integrated to create a local knowledge framework for the SU of the MGES at the KK sub-district.

4.1 Ecological Importance of KK Sub-district

4.1.1 Geography

Areas in KK sub-district were mostly a coastal plain. Along the coastal line was covered with the mangrove forest for around 5.492 km² (Department of Marine and Coastal Resources [DMCR], 2012). The mangrove provides ecosystem services such as habitats for juvenile aquatic animals, natural barrier for coastal protection from wave and wind, and ecotourism to coastal communities.

4.1.2 Community and Population

This sub-district comprises of 7 villages including 1) Ban Klong Kot, 2) Ban Klong Khone, 3) Ban Klong Khone, 4) Ban Prak-Talay, 5) Ban Klong Chong, 6) Ban Pracha Chomchuen, and 7) Ban Klong Chong Noi as shown in Figure 4.1.

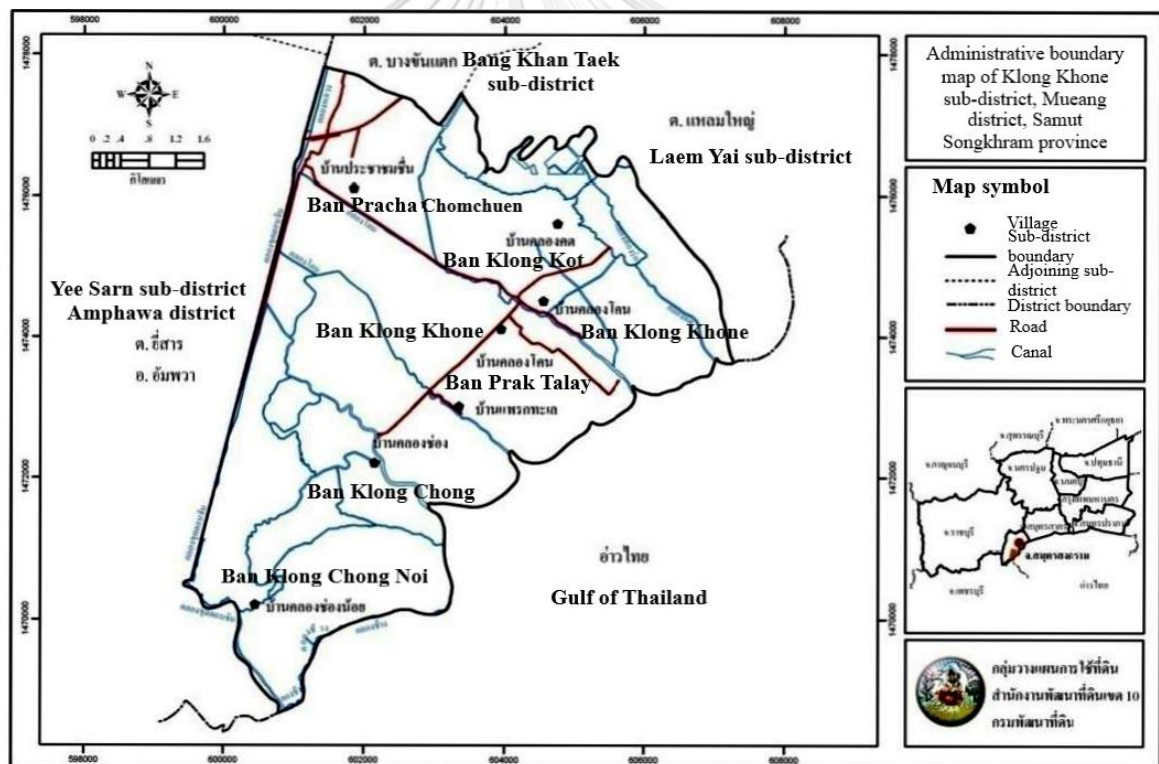


Figure 4.1 Administrative zones of KK sub-district at Samut Songkhran province.

Source: Land Use Planning Working Group (2552)

Almost villages in KK sub-district are located adjoining to the mangrove forest, except village no.1 and no.6. The local people who live near the mangrove forest can conveniently access to mangrove forest. They often apply their local

knowledge for harvesting blood cockles, fishes and krill; thus, they know how to utilize those ecosystem services without disturbing mangrove ecological production.

According to the basic information of June, 2016 from Civil Registration Section of Muang Municipality of Samut Songkhram province, it showed that there were population in KK sub-district approximately 3,319 persons with 902 families. There were 1,584 males and 1,735 females as shown in Table 4.1 (KKSAAO, 2016).

Table 4.1 Numbers of Households in KK Sub-district, Samut Songkhram Province

Village No.	Name of villages	Numbers of household	Number of Population in 2016		
			Male	Female	Total
1	Ban Klong Kot	75	135	145	280
2	Ban Klong Khone	162	315	340	655
3	Ban Klong Khone	101	163	162	325
4	Ban Prak Talay	134	224	250	474
5	Ban Klong Chong	207	380	434	814
6	Ban Pracha Chomchuen	85	134	142	276
7	Ban Klong Chong Noi	138	233	262	495
Total		902	1,584	1,735	3,319

Source: Klong Khone Subdistrict Administrative Organization (2016)

4.1.3 Mangrove Forest Ecosystem Services for Community Benefits

Main occupations of local people at KK sub-district were coastal fishery along with the making of shrimp paste and aquaculture such as mussel and blood cockle farming (KKSAAO, 2016).

In 2007, an ecotourism business at KK sub-district was created by the former village chiefs and local people as a community enterprise. It generated various occupations such as homestay and resort business entrepreneurs, resort staffs, boat rental services, and mangrove seedling propagator which provided more income to the local people (Poonkratok *et al.*, 2013).

Each occupation possessed different kinds of local knowledge on mangrove ecosystem. Fishermen had the local knowledge on mangrove biophysical and production services because their livelihood were relied on and tied to the utilization

of mangrove provisioning services for food consumption and trade. However, some of them applied their local knowledge for utilizing mangrove cultural services to implement an ecotourism. They created many recreational activities such as mangrove planting, blood cockle collecting, and wakeboarding on wooden sled based on their local knowledge and livelihood to provide services to visitors. They also transferred their local knowledge and experiences on mangrove restoring and values of MGES to visitors.

4.1.4 Ecological landscape of Study Area

The KK sub-district mainly consisted of mangrove forest and shrimp farming. The mangrove forest areas were divided into protection zone and reforestation zone. The mud flat on a foreshore zone was used for harvesting blood cockle and krill as well as was used as a reforestation site for mangrove planting activities which was a part of ecotourism program. In 1990, almost shrimp ponds at KK sub-district were abandoned and some ponds were used for blood cockle farming (Rittichai, 2012) (Figure 4.2).

The surrounding sub-districts were covered with the mangrove forest, shrimp ponds, horticulture, and industries. The mangrove forest and shrimp farming were found in the sub-districts which located connecting to the Gulf of Thailand including Laem Yai sub-district and Yee Sarn sub-district of Samut Songkhram province and Ban Ta Boon sub-district of Phetchaburi province. For Ban Bang Khan Taek sub-district which located inland, it covered with the horticultural areas, factories and housing estate.

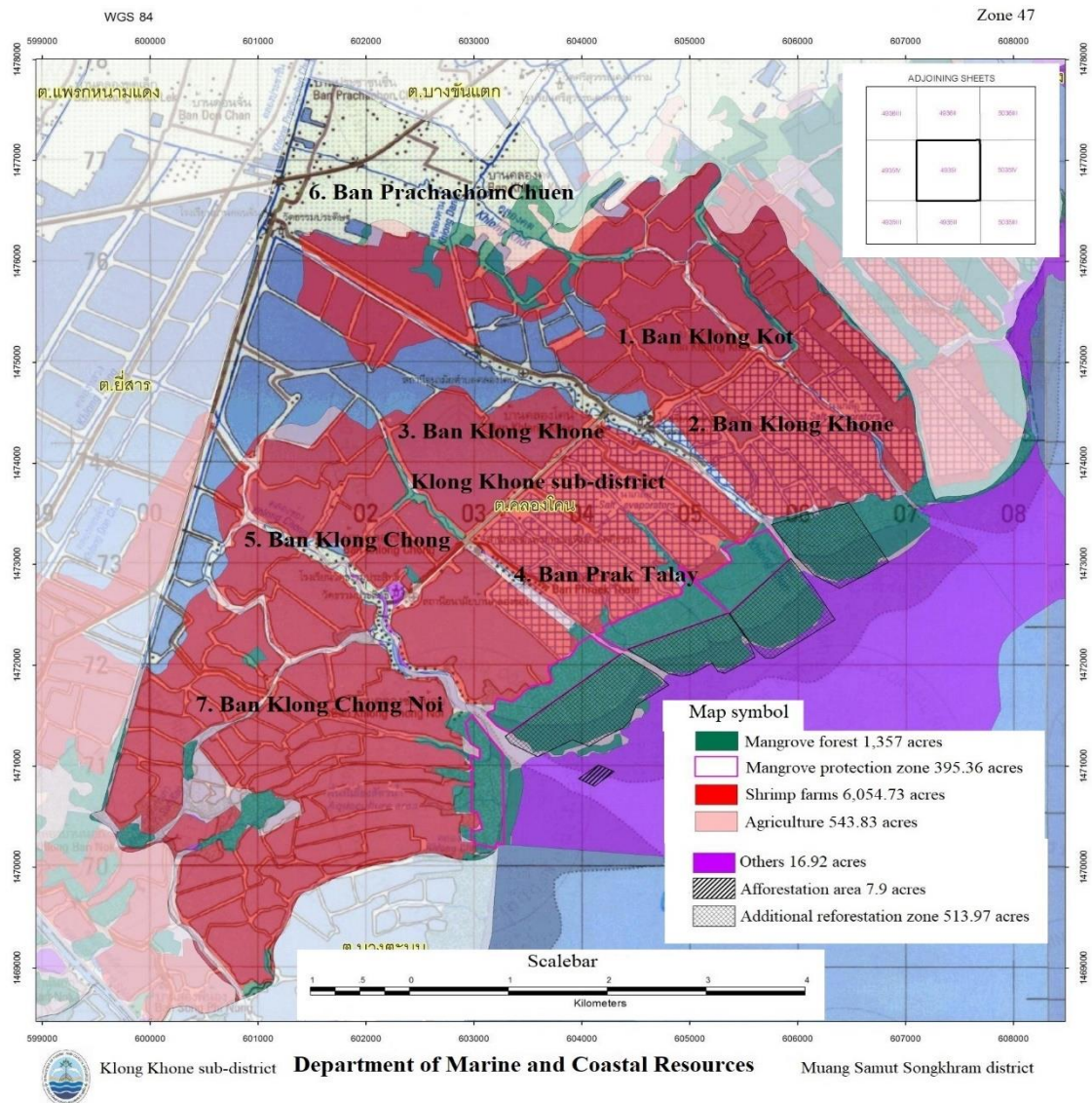


Figure 4.2 Mangrove forest land use zonation map in 2009 of KK sub-district, Samut Songkhram province, Thailand.

Source: Adapted from Department of Marine and Coastal Resources [DMCR] (2012)

4.2 Verification of Obtained Data Influenced by Demographic Information

A quality of obtained demographic information including gender, age, birthplace, and education level was analyzed for its influence on factors influencing local knowledge development such as the mangrove ecological change on perception and awareness and volunteering on participation. A summary of demographic information of fishermen was shown in Table 4.2.

Table 4.2 Demographic Information of Fishermen

Demographic information of fishermen	N	%
Gender		
Male	86	61
Female	54	39
Age groups		
Adolescents (15-24)	2	1.4
Young adults (25-44)	33	23.6
Middle-age adult (45- 64)	78	55.7
Elders (> 65)	26	18.6
Did not identify their age	1	0.7
Birthplace		
Born in Klong Khone sub-district	130	93
Do not born in Klong Khone sub-district	10	7
Education level		
Primary school	113	81
High school	25	18
No schooling	2	1

4.2.1 Gender role influencing awareness on mangrove ecosystem services

A gender composition of respondents was eighty-six male (61%) and fifty-four female (39%) ($N = 140$) (Table 4.2).

Men and women have a diverse knowledge and perception on mangrove ecosystem because of their roles and responsibilities involved with the mangrove utilization. Their roles were constructed by culture, social norms, and values specifically to the society (Browne, 2002; Carvajal *et al.*, 2013; Medard *et al.*, 2002; Myers, 2010). For a fishery sector at KK sub-district, the men and women had different roles and duties involved with a harvest of aquatic animals, production of fermented shrimp paste, and sale of aquatic animals and shrimp paste products. The men had major role as the household head to harvest the aquatic animals. The women played supportive roles and were responsible for doing housework, cooking, producing salted shrimp paste, and taking care of children and elders in family (Browne, 2002; Taniguchi, 2006). Thus, they had less available time to assist their

husband in catching aquatic animals because they were limited by their domestic works. As a result, the men and women possessed the different knowledge, perception and awareness on MGES (Yang *et al.*, 2018).

According to a χ^2 test of independence with $\alpha = 0.05$ as criterion for significance, the male and female respondents had different responses on a perception related to the MGES and intensity of wave and wind. The male respondents (88%, $n = 86$) were significantly higher aware of a reduction of mangrove forest areas than the female respondents, $\chi^2 (2, N = 140) = 7.209, p < .05$. Seventy-seven male respondents (89.5%, $n = 86$) had higher perception and awareness on increasing intensity of wave and wind than female respondents at significant level, $\chi^2 (2, N = 140) = 10.138, p < .05$. Eleven percent of female respondents ($n = 54$) did not perceive that the reduction of mangrove forest areas affected the increasing intensity of wave and wind, $\chi^2 (2, N = 140) = 10.138, p < .05$. It means that the different of gender roles had an influence on their knowledge and perception of mangrove ecosystem at a statistically significant level.

4.2.2 Experience of age group on participation and plan determining

Each age group possessed a variety of experience, knowledge, and values because they passed a different historical, cultural and social change (Mannheim, 1952; Sharabi, 2016). Age group's experiences were also developed from their assigned roles and responsibilities. Their personal experiences and knowledge resulted in the different perspectives and practices in natural resource management and utilization.

At KK sub-district, the age groups were categorized into four groups based on their experiences involving two phases of mangrove stand initiation stage and young mangrove forest regrowth stage. These age group included an adolescent (15 - 24 years old), young adult (25 – 44 years old), middle-age adult (45 – 64 years old), and elder (> 65 years old). Major group of respondents of this study was the middle-age adults (56%, $N = 140$) who experienced both two phases of mangrove stand initiation and young forest regrowth. Young adult, elder and adolescent respondents were 24%, 19%, and 1% respectively ($N = 140$) (Table 4.2). There was one respondent did not indicate his/her age. During collecting questionnaire, the middle-age adults were

found staying at home more than the young adults because the young people had to go out to work or study. As a result, the major respondents of the study were middle age-adults.

During the mangrove stand initiation (1990-2006), the former village chiefs and local people played a leading role in initiating, implementing, and monitoring the mangrove reforestation for restoring mangrove ecological production. They actively participated in the mangrove restoring because they believed that the mangrove reforestation can restore nursery and habitat functions of mangrove forest for aquatic animals to generate income and sustain their means of subsistence. According to their participation in mangrove restoring, they transferred their knowledge and experiences related mangrove ecosystem for restoring the mangrove forest.

Since 2007 to present, the adolescent and young adults have more engaged to learn benefits from a restored mangrove ecosystem to develop local knowledge and adapt their utilization of MGES in sustainable manner. The former village chiefs and local people who initiated and operated the mangrove restoration were older to the middle-age adults and elders. The middle-age adults still participated in the mangrove conservation and coordinated with the adolescent and young adults to design a new business for sustainable mangrove utilization such as ecotourism. The elders were retired from mangrove restoring activities and were respected as local philosophers who played important role in disseminating local knowledge on mangrove ecosystem and experiences in mangrove restoration to the young.

According to the different experiences and perspectives of age groups, it affected their responses on factors influencing participation and plan determining. Most of young adults (88%, $n = 33$) stated that a public interest higher influenced their participation than other age groups, $\chi^2 (6, N = 140) = 13.407, p < .05$. For determining mangrove restoration plan, the results from χ^2 test showed that the elders (48 %, $n = 26$) more recognized an importance of a voluntary participation than other age groups, $\chi^2 (3, N = 140) = 7.804, p = .05$. Over half of elders (56%, $n = 26$) also indicated that human resource or manpower was higher significant in designing mangrove restoration plan than other age groups, $\chi^2 (3, N = 140) = 11.343, p < .05$. While the elders recognized an importance of the participation and working staffs in

mangrove stand initiation phase, no adolescent mentioned about these factors. The young adult respondents (53%, $n = 33$) tended to higher concern about their mean of daily living in designing mangrove restoring plan than other age groups, $\chi^2 (3, N = 140) = 12.037, p < .05$ (Table 4.3). It implies that the knowledge and experiences of each age group during the mangrove stand initiation and the young forest regrowth phases had an influence on their responses.

Table 4.3 Factor in a Design of Mangrove Restoration Plan During Mangrove Stand Initiation Stage

Factors in mangrove restoration plan design*	Age group								X ² P-value
	15-24 years old (n = 2)		25-44 years old (n = 33)		45-64 years old (n = 78)		> 65 years old (n = 26)		
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	
Human resources	0 (0)	2 (100)	7 (22)	25 (78)	18 (24)	57 (76)	14 (56)	11 (44)	0.01**
Participation	0 (0)	2 (100)	6 (19)	26 (81)	18 (24)	57 (76)	12 (48)	13 (52)	0.05**
Livelihood of local people	0 (0)	2 (100)	17 (53)	15 (47)	16 (22)	58 (78)	6 (24)	19 (76)	0.007**

Note: The percentages are in parentheses.

Remark: * There was 96 % of respondents ($N = 140$) who answered these questions related factors in a design of mangrove restoration plan during mangrove stand initiation stage.

** $p < 0.05$

4.2.3 Birthplace motivating voluntary participation

Majority of respondents (93%) were local people born in KK sub-district and ten respondents (7%) were non-local people ($N = 140$) (Table 4.2).

The results of study found that there was no significant different response between the local people and non-local people on volunteering in mangrove restoring and SU of MGES, $\chi^2 (2, N = 140) = 0.462, p = .792$. From field observation, the non-local people including private companies, NGOs, students, and tourists also volunteered in mangrove restoring activities. In contrast, other studies reported that

the people who born in community had a place attachment and a sense of community higher than non-local people (Anton *et al.*, 2014; Mesch *et al.*, 1998; Omoto *et al.*, 2002). The local people with a sense of ownership were likely to voluntarily participate in the community activities more than non-local people. It can be concluded that the birthplace did not a significant factor influencing the people's volunteering at KK sub-district. The volunteering of local people at KK sub-district generated from the local people's awareness, understanding, and acceptance to participate in community's activities which finally developed into a sense of ownership.

4.2.4 Education of environmental knowledge for awareness raising and volunteering

The respondents of the study mainly attended primary school (81%, $N = 140$). Twenty-five (18%) and two respondents (1%) attended high school and no schooling respectively ($N = 140$) (Table 4.2).

From reviews of many case studies, they showed that high school students tended to have higher environmental awareness and volunteering in natural resources management than lower educated people because they were educated with more complex scientific and environmental knowledge and were raised awareness for volunteering (Gesthuizen *et al.*, 2012).

In contrast with the results of study from χ^2 test, it showed that primary the school educated respondents (89%, $n = 113$) had higher perception on a reduction of MGES than other education, $\chi^2 (4, N = 140) = 15.180, p < .05$ (Table 4.4). However, there was no significant different response from each education level on volunteering for participation during two phases of mangrove stand initiation and young forest regrowth, $\chi^2 (4, N = 140) = 2.502, p = .644$ (Table 4.4). It means that the local people's perception on volunteering for mangrove ecological restoration did not only depend on a formal education system. It was inculcated through an informal education system from the local people's involvement in harvesting the MGES to sustain their livelihood.

It can be concluded that a demographic information of fishermen can influence on fishermen's responses related to factors influencing the LKLC. However, they were not the factors that directly affected the LKLC. Consequently, they were not regarded as factors in the LKLC that influenced the SU of MGES.

Table 4.4 Education Level on Factors Influencing Perception ($N = 140$)

Factors in perception of local people	Educational level									X ² P-value
	Primary school (n = 113)			High school (n = 25)			Non-school attendance (n = 2)			
	Yes (%)	No (%)	Do not know (%)	Yes (%)	No (%)	Do not know (%)	Yes (%)	No (%)	Do not know (%)	
Gender	42 (37)	59 (52)	12 (11)	4 (16)	21 (84)	0 (0)	0 (0)	1 (50)	1 (50)	0.011*
Age	77 (68)	27 (24)	9 (8)	13 (52)	12 (48)	0 (0)	0 (0)	1 (50)	1 (50)	0.008*
Birthplace	101 (89)	7 (6)	5 (4)	16 (64)	9 (36)	0 (0)	1 (50)	0 (0)	1 (50)	0.000*
Reduction of MGES	100 (89)	8 (7)	5 (4)	20 (80)	5 (20)	0 (0)	1 (50)	0 (0)	1 (50)	0.004*
Intensity of wave and wind	100 (89)	8 (7)	5 (4)	20 (80)	5 (20)	0 (0)	1 (50)	0 (0)	1 (50)	0.004*
Reduction of mangrove forest areas	102 (90)	1 (1)	10 (9)	20 (80)	4 (16)	1 (4)	1 (50)	0 (0)	1 (50)	0.001*
Location of households	87 (77)	15 (13)	11 (10)	14 (56)	11 (44)	0 (0)	1 (50)	0 (0)	1 (50)	0.001*

Note: The percentages are in parentheses.

Remark: * $p < 0.05$

4.3 Factors and Their Functions in the LKLC

Local knowledge life cycles (LKLC) were found playing an important role during two phases of mangrove stand initiation stage for mangrove restoring (1990 - 2007) and young mangrove forest regrowth stage for coping with ecological stresses and maintaining means of daily support (2008 – present) at KK sub-district. Roles of the LKLC in those phases of natural restoration and utilization compose of eight steps including 1) perception of local people, 2) goal setting, 3) participation of local people, 4) knowledge acquisition, 5) plan design, 6) plan validation, 7) practice of local people, and 8) post-evaluation of practices respectively.

The LKLC was originally built in a business organization which aimed to improve organizational performance and enhance competitive advantages with a clear target for short-term quantitative benefits (Omotayo, 2015). In term of the LKLC for natural mangrove forest management and utilization at community level, it was developed with the same cycle as business organization, but it involved with a dynamic changing environment and spent long-term for returned benefits. It intended to improve local livelihood which was bound to income and ecosystem services of mangrove forest. From field site survey and interviews with former village chiefs, there was unsure by no clear target in a direct benefit – income – once participated in the mangrove reforestation for forest expansion. The interviewees were desperate in experts' knowledge. They applied their local knowledge on mangrove ecosystem with trials and errors to select pioneer plant species and site and seek a planting method of the first pioneer plant species to bare land in 1990. They indicated that an obtained higher income from restored mangrove forest was a time-consuming outcome to encourage more people to participate in mangrove restoring. They used trust in village chiefs, altruism, and sense of ownership to motivate their participation instead. Supported by the study at Ban Tung Tasae village in Trang province, Thailand, this village initiated trust, norms of reciprocity, local autonomy, and effective leadership to facilitate the capacity building and bottom-up participation in mangrove forest conservation (Sudtongkong *et al.*, 2008). Similar to the study, the trust of villagers toward the village chiefs was a prerequisite factor for turning the bare lands of abandoned shrimp farms to a high density of mangrove forest.

In business field, the structures supporting knowledge management life cycle consists of three main groups. They including managerial, social, and technological structures (Debowski, 2006). In case of KK sub-district, the study found that the factors in the LKLC during two phases of mangrove stand initiation stage and young forest regrowth stage covered with more than these structures. They also involved with emotional, ecological and economic factors. Therefore, the study categorized these factors in the LKLC into five groups based on their functions in the local knowledge development. They consisted as follow:

- 1) emotional factors such as trust and loyalty, volunteering with altruism, guilt, and sense of ownership,
- 2) ecological or environmental factors such as change of MGES and intensity of wave and wind,
- 3) managerial factors such as land use zoning, common property right, and human resources or manpower,
- 4) social factors such as social norms and local knowledge application, and
- 5) economic factors such as income.

The results found that the factors in eight steps of LKLC were varied depending on the changing targeted benefits of MGES for utilization during two phases of mangrove stand initiation and young forest regrowth. The study also found that some factors in LKLC were found both in the phase I and phase II. Some factors were found only in the phase I or phase II.

4.3.1 Perception of a change of mangrove ecological production

All perception involved with cognitive process of an understanding and awareness of adverse effects of mangrove degradation and attention to solve poverty by restoring the mangrove ecological functions. For the study area, a reduction of income and grief of local people generated from a stress on a reduction of ecological production which depleted seafood including fishes, blood cockle, and krill. The results showed that 79% of respondents ($N = 140$) understood that a reduction of MGES affected their income and fishery occupation. Eighty-seven percent of respondents ($N = 140$) were aware that a reduction of blood cockles and krill and an increasing intensity of wave and wind were caused by the mangrove degradation (Table 4.5). Supported by the study in a central Peninsular Malaysia, it found that the local people perceived that mangrove forest was important for their livelihood because marine lives provided additional income and served as a barrier from strong winds (Abdullah *et al.*, 2014).

The former village chief shared his experience that aquatic animals at KK sub-district needed mangrove trees as nursery habitat. His knowledge in ecological production strictly related to a primary producer which played significant functions in protecting juvenile aquatic organisms (Aksornkoe, 1993; Craft, 2016; McKee, n.d.;

Nagelkerken *et al.*, 2008; Smith III, n.d.). Similar to the result of the study, 88% of respondents ($N = 140$) perceived that a degraded mangrove affected a loss of habitat and nursery function of mangrove forest (Table 4.5). The former village chief's perception on effects of mangrove degradation was transferred to other people to perceive the same information. He aimed to raise his kinship and close friends to recognize the values of mangrove ecological production and take actions for mangrove restoring based on their experiences and local knowledge. It can be concluded that the former village chiefs applied their site-specific knowledge on mangrove ecosystem to develop species diversity by providing a green nursery habitat for solving poverty at KK sub-district.

A common property right became a major factor that influencing the perception of local people for mangrove restoring and utilization through indirectly developed a sense of ownership on mangrove forest (Adhikari *et al.*, 2014). Majority of respondents (94%, $N = 140$) expressed that their perception was motivated by a common property right (Table 4.5). Supported by the study of Lenggong World Heritage Site (WHS) in Malaysia, it found that the sense of belonging motivated the young residents' perception to participate in tourism development and conservation of WHS (Jaafar *et al.*, 2015).

Table 4.5 Factors Motivating Perception of Local People in the LKLC During Mangrove Stand Initiation and Young Forest Regrowth ($N = 140$)

Factors motivating perception of local people	Yes		No		Do not know	
	N	%	N	%	N	%
Common property right	131	94	4	3	5	3
Mangrove forest areas	123	88	5	3	12	9
Intensity of wave and wind	121	87	13	9	6	4
Mangrove ecosystem services	121	87	13	9	6	4
Social norms	117	84	10	7	13	9
Income from mangrove ecosystem services	110	78	25	18	5	4
Volunteering with altruism	107	76	15	11	18	13

Note: Multiple responses were possible.

The results also revealed that the male respondent seems to have higher perception on reduction of mangrove ecological functions and sense of ownership than the women at significant level. While 90% of men (n = 86) knew that the mangrove deforestation affected the ecological functions in storm and coastal protection, 11% of women (n = 54) was unsure about these impacts (Table 4.6). Both men and women respondents seem to have similar perception on the reduction of MGES, even though they had different roles and responsibilities involved with the mangrove utilization. It means that the perception of local people on mangrove ecosystem was shaped by their knowledge, experience, attention, values, and emotional state (Bodenhausen *et al.*, 2009; Bodenhausen *et al.*, 2013; Kenyon *et al.*, 2015; Ramli *et al.*, 2018).

Table 4.6 The Role of Gender on Factors Influencing Perception (N = 140)

Factors influencing perception	Male (n = 86)			Female (n = 54)			X ² P-value
	Yes (%)	No (%)	Do not know (%)	Yes (%)	No (%)	Do not know (%)	
Intensity of mangrove ecosystem services reduction	76 (89)	8 (9)	2 (2)	45 (84)	5 (9)	4 (7)	0.351
Intensity of wave and wind	77 (90)	9 (10)	0 (0)	44 (82)	4 (7)	6 (11)	0.006*
Reduction of mangrove forest areas	77 (89)	5 (6)	4 (5)	46 (85)	0 (0)	8 (15)	0.027*
Common property right	81 (95)	4 (5)	1 (1)	50 (93)	0 (0)	4 (7)	0.046*

Note: The percentages are in parentheses.

Since the mangrove ecosystem had restored, the perception of local people was shifted from a poverty reduction to a diversified income by utilizing mangrove cultural services and knowledge dissemination by installing learning center. The former village chief revealed that he received a recommendation from a former provincial governor to diversify the local people's income by utilizing mangrove cultural services for ecotourism. The ecotourism was new to KK sub-district. He had to learn and observe from other cases and applied in harmony with an ecological and

social conditions of KK sub-district for local people's long-term benefits. According to this new perception, it resulted in a new goal in the Phase II for SU of MGES.

4.3.2 Goal setting for solving poverty and sustaining local livelihood

- **Poverty alleviation by mangrove restoring**

A poverty alleviation by increasing mangrove forest in the phase I was a time-consuming process, while a utilization of MGES from restored mangrove forest in the phase II clearly intended to increase an income, transfer local knowledge, and conserve mangrove for the next generation.

A functionalism theory of Durkheim identified that all social institution functions together and adapts to compensate for a social change in order to maintain the social equilibrium and mutual independence (Durkheim, 1964). In case of KK sub-district, the results showed that 54% of respondents ($N = 140$) indicated that the former village chiefs played a leading role in goal setting to plant the mangrove forest. The former village chief revealed that the local people suffered from poverty and lacked food and income from a collapse of shrimp farming in 1989. Many families were torn apart because some of their family members had to work in other provinces. He also indicated that a despair of local people was his huge pressure. He revealed that his sense of community, kinship, responsibility and accountability motivated them to solve these problems. He and other village chiefs coordinately analyzed problems based on their empirical knowledge on mangrove forest. They found that a loss of mangrove habitat function was a root cause of aquatic animals' reduction which was a main source of income and livelihood of local people. To maintain the fishery livelihood and solve the poverty, they determined to increase mangrove forest for providing a green shelter for aquatic organisms by mangrove planting.

From an in-depth interview, it showed that a goal for poverty alleviation by mangrove restoration was created based on local knowledge related mangrove ecosystem through participation of local people in mangrove restoring process. Similar to the quantitative results, they showed that the goal was determined based on an application of local knowledge related to the mangrove zonation (56%), ebb tide and neap tide (31%) for demarcation and

selection of mangrove site to plant pioneer mangrove saplings ($N = 140$). During applying the local knowledge, 31% of respondents ($N = 140$) indicated that the local people participated in setting mangrove restoration goal, even though they did not know how long it take to obtain a return of economic benefits from mangrove restoring (Figure 4.3).

The goal for restoring the mangrove ecological production was a mutual interdependence among the local people, village chiefs and governmental organizations to provide benefits to all stakeholder. While a poverty of local people was alleviated from an increasing income from a restored mangrove forest, the village chiefs achieved their roles and responsibilities in solving community's problems. The governmental agencies also obtained an increase of mangrove forest from community's mangrove restoring project. The former village chiefs revealed that they were appreciated and so proud of themselves in restoring the mangrove forest, maintaining a mean of local subsistence, and reuniting family members.

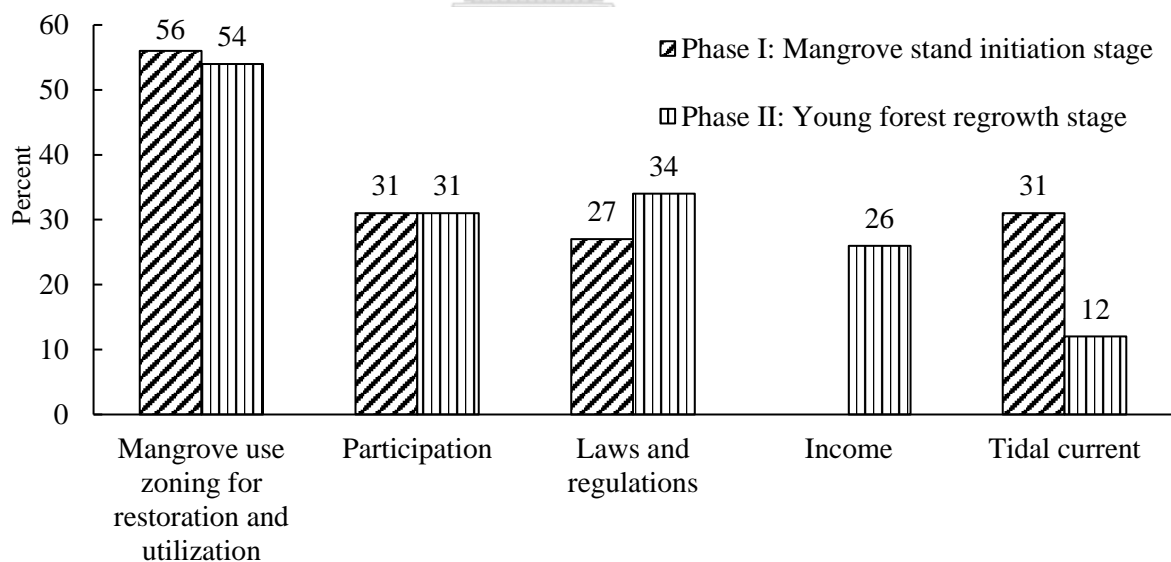


Figure 4.3 Major factors influencing goal setting during mangrove stand initiation and young forest regrowth ($N = 140$).

- **Diversifying income by utilization of restored MGES**

After restoring the mangrove ecosystem and solving the poverty of local people, the goal was shifted into the diversifying income by utilization of MGES from restored mangrove ecosystem. It aimed to maintain the local people's daily subsistence, transfer local knowledge, and cope with incoming ecological and social stresses. This goal did not only focus on the harvest of provisioning services but also covered the utilization of cultural services for an ecotourism.

According to in-depth interview with former village chief, he revealed that an ecotourism at KK sub-district was suggested by a former provincial governor to increase local people's income and employment and disseminate local knowledge on mangrove ecosystem for restoring and utilization mangrove forest. A consequence of ecotourism initiation at KK sub-district, the KKM FCC was established by a former village chief. It was held in form of a community enterprise for an equitable distribution of benefits. It recruited the local people who were interested in additional income to participate in the enterprise. According to in-depth interview with a headman of KKM FCC, he revealed that the ecotourism business development and ecotourism activities were reviewed and observed from local tourism at Amphawa community. He mentioned that a tourism at Amphawa community used a cultural capital of old markets which was a community heritage as a tourism attraction (Buason, 2011). In case of KK sub-district, the KKM FCC used an ecological capital of mangrove forest and social-cultural capital of local community as a signature tourist attraction and activities. The ecotourism business at KK sub-district did not only aim to service tourists for providing more income and job opportunities for the local people, but it also served as a learning center to facilitate a transmission of local knowledge on mangrove restoring and values of MGES. In addition, it also indirectly supported an increase of mangrove forest through inserting mangrove planting activities in its tourism activities. The ecotourism activities were conducted under a control of local governmental agencies and local people's

monitoring in order to ensure that their activities did not affect to the mangrove ecological production and local livelihood.

The results showed that the goal for the diversifying income through the utilization of MGES from restored mangrove ecosystem in the phase II of young forest regrowth was set determinedly under a clearly defined mangrove boundary for utilization (54%) under the Marine and Coastal Management Promotion Act and Forest Reserve Law (34%) ($N = 140$). Thirty-one percent of respondents ($N = 140$) revealed that a participation of local people was really important in goal setting to ensure that all stakeholder had the same target in sustaining the MGES for protecting a source of income. Apparently, an income was more mentioned in the phase II of young forest regrowth stage (26%, $N = 140$) after the goal was shifted from a poverty alleviation through mangrove restoring to a diversified income through ecotourism (Figure 4.3).

4.3.3 Motivating the participation of local people

A participation of local people during two phases of mangrove stand initiation and young forest regrowth at KK sub-district was generated from a self-motivation which was influenced by affiliative, normative and material motives (Knoke, 1988; Puffer *et al.*, 1992). The study found that a trust, volunteering with an altruism, guilt, and sense of ownership were major emotional factors influencing participation during two phases of mangrove forest development.

The trust-induced participation was motivated by an affiliative motivation which involved with an emotional attachment of local people to their village chiefs and charismatic domination of HRH Princess Maha Chakri Sirindhorn (Davenport *et al.*, 2007; Häkkinen, 2012). The results showed that the participation of local people in an early phase of mangrove stand initiation generated from the trust and respect in village chiefs (68%, $N = 140$) (Table 4.7). In rural communities of Thailand, a relation between village chief and villagers was based on superior-inferior relationship (Hanks, 1962). The village chief was responsible for any activities concerning regulations and well-being of villagers. He had to show his ethical leadership characteristics to villagers, while the villagers have to pay respect and listen to the village chief (De Young, 1955). This hierarchical relationship was embedded in Thai

cultural village organization which motivated the local people to participate in community's activities.

From in-depth interview, it found that the local people increasingly participated in mangrove restoring activities after the first royal visit of HRH Princess Maha Chakri Sirindhorn for planting mangrove saplings in 1997. One hundred and twenty-five respondents (89%, $N = 140$) indicated that they participated in mangrove restoring because of their trust and loyalty in HRH Princess Maha Chakri Sirindhorn (Table 4.7). The respondents revealed that they were so proud of welcoming HRH Princess Maha Chakri Sirindhorn's royal visits and intended to pass on their pride to their descendants by continuously conserving the mangrove forest and sustainably utilizing the MGES. Supported this interview by statistical results, 49% of respondents ($N = 140$) indicated that the royal visits of HRH Princess Maha Chakri Sirindhorn raised the local people's self-esteem which motivated them to willingly participate in mangrove restoring and SU of restored MGES (Table 4.7). It reflected an affective relationship such as love, trust, and reverence of the Thai people to a royal family which was rooted in their beliefs and attitudes, and unique to the Thai culture.

Table 4.7 Factors Influencing Participation of Local People in the LKLC During Mangrove Stand Initiation and Young Forest Regrowth ($N = 140$)

Factors influencing participation	Yes		No		Do not know	
	N	%	N	%	N	%
Common property right	126	90	6	4	8	6
Trust and loyalty in HRH Princess Maha Chakri Sirindhorn	125	89	12	9	3	2
Trust in village chiefs	95	68	32	23	13	9
Volunteer with altruism	89	63	47	34	4	3
Guilt	85	61	46	33	9	6
Self-esteem	69	49	47	34	24	17
Rewards and economic incentives	17	12	118	84	5	4

Note: Multiple responses were possible.

A building of interpersonal trust between the local people and their village chiefs which motivated the participation relied on trustworthy behaviors of leaders. The leader's trustworthy behaviors included an integrity, competence and benevolence (Häkkinen, 2012). The results of the study revealed that the local people at KK sub-district trusted HRH Princess Maha Chakri Sirindhorn and their former village chiefs because of the competence (66%), integrity (59%), and benevolence (53%) ($N = 140$) (Figure 4.4). These characteristics were a charismatic power of village chiefs and HRH Princess Maha Chakri Sirindhorn that dominated the local people's participation during two phases of mangrove stand initiation and young forest regrowth (Table 4.7).

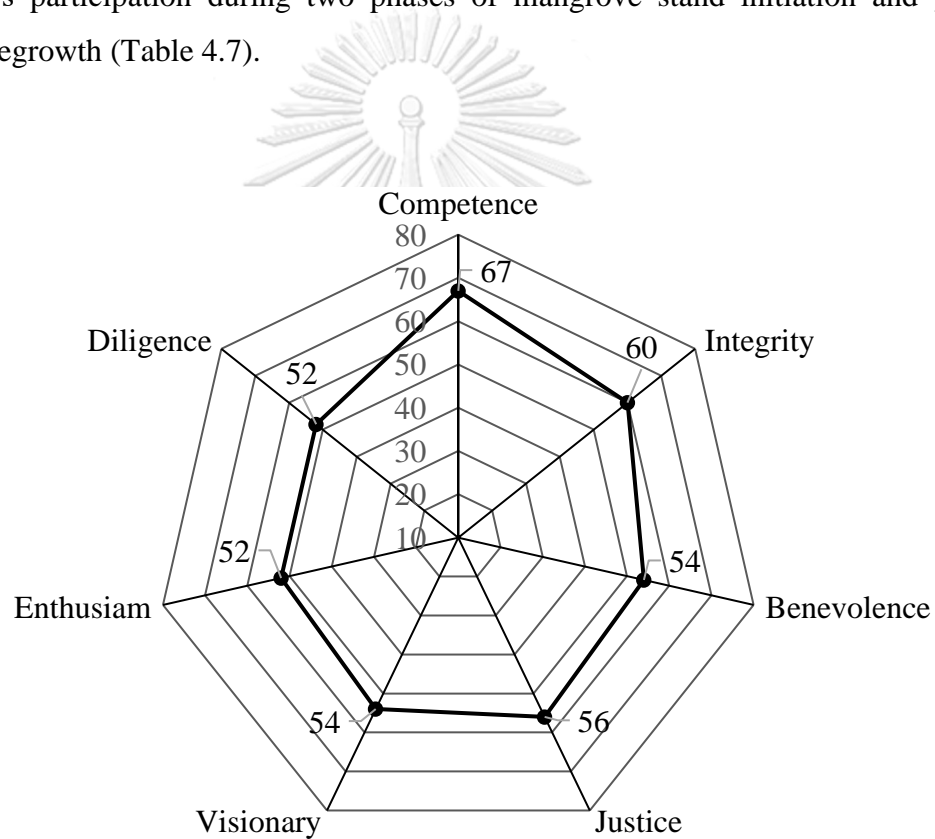


Figure 4.4 Trustworthy characteristics of leader ($N = 140$).

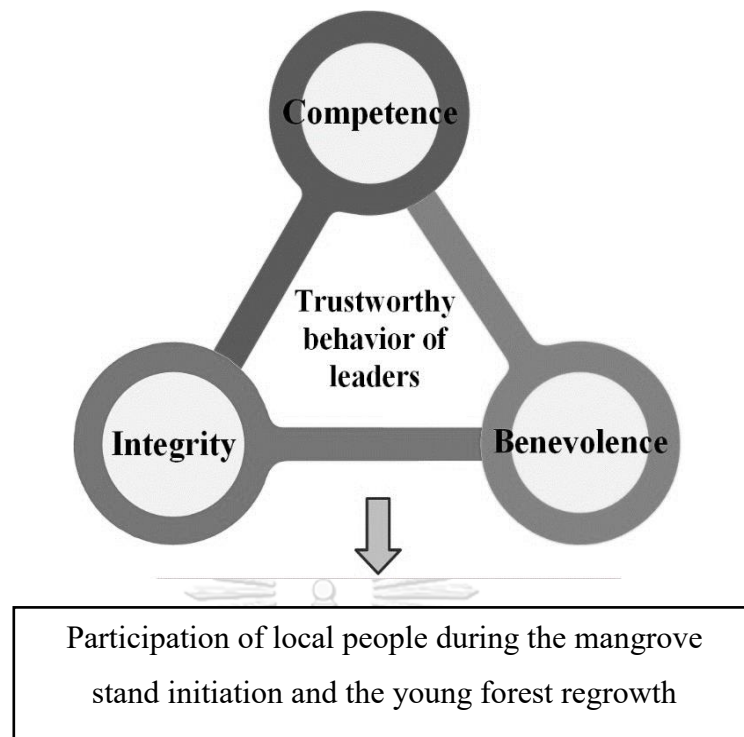


Figure 4.5 Trustworthy behaviors of leaders induced trust and participation.

Another affective pressure on the local people's participation was a feeling of guilt (61%, $N = 140$) (Table 4.7). The guilty feeling arose from a feeling of responsibilities for the community and other people (Stolinski *et al.*, 2004). It was also developed from the close social connectedness among the local people (Sommer *et al.*, 1997). The results from field surveys showed that all local people in KK sub-district know each other because they were relatives, friends, neighbor and acquaintance. To maintain their socialized relationship with other people, the local people had to participate in community's activities (Hski-Leventhal, 2009).

For a normative motive, an active participation of local people during the mangrove stand initiation and the young forest regrowth phases was stimulated by an altruistic volunteering (63%, $N = 140$). Eighty-four percent of respondents ($N = 140$) indicated that they participated in mangrove restoring without regarding personal benefits and monetary incentives (Table 4.7). The former village chiefs revealed that the voluntary participation generated from the local people's sense of ownership and responsibility for community interest. The volunteering with altruism also influenced by personal characteristics such as generous and empathy, time availability, and

social, psychological and financial resources (Kahana *et al.*, 2013; Unger, 1991). While some local people volunteered in mangrove restoring activities with altruism, some people participated because of utilitarian incentives provided by a common property right.

The common property right on mangrove forest was a utilitarian or material motive which indirectly created an affective incentive, namely a sense of ownership encouraging the local people's participation (Adhikari *et al.*, 2014). According to the 1941 revision of Forest Protection Act, the mangrove forest in Thailand including KK sub-district was legally claimed as a state property governed by Royal Forest Department (RFD). The local people were allowed by RFD to utilize the mangrove provisioning and cultural services for the tenure, social and food security. They were provided rights for access, withdrawal, management, exclusion and alienation of ecosystem services (Ostrom *et al.*, 2007; Schlager *et al.*, 1992). Most of respondent (87%, $N = 140$) indicated that their property right on common-pool mangrove resources motivated them to join in mangrove restoring and the SU of MGES from restored mangrove forest (Table 4.7). Some local people participated in mangrove restoring activities because they realized that a restored mangrove forest will finally return them a local occupation and monetary benefits. It implied that the local people also focused on their self-interest in term of income and local livelihood which derived from the restored mangrove forest. As a result, the common property right became the most influencing factor on the local people's participation in restoring and utilizing the mangrove forest.

4.3.4 Mangrove ecological knowledge acquisition

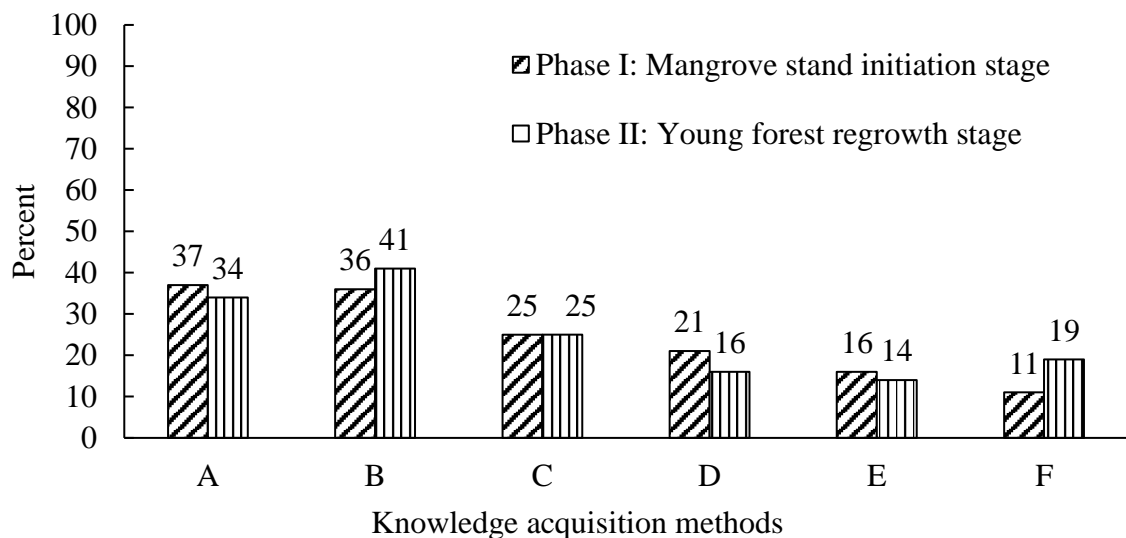
- **Knowledge acquisition methods for mangrove restoration**

During the mangrove stand initiation, the local knowledge on mangrove ecosystem was elicited from various sources with several techniques. The results showed that general simple methods for obtaining mangrove restoration knowledge was acquired from trials and errors and observation (37%, $N = 140$) (Figure 4.6). These techniques were fundamental methods which were commonly conducted in local communities for accumulating and creating a new local knowledge (Eyong, 2007; Gadgil *et al.*, 1993; Joa *et al.*, 2018). For

example, the trial and error was used by farmers in Kasiki village and Lilondo village in Tanzania to select arable land for crop farming (Lwoga *et al.*, 2010).

The former village chiefs and local philosophers indicated that an early phase of mangrove stand initiation was conducted by imitating and learning from other sites. They found that the mangrove plant species named *Rhizophora* sp. which was used in other sites as introduced by local government agencies (Moore, 2009) was not suitable for planting on mangrove foreshore zone at KK sub-district. They analyzed that a failure of mangrove restoring in an initial phase was occurred from a sole dependence on a scientific knowledge, insufficient specific information on mangrove conditions, and lack of local knowledge application (Mek Piboon *et al.*, 1998; Suwannat *et al.*, 1996). Supported by several mangrove restoration projects were failed because of lacking sufficient information in mangrove restoration such as sedimentation, substrate elevation, autecology, and edaphic conditions (Lewis *et al.*, 2014). To elicit more information and increase the knowledge on mangrove forest, a discussion with other groups of people and document reviews were required. Fifty respondents (36%, $N = 140$) indicated that the discussion provided them a new knowledge with different perspectives on mangrove ecosystem. Twenty-five percent of respondents ($N = 140$) revealed that governmental published materials such as a preparation of mangrove saplings were reviewed for applying in mangrove restoring (Figure 4.6). Moreover, the respondents revealed that a socialization and document reviews enabled them to integrate their knowledge with others and to adapt their knowledge for mangrove restoring.

Based on an accumulated knowledge on mangrove ecosystem, the respondents indicated that *Rhizophora* sp. cannot resist long periods of flooding and tidal surge, but *Avicennia* sp. can tolerate long periods of tidal inundation, infestation of barnacles, widest range of soil salinity and aridity (Field, 1998; Lewis *et al.*, 2014; Selvam, 2007). Therefore, they selected *Avicennia* sp. as pioneer plant species to plant on foreshore zone instead.



Note:

- | | | | |
|---|---------------------------------|---|---------------------------|
| A | Trial and error and observation | D | TV/Radio/Newspaper |
| B | Discussion and training | E | Internet and social media |
| C | Document reviews | F | Story telling |

Figure 4.6 Knowledge acquisition methods during mangrove stand initiation and young forest regrowth ($N = 140$).

- **Knowledge acquisition methods for utilization of restored MGES**

After the mangrove ecological production was restored, a community-based mangrove ecotourism was developed at KK sub-district in 2007. It was a new business in community, and no one had experiences and knowledge on mangrove ecotourism. To utilize the mangrove forest for ecotourism, the knowledge related ecotourism business operation and activities was accumulated from the same methods as in the phase of mangrove stand

initiation for mangrove restoring. The results showed that the knowledge on mangrove ecotourism was accumulated from trials and errors and observation from other case studies (34%), training and networking communication (41%) with non-governmental agencies (NGOs) and business entrepreneurs, and reviews of research papers (25%) ($N = 140$) (Figure 4.6). Even though, the knowledge acquisition methods of both two phases were similar, but they had some different details due to the change of ecological, social-cultural conditions. For example, while the knowledge for mangrove restoring was elicited from a discussion only among the local people, the knowledge for using of restored MGES was acquired from the discussion with more several groups of people. The respondents indicated that the obtained knowledge was continuously refined in harmony with the KK community's ecological and social environment.

4.3.5 Designing mangrove restoring and utilization of restored MGES plan

While the mangrove restoration during mangrove stand initiation was designed to restore the mangrove ecological production, the utilization of restored MGES was planned to obtain a diversifying income, maintain the local people's mean of subsistence, and transfer the local knowledge on mangrove benefits to others.

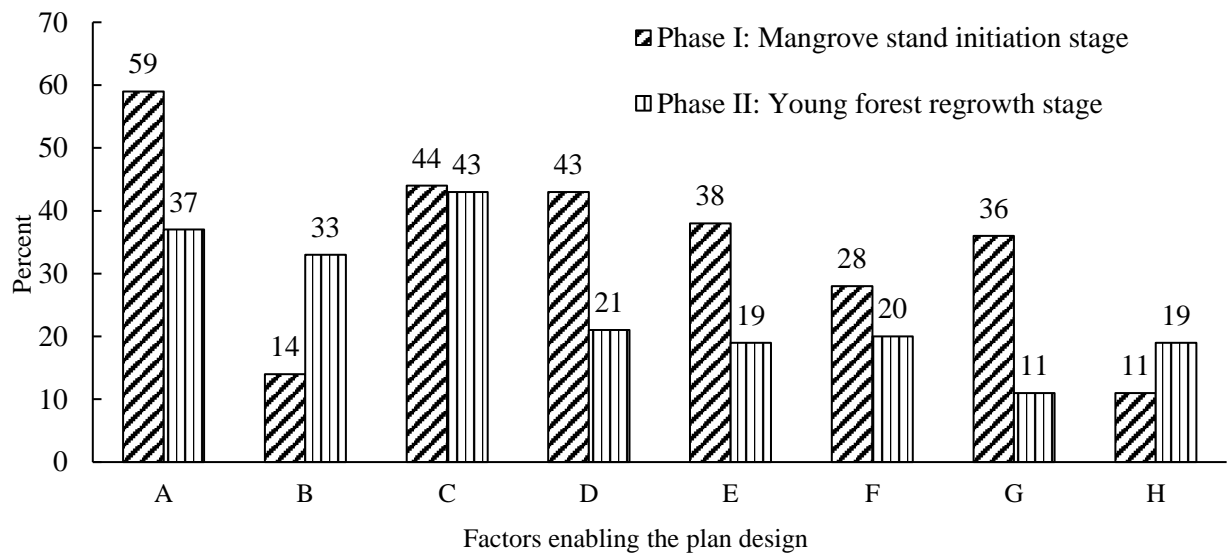
- **Mangrove restoring plan for poverty alleviation**

In 1990, the mangrove restoring was designed based on local knowledge on mangrove zonation, mangrove seedlings, tidal current, wind direction, and seasonal and interannual variability of sedimentation which was specific to KK community. The results showed that over half of respondents (59%, $N = 140$) indicated that a restoration site selection was the first step of mangrove restoring process (Figure 4.7). An accreted mudflat on coastline at foreshore zone was selected for an establishment of *Avicennia* sp. mangroves. The respondents indicated that the site selection was conducted based on their knowledge on tidal current (43%) and wind and swell wave (38%) ($N = 140$) respectively (Figure 4.7). Supported by several studies of mangrove restoration, those studies suggested that an understanding of mangrove planting environment such as adjacent mangrove forest, hydrodynamics (wave and currents) and climatic

conditions was the first important step of mangrove restoration (Field, 1998; Lewis, 2005; Lewis *et al.*, 2014).

An availability of mangrove *Avicennia* sp. propagules (44%, $N = 140$) which dispersed in restoration site influenced a design of mangrove restoring plan (Figure 4.7). From in-depth interviews, the local philosophers and former village chiefs revealed that the natural mangrove *Avicennia* sp. seedlings existed in the mangrove forest were collected to grow in nursery until the propagules germinated and then transplant in restoration site (Field, 1998; Rasool *et al.*, 2005; Tamin *et al.*, 2011). However, a natural reproduction of mangrove seedlings was unable to produce sufficient seedlings for replanting. As a result, the former village chiefs had to request the local governmental agencies to supply the mangrove seedlings and saplings.

A cost effectiveness for mangrove restoring was also concerned. Thirty-six percent of respondents ($N = 140$) indicated that a financial support was required in an initial phase to purchase equipment and mangrove saplings, and hire the local people to plant the mangrove saplings (Figure 4.7). From interviews with the former village chiefs, a major source of financial support was provided by a former provincial governor, former vice-provincial governor, Maeklong Fishery Cooperative Limited, and the Fishery Association of Samut Songkhram. This showed a role, responsibility and function of political institutions to support the community through supplying materials and resources for natural resource management.



Note:

- | | | | |
|---|--|---|------------------------------|
| A | Land use zoning | E | Wave and wind |
| B | Laws and regulations | F | Local livelihood |
| C | Available and distribution of mangrove seedlings | G | Budget and financial support |
| D | Tidal current | H | Technological support |

Figure 4.7 Factors enabling the plan design during mangrove stand initiation and young forest regrowth ($N = 140$).

- **Utilization of restored MGES plan for diversified income**

During the young mangrove forest regrowth stage (2007-present), there were various groups of stakeholders involved in planning the SU of restored MGES. The local people were a major group of people (58%, $N = 140$) who actively involved in designing a plan for utilization of MGES from restored mangrove forest. The study found that the local knowledge on tidal current (21%), fisheries livelihood (19%), and wave and wind (20%) respectively were applied in designing a utilization plan of fishery resources and ecotourism ($N = 140$) (Figure 4.7). From field observation, a collection of blood cockle and mangrove planting activities implemented only during an ebb tide. Additionally, the study also found that a dispersal and reproduction of mangrove propagules

(43%, $N=140$) was used in planning the mangrove planting activities because a number of mangrove seedlings was required for replantation (Figure 4.7).

Governmental agencies (46%, $N = 140$) played an important role in planning the utilization of mangrove forest because they had an authority in controlling the harvesting practices and had responsibilities related to laws and regulations. To control the local people's utilization of coastal resources and prevent mangrove encroachment, the mangrove forest utilization plan was designed under the forest laws and regulations (33%) and mangrove zoning public property and economic zone (37%) ($N = 140$) (Figure 4.7).

For the educational institutions, the study also found that the academic institutions (40%, $N = 140$) also joined in plan design for utilization of MGES from restored mangrove forest. From in-depth interview, it found that there were many researchers from various universities visited KK sub-district to apply a scientific and technological knowledge to support the harvest plan of krill and blood cockles. The study found that 19% of respondents ($N = 140$) indicated that a technological knowledge from academicians or researchers was increasingly used in mangrove harvest plan (Figure 4.7). The researchers used their scientific knowledge and techniques to measure salinity, sedimentation, nutrients and metal loading which can affect to the survival and growth of benthic communities. They had chances to disseminate and exchange their explicit scientific knowledge with the local people who possessed a local knowledge on mangrove forest specifically to the KK sub-district for designing the SU of MGES from restored mangrove forest. It resulted in an externalization of local people's knowledge on mangrove ecological production into a written format.

4.3.6 Validation of mangrove restoring and the utilization of restored MGES plan

A test of mangrove restoring plan and utilization of restored MGES plan was conducted to ensure that a designed plan responded to a determined goal for solving poverty, expanding mangrove forest, generating a diversified income, and maintaining the local people's subsistence.

In case of KK sub-district, the mangrove restoring plan and utilization of restored MGES plan were not assessed by rethinking, but it was tested in a real-life situation through trials and errors and observations. Comparing to an assessment of KM in business organizations, a validation covered five components including people, process, structures, culture, and technology (Awad *et al.*, 2004).

- **Validation of mangrove restoring plan**

The village chiefs (54%), Samut Songkhram Provincial Government Office, Department of Marine and Coastal Resources (45%), local people (26%), and educational institutions (17%) ($N = 140$) functioned in assessing and governing the mangrove restoring plan. The governmental agencies and village chiefs were bureaucrats who had legal authority in examining the mangrove restoring plan to ensure that it was regulated under the national laws (32%) and implemented in mangrove reforestation areas (39%) ($N = 140$). For a role of local people, they applied their local knowledge related mangrove plant species, tidal inundation, sedimentation, and barnacles to validate the mangrove restoring plan (10%, $N = 140$). They revealed that an effective mangrove restoring plan had to be consistent with their livelihood (14%, $N = 140$). In term of educational institutions' functions, the academic institutions applied their scientific and technological knowledge to measure a usability of the mangrove restoring plan. Fourteen percent of respondents ($N = 140$) indicated that they received a technological support from many educational institutions which also included Chulalongkorn university (Figure 4.8).

At KK sub-district, the validation of mangrove restoring plan spent around 2 years for seeking pioneer plant species which resisted to wave energy and planting techniques by trials and errors and observation. A tidal current was a major concern for young mangrove plant survival (27%, $N = 140$) (Figure 4.8). This challenge was solved by an application of local knowledge to select mangrove pioneer plant species and planting method of mangrove sapling by tied them to a bamboo stake. Similar to the validation of mangrove reforestation practices in Western Port in Australia, it spent 6 years from 2004 to 2010 for developing seedling planting techniques resisting to an extreme dynamic of tidal

currents and storms (Kirkman *et al.*, 2012). According to the validation techniques of mangrove planting at KK sub-district and Western Port, they accomplished the challenges of seedlings survival by applying local knowledge of natural tidal currents phenomena through trials and errors.

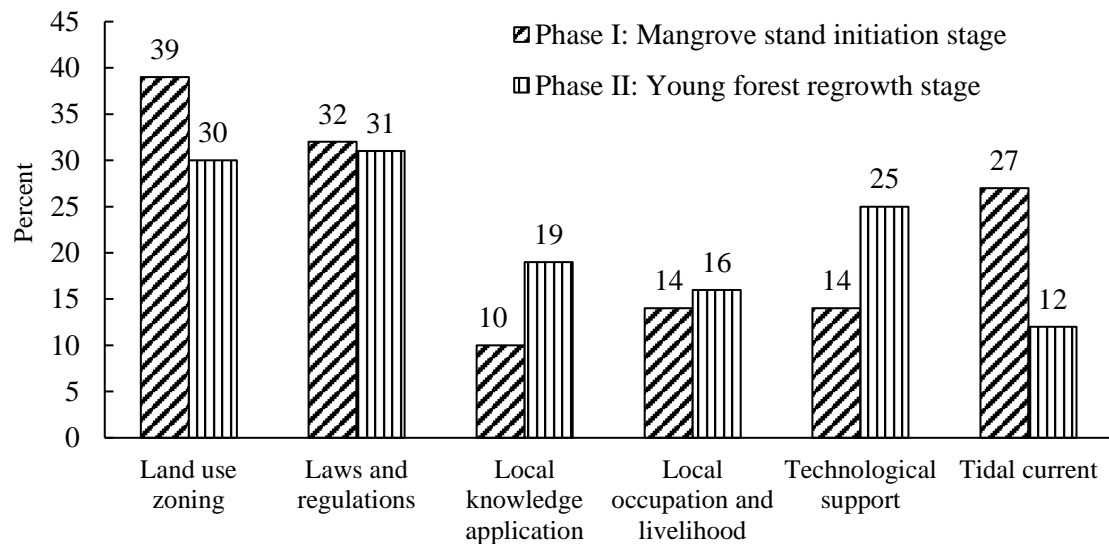


Figure 4.8 Factors enabling the plan validation during mangrove stand initiation and young forest regrowth ($N = 140$).

- **Validation of utilization of restored MGES plan**

An evidence confirmed a potential of designed mangrove restoring was an expansion of mangrove forest from 1.44 km² to 1.92 km² in 1994 and a restored MGES such as a habitat and nursery ground for juvenile aquatic animals and decreased intensity of tidal currents and waves. The former village chief revealed that blood cockles, krill, and flathead grey mullet gradually returned since the mangrove forest has been planted in 1990.

After resolving mangrove ecological crisis and reducing poverty, the local knowledge, local fishery livelihood, and scientific knowledge were higher influenced on the plan validation for utilization of restored mangrove forest (Figure 4.8). A local knowledge on mangrove ecological functions was advantageous in determining and assessing a practicability of sustainable harvesting plan. The local knowledge on tidal current, sedimentation, and seasonal monsoon was applied to validate the harvest plan of aquatic animals

and ecotourism (19%, $N = 140$) (Figure 4.8). The local philosophers revealed that the local people applied their local knowledge on a gravitational force of the moon to forecast an ebb tide and neap tide for determining and validating a harvesting plan of aquatic animals. From field observation, the local people harvested the blood cockles only during the ebb tide and left the aquatic animals to grow and reproduce their population during the flood tides.

The study found that a fishing-based livelihood was applied and integrated both in validating the utilization plan. Their daily subsistence and livelihood of local people heavily relied on the MGES such as blood cockles and krill. Sixteen percent of respondents ($N = 140$) indicated that the utilization of restored MGES plan had to be consistent with their fisheries occupation and local livelihoods (Figure 4.8) to prevent a conflict between governmental agencies and local people on harvesting MGES. The study revealed that an integration of local livelihood to assess utilization plan was required in order to maintain the livelihood of mangrove-dependent people and avoid and reduce any conflicts between local people and governmental authority.

A scientific and technological knowledge for assessing a suitability of mangrove forest harvesting plan required a support from governmental agencies and educational institutions. The respondents (25%, $N = 140$) identified that the scientific knowledge and technology influenced an assessment of the SU of restored MGES plan (Figure 4.8). The same respondents revealed that it was used in measuring the growth of mangrove forest flora and fauna and biodiversity. For example, there was a study by academic institutions used their scientific knowledge to examine a change in the benthic community structures over 3 years (1994-1997) at KK sub-district. Based on their scientific analysis, it showed that there was a high value of species richness of benthic animals under the mangrove canopy at 2-year-old mangrove plantation site (Suzuki *et al.*, 1997).

4.3.7 Practices for mangrove restoring and the SU of restored MGES

A bureaucratic theory of Max Weber indicated that there were three types of social legitimation powers influencing social actions and movements. These social

powers included charismatic power, traditional power, and rational-legal power (Weber, 1978). In case of KK sub-district, the study found that major factors motivating and controlling a mangrove restoring and using of restored MGES involved with these bureaucratic powers. The local people's practices were mainly influenced by charismatic and traditional powers of HRH Princess Maha Chakri Sirindhorn and village chiefs and legal power of governmental agencies.

A trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn was the highest influencing factor on local people's practices during two phases of mangrove stand initiation (56%) and young forest regrowth (49%) ($N = 140$) (Figure 4.9). It involved with an emotional bond between local people and their leaders. The former village chiefs revealed that the local people changed their practices to be more ecological friendly in harmony with a restored mangrove forest after the first royal visit of HRH Princess Maha Chakri Sirindhorn at KK sub-district in 1997. A changing behavior and practice of local people was influenced by a socialized charismatic authority of HRH Princess Maha Chakri Sirindhorn. The socialized charismatic leader uses a power to serve the public and empower the people with regard to the people's feeling and rights (Howell, 1988 cited by Popper, 2000). In term of HRH Princess Maha Chakri Sirindhorn, her socialized charisma was developed from her dedication to alleviate the Thai people's hardship and improve their quality of life by using her heredity social power. It enhanced social ties of affection between the Thai people and HRH Princess Maha Chakri Sirindhorn. It means that the trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn which motivated a sustainable practice was developed from HRH Princess Maha Chakri Sirindhorn's socialized charismatic power and social connectedness between the Thai people and royal family.

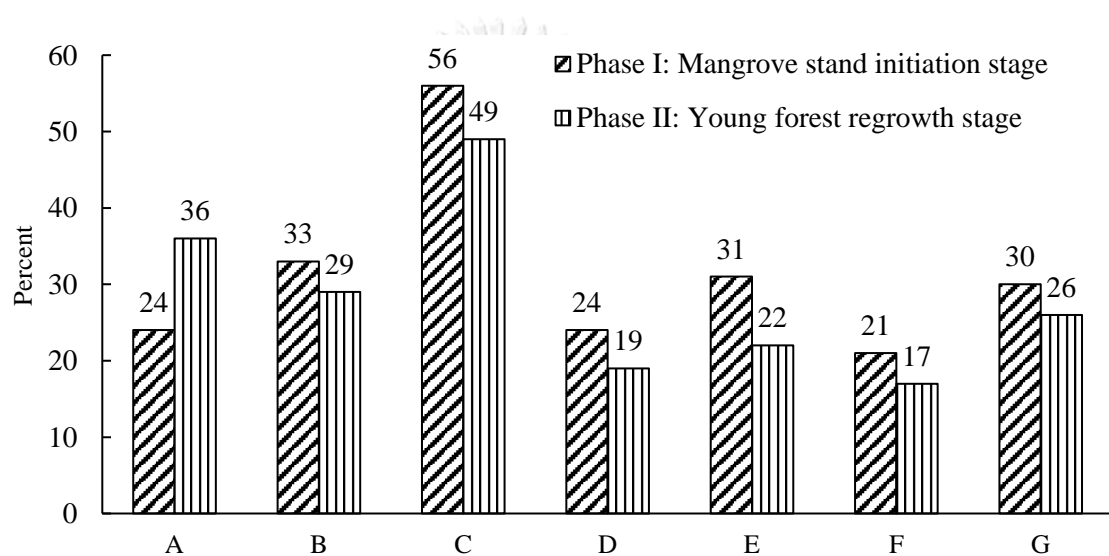
While HRH Princess Maha Chakri Sirindhorn dominated the local people's practices through her socialized charismatic power, the village chiefs used all type of social power to influence an adaptation of local people's practices. The village chiefs obtained a rational power from a legal election under the Constitution of Thailand. They had roles and responsibilities to solve any problems and conflicts in community (De Young, 1955). They also had traditional power which was developed from

patronage system and kin relationship. In rural communities of Thailand, a kinship system provided a basic foundation for reciprocal and cooperative working groups (Ferraro *et al.*, 2010). The local people in the same village thought that they were relatives and used a kinship term to express their degree of relationship, even though there were no actual kinship relations (De Young, 1955). In case of KK sub-district, the study found that most village chiefs had a sense of family and kinship because they originally born in KK community. Some of them had traditional power from using a capitalism in cumulating this power. They also had a charismatic power which was developed from their leadership characteristics including competence, benevolence, and integrity. Based on these three types of village's chief powers, it motivated the local people to trust in their village chiefs and tend to follow a leaders' persuasion. The results showed that the trust in village chiefs influenced the local people's practices during two phases of mangrove stand initiation (24%) and young forest regrowth (19%) ($N = 140$). Their trust also motivated the local people to follow the leader's persuasion in adapting their practices for the mangrove restoring (31%) and the utilization of restored MGES (22%) ($N = 140$) (Figure 4.9).

In term of factors which had a rational power influencing local people's practices, the results showed that laws and regulations and mangrove forest zoning played major roles influencing the local people's practices during two phase of stand initiation and young forest regrowth. Regarding this legal authority, the governmental agencies used their bureaucratic power to control the local people's utilization of restored mangrove forest. Thirty-six percent of respondents ($N = 140$) indicated that their harvesting practices of mangrove woods and blood cockles were changed due to an enforcement of Forest Reserve Law and Marine and Coastal Management Promotion Act. Moreover, the cabinet resolution related a zoning of the mangrove forest into conservation zone and economic zone (29%, $N = 140$) also controlled the local people's utilizing activities of MGES (Figure 4.9).

While the trust, persuasion, and legal frameworks were the factors that generated from the other people's authorized power, the emotional factors of individual also influenced the local people's changing practices for mangrove restoring and using of MGES form restored mangrove forest. These emotional factors

included a sense of community and volunteering with altruism. The sense of community was indirectly developed from a provision of communal right on mangrove forest. It motivated the local people to adapt their practices in consistent with a goal of community in alleviating a poverty through restoring mangrove ecosystem (21%, $N = 140$). The altruistic volunteering of local people (26%, $N = 140$) also influenced the local people's harvesting practices of fishery resources (Figure 4.9).



Note:

- | | |
|--|--------------------------------|
| A Laws and regulations | D Trust in village chiefs |
| B Land use zoning | E Persuasion by village chiefs |
| C Trust and loyalty in HRH Princess Maha Chakri Sirindhorn | F Sense of community |
| | G Volunteering with altruism |

Figure 4.9 Factors motivating the practices of local people during mangrove stand initiation and young forest regrowth ($N = 140$).

4.3.8 Post-evaluation of practices for conserving the mangrove forest and sustaining local livelihood

A post-evaluation in term of the KM process in business arena referred to a continuous assessment of activities in order to improve an organizational performance

for achieving objectives (Awad *et al.*, 2004; Debowski, 2006). According to a ripple model for monitoring KM strategies, it consisted of four levels including enhancing knowledge transfer activities, creation of knowledge capital, changed practices, and performance improvement (Hulsebosch *et al.*, 2009). This model assisted a company to consider a level for determining a monitoring system of KM. To evaluate or monitor the KM for achieving a desired level, it had to consider various factors such as an organizational behavior, trust between stakeholders, and involving institutions.

In case of KK sub-district, the post-evaluation was a follow-up process of local people's practices in restoring and conserving mangrove forest, harvesting aquatic animals, and operating ecotourism business in sustainable manner. This step aimed to observe the changing practices of local people under the dynamic of ecological, social-cultural, economic, and legal conditions. The results showed that the post-evaluation of practices during two phases of mangrove stand initiation and young forest regrowth were influenced by different factors. Major factors influencing the post-evaluation in the phase I of mangrove stand initiation were managerial and social factors, while the factors found in the phase II of young forest regrowth were mainly involved with emotional and managerial factors.

- **Post-evaluation of mangrove restoring practices during mangrove stand initiation**

The monitoring of the local people's practices for mangrove restoring during the mangrove stand initiation stage was monitored by a cooperation of village chiefs, volunteering local people, local governmental agencies and academic institutions. The results showed that an availability of working staffs (40%), a participation of stakeholders (23%), and local knowledge application (29%) were important in monitoring process of mangrove restoring ($N = 140$) (Figure 4.10). An engagement of stakeholders facilitated a dissemination of local knowledge and experience for coordinately monitoring of mangrove restoring.

A consequence of monitoring the local people's practices for mangrove restoring was a recovery of mangrove ecological production and local fishery livelihood of local people at KK sub-district.

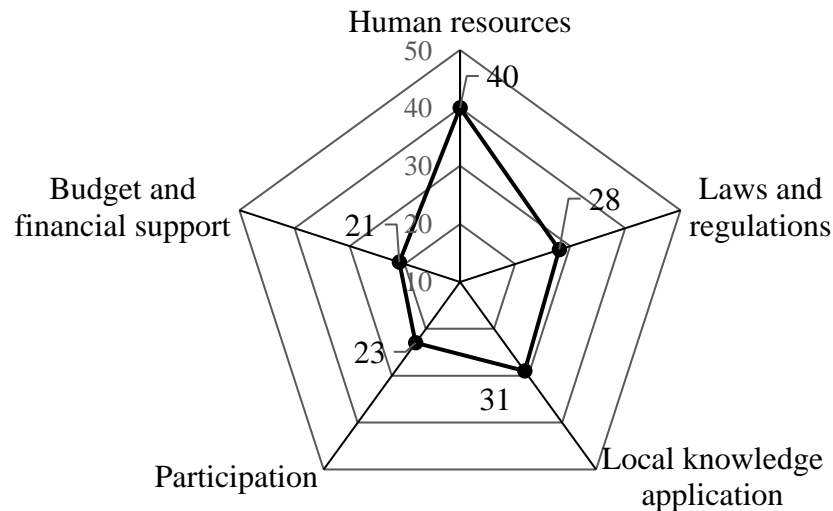


Figure 4.10 Factors enabling the post-evaluation of practices during mangrove stand initiation ($N = 140$).

- **Post-evaluation of utilization of restored MGES during young forest regrowth**

The study found that the local people's utilization of restored MGES during the young forest regrowth stage was mainly monitored by emotional bonding and legal frameworks. Forty-three percent of respondents ($N = 140$) revealed their trust and loyalty in HRH Princess Maha Chakri Sirindhorn motivated them to monitor both their utilization (Figure 4.11). The former village chiefs stated that no one dare to cut the wood and root out the planted mangrove saplings since the royal visit of HRH Princess Maha Chakri Sirindhorn in 1997. This showed the local people's practices was dominated by a charismatic power of HRH Princess Maha Chakri Sirindhorn. In addition, the local people's harvest of mangrove wood and aquatic animals was also monitored and controlled by a mangrove forest zoning for conservation and utilization purposes (38%, $N = 140$) (Figure 4.11).

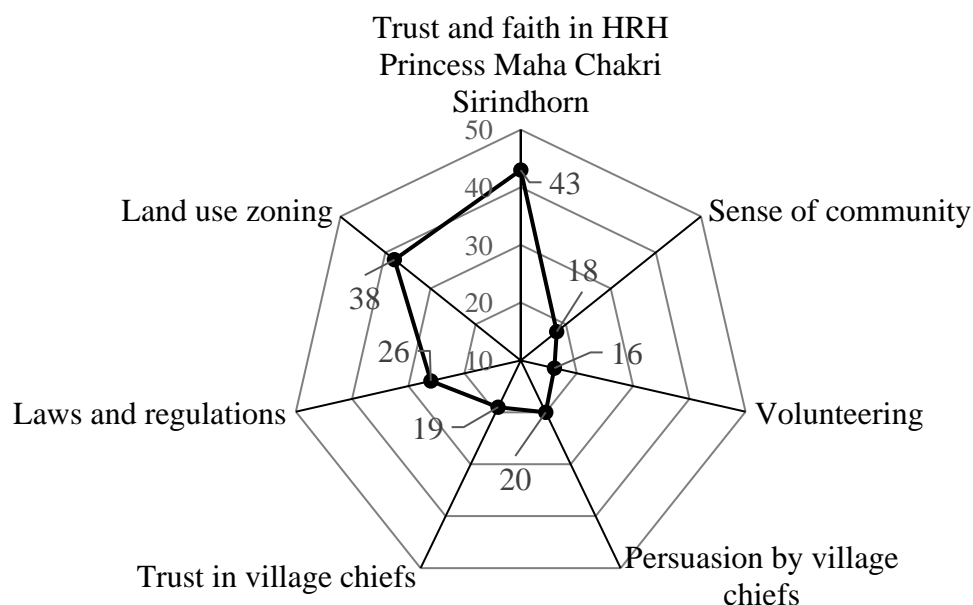


Figure 4.11 Factors enabling the post-evaluation of practices during young forest regrowth ($N = 140$).

According to the factors found in eight steps of LKLC, they can be summarized as shown in Table 4.8. Some factors such as trust and loyalty in HRH Princess Maha Chakri Sirindhorn, trust in village chiefs, volunteering with altruism, sense of ownership, common property right, and land use zoning were found on both mangrove stand initiation and young forest regrowth phases. Some factors were found only in the phase I of mangrove stand initiation such as policy, human resources, and budget and financial support, and some factors were found only in the phase II of young forest regrowth.

Table 4.8 Summary of Factors in the Local Knowledge Development

Factors in LKLC	Phase I*	Phase II**
1. Emotional factors		
• Trust and loyalty in HRH Princess Maha Chakri Sirindhorn	✓	✓
• Trust in village chiefs	✓	✓
• Volunteering with altruism	✓	✓
• Sense of ownership	✓	✓
• Guilt	✓	✓

Table 4.8 Summary of Factors in the Local Knowledge Development (Cont.)

Factors in LKLC	Phase I*	Phase II**
2. Ecological factors		
• Mangrove forest areas	✓	✓
• Mangrove ecosystem services	✓	✓
• Availability and distribution of mangrove seedlings	✓	✓
• Tidal current	✓	✓
• Wave and wind	✓	✓
3. Social factors		
• Social norms and values	✓	✓
• Participation	✓	✓
• Public interest	✓	✓
• Local knowledge application	✓	✓
• Local livelihood	✓	✓
• Persuasion by village chiefs	✓	✓
• Persuasion by experts	✓	✓
4. Economic factors		
• Income	✗	✓
5. Managerial factors		
• Laws and regulations	✓	✓
• Policy	✓	✗
• Land use zoning	✓	✓
• Common property right	✓	✓
• Human resources	✓	✗
• Budget and financial support	✓	✗
• Scientific knowledge and technological support	✗	✓
• Communication and advertisement	✗	✓

Remark: *Phase I: Mangrove stand initiation stage,

**Phase II: Young forest regrowth

According to the diverse factors and their functions in the LKLC, it resulted in a different utilizing activities of mangrove provisioning and cultural services during two phases of mangrove stand initiation and young forest regrowth. During the mangrove stand initiation, the MGES was mainly utilized as a source of food for household consumption and trade (90%, $N = 140$) (Figure 4.12) Comparing to the phase II of young forest regrowth stage, the restored mangrove forest was still harvested for food (87%, $N = 140$) (Figure 4.13). The utilization of mangroves for food did not much change after restoring the mangrove forest because the local people's livelihood still mostly depended on the mangrove provisioning services. It resulted in an existence of local knowledge on mangrove ecological production and traditional coastal fisheries which was transferred to a young generation in order to support the utilization of fishery resources.

In case of an aquaculture, the shrimp and blood cockle farming were widely conducted at KK sub-district during the mangrove restoring (39%, $N = 140$) (Figure 4.12). After restoring the mangrove forest, it remained a major occupation of local people (47%, $N = 140$) (Figure 4.13). However, it was operated with more concerns about environmental impacts. The former village chiefs and a chief of KKM FCC revealed that the local people changed their aquaculture from an intensive shrimp farming to an extensive blood cockle and mussel farming. The extensive farming of blood cockles relied only on a natural productivity so the nutrients in sediment trapped by mangrove roots and seawater was very important to the aquaculture production. To maintain healthy mangrove ecosystem and clean seawater, the local knowledge on mangrove ecological functions was applied in extensive aquaculture production.

Before a loss of mangrove forest from shrimp farming, the mangrove forest was collected for constructing dwellings (26%) and making charcoal (25%) ($N = 140$) respectively (Figure 4.12). However, a demand of timber for construction (14%) and fuelwood (11%) was reduced in the phase II of young forest regrowth stage ($N = 140$) (Figure 4.13) due to a clearance of mangrove forest for shrimp ponds and a prohibition of wood cutting and illegal encroachment according to forest reserve laws.

It resulted in a gradual disappearance of local knowledge related to charcoal making because the local knowledge was not transferred to young generation.

A community-based mangrove ecotourism at KK sub-district was more utilized for ecotourism (46%, $N = 140$) in phase II of young forest regrowth because of an encouragement of the former provincial governor and former village chiefs to increase an employment and income of local people (Figure 4.13). A headman of KKMFC shared his experience in developing ecotourism which was very new to KK sub-district. He had to observe from other cases, field trip, and discussion to develop an ecotourism business in harmony with mangrove forest and local people's livelihood. An observation of mangrove ecological production and discussion with participants in a community-based ecotourism enterprise was conducted to assess an impact of ecotourism on mangrove forest. A chief executive of KKSAO indicated that restaurants and resorts which were established to facilitate ecotourism at KK sub-district produced wastewater and noise pollution disturbing mangrove ecological production and local livelihood. Supported by the study of Sangchumnong (2018), it found that the tourism at KK sub-district was a main cause of waste and pollution. Thus, the local people had to learn and continuously refined their local knowledge to improve ecotourism management and activities for avoiding a disturbance on mangrove ecological functions.

The mangrove forest at KK sub-district was increasingly used as an educational area (50%, $N = 140$) in phase II of young forest regrowth after an ecotourism business was initiated and was promoted as tourist destination (Figure 4.13). Generally, the mangrove forest was an educational area for local people, especially a young generation to learn the MGES through harvesting mangrove plants and aquatic animals such as blood cockles, fishes, and krill to support their livelihood. After resolving a poverty through mangrove restoring, the restored mangrove forest was not only used for the local people's informal education. It was also used as a learning center for nonformal education to transfer local knowledge on mangrove ecosystem, local livelihood, and experiences of local people in restoring mangrove forest to visitors.

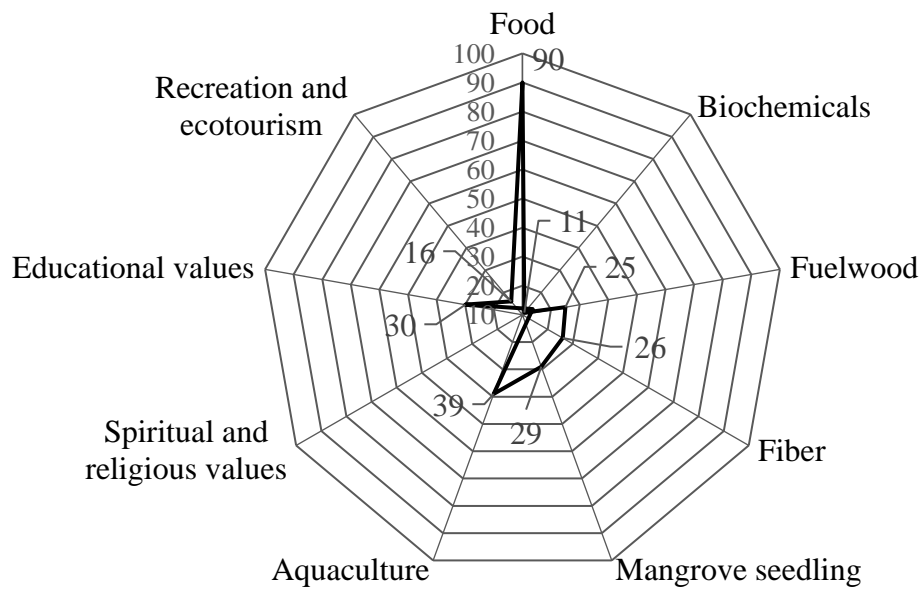


Figure 4.12 Mangrove provisioning and cultural services used during the phase I of mangrove stand initiation stage ($N = 140$).

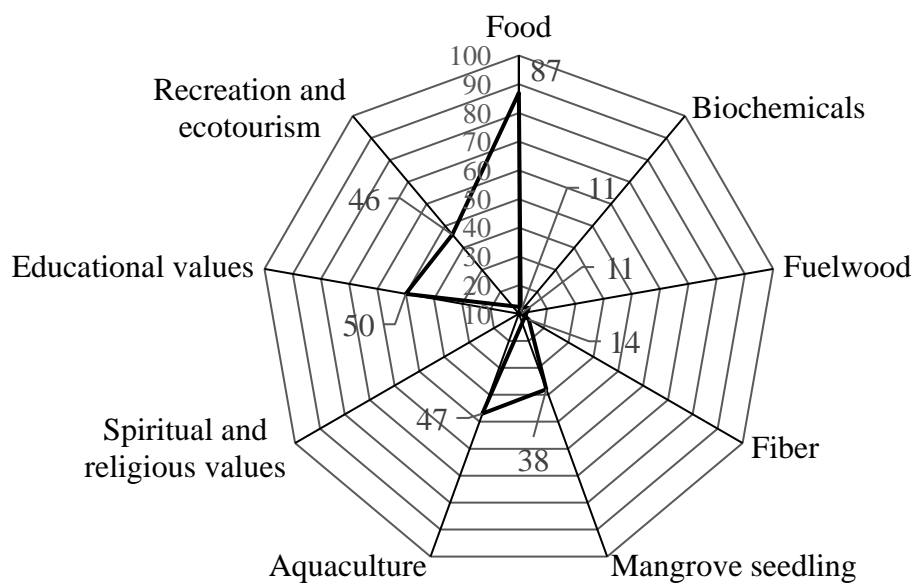


Figure 4.13 Mangrove provisioning and cultural services used during the phase II of young forest regrowth stage ($N = 140$).

During two phases of mangrove stand initiation and young forest regrowth, the local knowledge was developed responding to the change of targeted MGES for utilization during two phases of mangrove forest development. It resulted in a change

of utilizing activities of mangrove provisioning and cultural services during the mangrove stand initiation and the young forest regrowth phases.

4.4 Major Factors in the LKLC Enabling the SU of MGES

From the bare land to a restored mangrove ecosystem (1990-present), the knowledge on mangrove ecosystem was accumulated from selecting and planting native mangrove plant species on each zone of mangrove forest and became internalized values of individuals which controlled their behavior and characteristics. The episodic knowledge was retrieved for a group discussion through the process of analysis, synthesis and evaluation to create a new knowledge of mangrove ecosystem specifically to KK sub-district. Since 1990 to present, the local people had faced with the external change all the time such as tourism development, global trading, climate change and newborn disease (Alongi, 2002; Dasgupta *et al.*, 2013; Datta *et al.*, 2012). Therefore, the local people, who had knowledge and learning skills, were responsive to the change through adapting their knowledge and actions in harmony with the ecological and social change.

Regarding the LKLC during the phase I of mangrove stand initiation and the phase II of young forest regrowth, the study found that each step of the LKLC was influenced by specific factors. The major factors in the LKLC which led to the SU of MGES at KK sub-district were concluded as follow:

4.4.1 Perceiving change of mangrove ecological production

A perception of local people for mangrove restoring was developed from an extreme poverty which caused by a loss of mangrove ecological production. From in-depth interview, the local people recognized the benefits of mangrove ecological functions in providing a nursery ground and habitat for juvenile aquatic animals which was their major source of food and income. They aimed to plant the mangrove trees which is a producer to restore the mangrove nursery function for solving poverty. After restoring the mangrove forest, 89% of respondents ($N = 140$) revealed that an availability and distribution of natural mangrove seedlings was increased because a reproductive function of mangrove forest was recovered. Moreover, 83% of respondents ($N = 140$) also observed an increase of sediment due to a development of

mangrove ecological condition or ecological succession in trapping and accumulating more sediments. Ninety-three percent of respondents ($N = 140$) indicated that an existence of marine life revealed a recovery of habitat and nursery functions of mangrove ecological production (Table 4.9). The local people's continuous observation and interaction with mangrove forest became an accumulative experiences and local knowledge providing them a framework for evaluating a development of mangrove ecological conditions. It implied that the local knowledge and prior experience of local people can influence the local people's perception towards a change of mangrove ecological production. Similar to the Aichi Biodiversity Target 1, it indicated that an awareness of local people on the values of biodiversity and actions was important for conservation and sustainable use of biodiversity (Convention on Biological Diversity [CBD], 2012a) (Table 4.10).

4.4.2 Incentive income and provision of job opportunities

An extreme poverty was originally defined by World Bank as living on USD 1.25 or less a day (United Nation [UN], 1995). It did not only focus on a lack of income, but basic human needs including food, drinking water, sanitation, health, shelter, and education as well as participation in decision-making were also considered to ensure sustainable livelihoods (UN, 1995).

After initiating mangrove restoring through mangrove planting activities, a poverty of local people at KK sub-district was alleviated due to a gradual recovery of mangrove ecological production. To alleviate the poverty and sustain the means of daily life of local people at KK sub-district, a diversified income through the SU of MGES from restored mangrove forest for seafood and ecotourism were initiated. From field observation, the income was increased after the mangrove forest was restored, and community-based mangrove ecotourism was initiated in 2007. Seventy percent of respondents ($N = 140$) indicated that an income was an economic indicator showing a sustainable utilization and poverty reduction at KK sub-district (Table 4.9). The income did not only increase, but a traditional coastal fishery occupation was recovered.

A community-based mangrove ecotourism business provided more job opportunities to local people. It conducted in a form of community enterprise which

developed new occupations and increased a rate of employment at KK sub-district. Several jobs such as boat rental service providers, cooking group, and mangrove seedlings nursery group were developed to separate tasks for specialized groups and distribute equitably income to participants. Seventy-nine percent of respondents ($N = 140$) indicated that job opportunities was important to sustain their income and way of living (Table 4.9). Similar to the practical principle 12 of AAPSUBD, it aimed to promote economic incentives such as job opportunities and equal distribution of benefits derived from the sustainable use of natural resources (Table 4.10) (Convention on Biological Diversity [CBD], 2004).

4.4.3 Participation and self-reliance

An alleviation of poverty does not only increase a monetary benefit, but it involves a local people's participation for building capacity to improve their well-being based on their self-reliance. The participation approach was found dominantly in a success of sustainable utilization and management of mangrove forest (Coulibaly-Lingani *et al.*, 2011; Lise, 2000; Raufirad *et al.*, 2017). It promoted in an effective process of decision-making, monitoring, and reducing conflicts associated with mangrove management (Raufirad *et al.*, 2017).

The community-based mangrove restoration and utilization of restored MGES during two phases of mangrove forest development at KK sub-district were consistent with the King Bhumibol Adulyadej's working principles on poverty reduction for sustainable development including 1) self-reliance, 2) explosion from within, 3) social geography consideration, 4) participation of local people, and 5) knowledge sharing and transfer (Chaipattana Foundation, 2013). All royal development projects' implementation adopted these royal principles to enhance social development and improve the people's quality of life.

At KK sub-district, the ideas and practices of local people for poverty solving through mangrove restoring and a diversified income through the SU of MGES from restored mangrove forest were similar to royal working principles. An idea for restoring the mangrove ecological production was initiated by the former village chief cooperated with other village chiefs, his kinship and close friends. Eighty-six percent of respondents ($N = 140$) indicated that the participation allowed them to sustainably

harvest and manage mangrove forest by using their own methods based on their own experiences and cumulative knowledge with regard to local people's livelihood (Table 4.9). The engagement of local peoples enabled them to integrate their traditional values, social norms, and local livelihood in designing sustainable mangrove restoration and utilization plan. After restoring mangrove forest, the participation of local people facilitated a transfer of local knowledge to the governmental officials, academicians, NGOs, students, and tourists through discussion and observation trip for an application in other areas. This factor was similar to practical principle 9 of AAPSUBD that aimed to encourage the stakeholders to participate in planning and executing the management activities (Table 4.10) (CBD, 2004).

4.4.4 Trust and altruism motivating participation

A participation of local people during the mangrove stand initiation and the young forest regrowth phases at KK sub-district was encouraged by an emotional factors or civil social capitals including trust in HRH Princess Maha Chakri Sirindhorn and village chiefs and volunteering with an altruism. These social capitals were not mentioned in international principles of sustainable utilization such as CBD and AAPSUBD, but they were found in a morality condition of PSE which was proposed by His Majesty King Bhumibol Adulyadej The Great (Office of the National Economic and Social Development Board [NESDB], 2007) (Table 4.10). According to this condition, the local people at KK sub-district used their trustworthiness, integrity, and altruism in determining their interpersonal relationship, kinship, and social networks and practices for restoring mangrove forest and sustaining their means of living.

4.4.5 Allocation of communal land right on mangrove forest

To encourage the participation of local people for sustainable utilization of ecosystem services, an allocation of communal rights on land to mangrove-dependent communities was required (Adger *et al.*, 2000; Roy, 2014). According to the practical principle 2 and 6 of AAPSUBD, they mentioned about a recognition and respect the rights of people who used and managed the natural resources which also included local communities. To ensure the local people's right for their access, ownership, and control over land and natural resources, an equal right should be reinforced by

allowing the local people to participate in decision-making on the utilization of natural resources and had an authority to carry out any actions regarding to their decisions (Table 4.10) (CBD, 2004). The study found that 91% of respondents ($N = 140$) indicated that the communities' rights on publicly owned mangrove forest supported sustainable local practices because it involved with a creation of a sense of ownership (Table 4.9). A former village chief indicated that a high dependence on the mangrove forest of local people enhanced their sense of ownership and voluntary for participation (Lise, 2000). As a result, the common property right had a high influence on the local people' decision making on the utilization of MGES. However, the sustainable use principles of AAPSUBD did not mentioned about a creation of sense of ownership from an allocation of land right to local communities.

4.4.6 Application of local knowledge on mangrove ecosystem

A local knowledge was regarded as an importance tool in designing and validating the mangrove restoration and utilization of restored MGES plan during the mangrove stand initiation and young forest regrowth phases as it contributed the SU and conservation of biodiversity. According to the Goal 9 of the Convention on Biological Diversity, it aimed to maintain socio-cultural diversity of indigenous and local communities by respecting and preserving traditional knowledge, innovations and practices of local communities through a wider application of such knowledge (CBD, 2006). Moreover, the practical principle 4 of AAPSUBD also recognized a potential of local knowledge; thus, it encouraged an incorporation and application of local knowledge into a modern use to avoid an overuse and enhance the sustainable utilization of natural resources (Table 4.10) (CBD, 2004). The results showed that 77% of respondents ($N = 140$) realized an importance of an application of local knowledge for restoring mangrove ecological production and sustaining local people's means of subsistence (Table 4.9). As a result, the local knowledge was continuously developed through integrating with a shared technological and scientific knowledge from academic institutions to support the local people in restoring the mangrove ecological production.

4.4.7 Enforcement of forest laws and mangrove zoning for conservation and utilization

A land use zoning, Forest reserve Law, and Marine and Coastal Management Promotion Act were applied and enforced to determine, regulate, and monitor the local people's sustainable practices. The land use zoning at KK sub-district was associated with a cabinet resolution which classified mangrove forest into three zones including conservation zones, economic zone A, and economic zone B (Department of Marine and Coastal Resources [DMCR], 2009; Mangrove for the Future [MFF], 2011). Over half of respondents (57%, $N = 140$) indicated that an enforcement of these environmental laws controlled the practices of local people (Table 4.9). According to the Aichi Biodiversity Target 6, it aimed to regulate fishing practices by legal management and sustainable harvest of all fish, invertebrate stocks, and aquatic plants (CBD, 2012a) (Table 4.10). The practical principle 1 of AAPSUBD mentioned that these national laws had to be timely adapted and developed in respond to an adoption of international agreements and policies for enhancing the sustainable utilization of natural resources (CBD, 2004). It can be concluded that the laws and regulations were required in regulate and govern the local people to harvest seafood and operate ecotourism in sustainable manner. Moreover, they had to be amended to be compatible with international agreements and policies.

4.4.8 Human resources and technological transfer

Generally, the human resource was a valued asset which is widely mentioned in business field (Rangarao *et al.*, 2014). It referred to the staffs from various unit in an organization. They had different functions, knowledge, skills, behaviors, and values in supporting an organizational performance and productivity (Rafiei *et al.*, 2015). To improve an organizational performance, a development of human resource was required through providing education and promoting participation (Rafiei *et al.*, 2015).

In case of KK sub-district, the human resource (85%, $N = 140$) was found as a key indicator in a post-evaluation of local people's utilization of restored MGES during young forest regrowth (Table 4.9). It referred to several groups of people who involved in sustainable mangrove forest utilization. It included local people, village

chiefs, local governmental agencies, academic institutions, and private companies. A participation of these groups of people across all functions provided them opportunities to share, create, and refine their knowledge and skills for sustainable mangrove forest utilization.

Roles and functions of these groups of people was found importantly in monitoring the utilization and conservation of mangrove forest. According to a chief of MGFDS 7, they had functions in safeguarding the mangrove forest from illegal cutting and encroachment, training and educating the local people, volunteers, and visitors, and planting and distributing the mangrove saplings for plantation. For the local people, they volunteered and assisted the mangrove forest ranger to protect the mangrove forest from illegal encroachment. Academic institutions provided scientific knowledge and technical advice to local people in observing and assessing the change of mangrove ecological conditions such as seawater quality, sediment, and salinity. According to the diverse roles and functions of these institutions, it reflected a different possession of an explicit and tacit knowledge.

An involvement of these diverse institutions during two phases of mangrove stand initiation and young forest regrowth facilitated a knowledge sharing and transfer for sustainable practices development which was consistent with the Goal 9 of CBD, Aichi Biodiversity Target 18 and 19, and practical principle 6 and 9 of AAPSUBD (Table 4.10). The CBD Goal 9 and the Aichi Target 18 aimed to promote and encourage a participation of local communities to share their local knowledge for the conservation and sustainable use of biodiversity (CBD, 2006; 2012a). The Aichi Target 19 and a practical principle 6 of AAPSUBD focused on the sharing, transfer and application of the scientific knowledge and technologies through encouraging an active collaboration of scientific researchers and local people who had local knowledge on their natural resources to assess natural resource management methods (CBD, 2012a) (Table 4.10). For the practical principle 9 of AAPSUBD, it take socio-economic, political, biological, ecological, institutional, religious and cultural factors in decision-making, planning, and monitoring the sustainable use of biodiversity components through encouraging an interdisciplinary cooperation which also included a participation of local people (CBD, 2004). Therefore, the human resources did not

only focus on groups of people, but also included the knowledge sharing and technological transfer among several groups.

Table 4.9 Major Factors in the LKLC Enabling the SU of MGES at KK sub-district
(*N* = 140)

Major factors enabling the LKLC	Yes		No		Do not know	
	N	%	N	%	N	%
Availability of marine animals for collection	130	93	4	3	6	4
Common property right	128	91	11	8	1	1
Participation	121	86	10	7	9	6
Availability of natural mangrove seedlings for collection and plantation	120	86	11	8	9	6
Human resources	119	85	6	4	15	11
Increase of sedimentation	116	83	2	1	22	16
Employment and occupation	110	79	16	11	14	10
Local knowledge application	108	77	8	6	24	17
Income	98	70	24	17	18	13
Land use zoning	97	69	16	11	27	19
Laws and regulations	80	57	32	23	28	20
Financial and technological support	41	29	29	21	70	50

Note: Multiple responses were possible.

Table 4.10 Major Factors in the LKLC During Two Phases of Mangrove Stand Initiation and Young Forest Regrowth at KK Sub-district
Regarding International Principles of SU of Natural Resources and PSE Concept

Steps in LKLC	Phase I*	International and national principles of SU	Phase II**	International and national principles of SU
1. Perception	<ul style="list-style-type: none"> Poverty - Reduction of aquatic animals due to a loss of ecological production Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 1 AAPSUBD 2 and 6 	<ul style="list-style-type: none"> Maintaining their means of daily subsistence - Aquatic animals (provisioning services) - Ecotourism (cultural services) Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 5, 11 and 12 AAPSUBD 2 and 6
2. Goal setting	<ul style="list-style-type: none"> Income 	<ul style="list-style-type: none"> Aichi Biodiversity Target 14 AAPSUBD 12 	<ul style="list-style-type: none"> Diversified income through multiple use of provisioning and cultural services (seafood and ecotourism) Employment and jobs creation 	<ul style="list-style-type: none"> Aichi Biodiversity Target 14 AAPSUBD 12
3. Participation of local people	<ul style="list-style-type: none"> Land use zoning for conservation and utilization zones Laws and regulations Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1 AAPSUBD 2 and 6 	<ul style="list-style-type: none"> Land use zoning for conservation and utilization zones Laws and regulations Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1 AAPSUBD 2 and 6

Remark: *Phase I: Mangrove stand initiation, **Phase II: Young forest regrowth

Table 4.10 Major Factors in the LKLC During Two Phases of Mangrove Stand Initiation and Young Forest Regrowth at KK Sub-district
Regarding International Principles of SU of Natural Resources and PSE Concept (Cont.)

Steps in LKLC	Phase I*	International and national principles of SU	Phase II**	International and national principles of SU
4. Knowledge acquisition	<ul style="list-style-type: none"> Trust and faith in royal family and village chiefs Volunteering with an altruism 	<ul style="list-style-type: none"> PSE (morality) 	<ul style="list-style-type: none"> Trust and faith in royal family and village chiefs Volunteering with an altruism 	<ul style="list-style-type: none"> PSE (morality)
	<ul style="list-style-type: none"> Local knowledge transfer and application Scientific knowledge and technological support 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 Aichi Biodiversity Target 19 AAPSUBD 4 and 6 	<ul style="list-style-type: none"> Local knowledge transfer and application Scientific knowledge and technological support 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 Aichi Biodiversity Target 19 AAPSUBD 4 and 6
5. Plan design	<ul style="list-style-type: none"> Budget and financial support 		<ul style="list-style-type: none"> Land use zoning for conservation and utilization zones Laws and regulations 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1
	<ul style="list-style-type: none"> Land use zoning 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1 	<ul style="list-style-type: none"> Local knowledge transfer and application 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6

Remark: *Phase I: Mangrove stand initiation, **Phase II: Young forest regrowth

Table 4.10 Major Factors in the LKLC During Two Phases of Mangrove Stand Initiation and Young Forest Regrowth at KK Sub-district Regarding International Principles of SU of Natural Resources and PSE Concept (Cont.)

Steps in LKLC	Phase I*	International and national principles of SU	Phase II**	International and national principles of SU
	<ul style="list-style-type: none"> Local knowledge transfer and application Scientific knowledge and technological support 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 Aichi Biodiversity Target 19 AAPSUBD 4 and 6 		
6. Plan validation	<ul style="list-style-type: none"> Local knowledge transfer and application Land use zoning 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 Aichi Biodiversity Target 6 AAPSUBD 1 	<ul style="list-style-type: none"> Local knowledge transfer and application Land use zoning for conservation and utilization zones Laws and regulations Common property right (sense of ownership) 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 Aichi Biodiversity Target 6 AAPSUBD 1 AAPSUBD 2 and 6
7. Practices of local people	<ul style="list-style-type: none"> Common property right (sense of ownership) 	<ul style="list-style-type: none"> AAPSUBD 2 and 6 		<ul style="list-style-type: none"> AAPSUBD 2 and 6

Remark: *Phase I: Mangrove stand initiation, **Phase II: Young forest regrowth

Table 4.10 Major Factors in the LKLC During Two Phases of Mangrove Stand Initiation and Young Forest Regrowth at KK Sub-district Regarding International Principles of SU of Natural Resources and PSE Concept (Cont.)

Steps in LKLC	Phase I*	International and national principles of SU	Phase II**	International and national principles of SU
	<ul style="list-style-type: none"> Local knowledge transfer and application Trust and faith in royal family and village chiefs Volunteering with an altruism 	<ul style="list-style-type: none"> CBD 9 Aichi Biodiversity Target 18 AAPSUBD 4 and 6 PSE (morality) 	<ul style="list-style-type: none"> Trust and faith in royal family and village chiefs Volunteering with an altruism 	<ul style="list-style-type: none"> PSE (morality)
	<ul style="list-style-type: none"> Land use zoning for conservation and utilization zones Laws and regulations Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1 AAPSUBD 2 and 6 	<ul style="list-style-type: none"> Land use zoning for conservation and utilization zones Laws and regulations Common property right (sense of ownership) 	<ul style="list-style-type: none"> Aichi Biodiversity Target 6 AAPSUBD 1 AAPSUBD 2 and 6
8. Post-evaluation of practices	<ul style="list-style-type: none"> Common property right (sense of ownership) 	<ul style="list-style-type: none"> AAPSUBD 2 and 6 	<ul style="list-style-type: none"> Common property right (sense of ownership) 	<ul style="list-style-type: none"> AAPSUBD 2 and 6

Remark: *Phase I: Mangrove stand initiation, **Phase II: Young forest regrowth

Table 4.10 Major Factors in the LKLC During Two Phases of Mangrove Stand Initiation and Young Forest Regrowth at KK Sub-district Regarding International Principles of SU of Natural Resources and PSE Concept (Cont.)

Steps in LKLC	Phase I*	International and national principles of SU	Phase II**	International and national principles of SU
	<ul style="list-style-type: none"> • Land use zoning for conservation and utilization zones • Laws and regulations 	<ul style="list-style-type: none"> • Aichi Biodiversity Target 6 • AAPSUBD 1 	<ul style="list-style-type: none"> • Trust and faith in royal family and village chiefs • Volunteering with an altruism 	<ul style="list-style-type: none"> • PSE (morality)
	<ul style="list-style-type: none"> • Local knowledge transfer and application 	<ul style="list-style-type: none"> • CBD 9 • Aichi Biodiversity Target 18 • AAPSUBD 4 and 6 	<ul style="list-style-type: none"> • Land use zoning for conservation and utilization zones • Laws and regulations 	<ul style="list-style-type: none"> • Aichi Biodiversity Target 6 • AAPSUBD 1
	<ul style="list-style-type: none"> • Budget and financial support 		<ul style="list-style-type: none"> • Human resources 	<ul style="list-style-type: none"> • CBD 9 • Aichi Biodiversity Target 18 and 19 • AAPSUBD 6 and 9
	<ul style="list-style-type: none"> • Human resources 	<ul style="list-style-type: none"> • CBD 9 • Aichi Biodiversity Target 18 and 19 • AAPSUBD 6 and 9 		

Remark: *Phase I: Mangrove stand initiation, **Phase II: Young forest regrowth

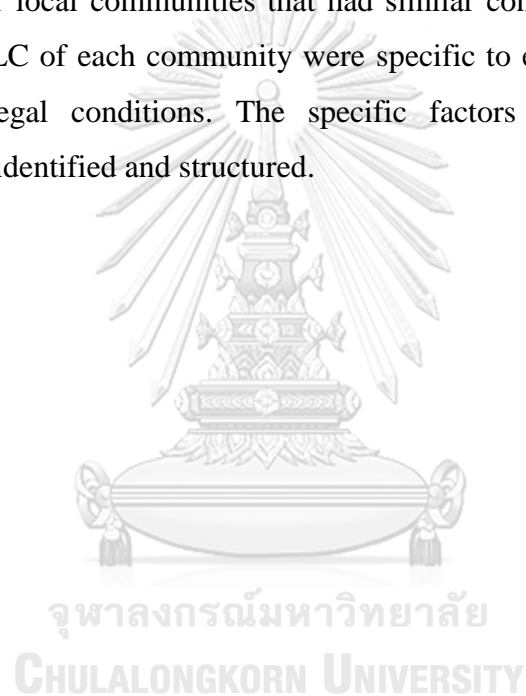
A local knowledge framework for SU of mangrove forest at KK sub-district was created (Figure 4.14) based on these major factors in the LKLC during two phases of mangrove stand initiation and young forest regrowth (Table 4.10). It was illustrated to demonstrate an interrelationship of factors on a process of local knowledge development which was specifically to KK sub-district. It consisted of two main parts including a process of the LKLC and major factors in the LKLC. The factors that mainly influenced two phases of LKLC included a common property right, changing of mangrove ecological production, income, employment and job opportunities, land use zoning, laws and regulations, trust and loyalty, volunteering participation, local knowledge application, scientific knowledge and technological support, budget and financial support, and human resources. They were not disappeared even though there was a change of ecological and social conditions. Some of them was emphasized by the local people. It implied that these factors were key conditions of local knowledge development that enhanced the KK community's capacity to restoring the mangrove ecosystem and SU of restored MGES.

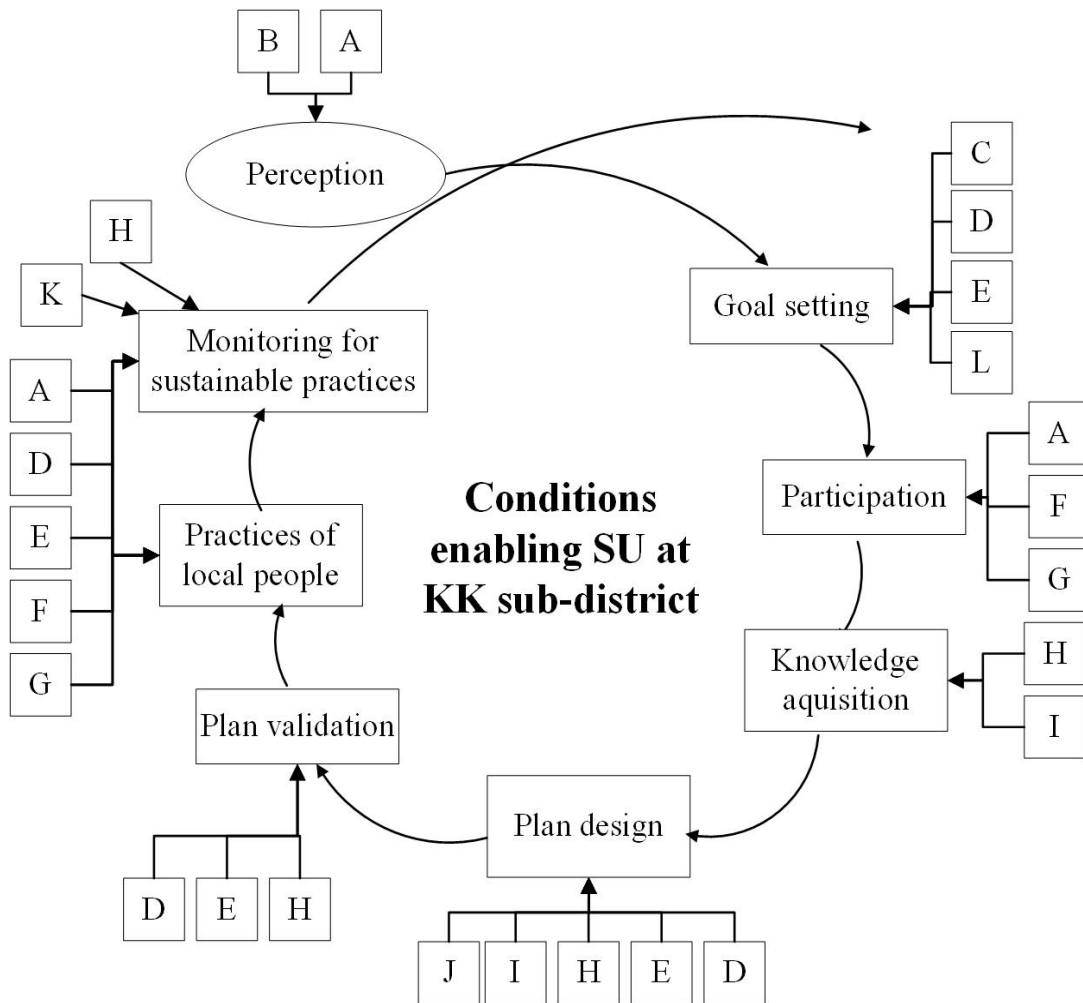
According to in-depth interview with chief executive of KKSABO and current village chiefs, they revealed that external threats such as solid waste, noise pollution and industrial development threatened the mangrove ecological production and local people's livelihood at KK sub-district. To address these incoming external threats, the village chiefs, local governmental agencies, and local people can apply the proposed local knowledge framework to develop a new phase of LKLC. They can take the major factors in the LKLC into account to develop their local knowledge and build their capacity to solve these problems.

The local philosophers and community enterprises revealed that a governmental projects named the Sustainable Village and Community Development by the King's Philosophy was conducted at KK sub-district to build the community's capacity. This governmental project aimed to reduce inequality for improving quality of life, generate income and provide job opportunities, and enhance a participation for problems solving and community's capacity building. It focused only social factors such as participation, employment and local knowledge application and economic factors such as income and debt. However, it ignored about emotional factors such as

trust and sense of ownership, ecological factors, and some managerial factors such as common property right and scientific and technological support which were found in this study as major factors in the LKLC for community development such as capacity building. Therefore, the major factors in the proposed local knowledge framework can be taken into account for building community's capacity and sustaining the local people's subsistence under the changing ecological, social, cultural and economic conditions.

However, this proposed local knowledge framework can be applied only at KK sub-district or local communities that had similar conditions because the major factors in the LKLC of each community were specific to ecological, social, cultural, economic, and legal conditions. The specific factors in the LKLC of those communities was identified and structured.





Note:

Major factors influencing the LKLC

- | | |
|--|---|
| A Common property right (sense of ownership) | F Trust and loyalty in HRH Princess Maha Chakri Sirindhorn and village chiefs |
| B Changing of mangrove ecological production | G Volunteering |
| C Income | H Local knowledge application |
| D Land use zoning for conservation and utilization | I Scientific knowledge and technological support |
| E Laws and regulations on mangrove forest, costal and marine resources | J Budget and financial support |
| K Human resources | |
| L Employment and job opportunities | |

Figure 4.14 A proposed local knowledge framework for sustainable utilization of mangrove forest at KK sub-district.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

This study was conducted to identify the factors in the LKLC during two phases of mangrove stand initiation stage and young forest regrowth stage at KK sub-district to create a local knowledge framework for the SU of MGES from restored mangrove forest. The study concluded key findings and offered implications and suggested a recommendation for future research.

5.1 Key Factors in the LKLC

Local knowledge life cycles (LKLC) played an important role during two phases of mangrove stand initiation for mangrove restoring (1990 - 2007) and young forest regrowth for maintaining means of daily support (2008 – present) at KK sub-district. It was developed by an influence of several specific factors. The factors in the LKLC were categorized into five groups based on their similar functions as shown in Table 5.1.

Table 5.1 Summary of Factors in the LKLC at KK Sub-district

Categories	Factors in LKLC at KK sub-district
Emotional factor	<ul style="list-style-type: none"> • Trust and loyalty in HRH Princess Maha Chakri Sirindhorn • Trust in village chiefs • Volunteering with altruism • Guilt • Sense of ownership
Ecological factor	<ul style="list-style-type: none"> • Mangrove forest areas • Mangrove ecosystem services • Tidal current • Wave and winds • Sedimentation
Social factor	<ul style="list-style-type: none"> • Social norms and values • Local knowledge application

Table 5.1 Summary of Factors in the LKLC at KK Sub-district (Cont.)

Categories	Factors in LKLC at KK sub-district
	<ul style="list-style-type: none"> • Employment and job opportunities • Public interest • Local livelihood
Economic factor	<ul style="list-style-type: none"> • Income
Managerial factor	<ul style="list-style-type: none"> • Forest reserve laws and marine and coastal protection act • Land use zoning • Common property right • Human resources • Budget and financial support • Scientific knowledge and technological support

5.1.1 Emotional factor

An emotional factor played important roles in the LKLC including a participation, practices, and monitoring of practices. It was categorized into three main groups including affiliative, normative and material motives.

The affective or affiliative motive was an important motive in the LKLC. It included a trust and loyalty in HRH Princess Maha Chakri Sirindhorn and village chiefs and a feeling of guilt. A major affective factor of the study was a trust and reverence of local people to HRH Princess Maha Chakri Sirindhorn. It was developed from a socialized charismatic leader of HRH Princess Maha Chakri Sirindhorn which showed a social tie of affection between the Thai people and royal family. A trustworthy characteristic of village chiefs including competence, integrity, and benevolence built an interpersonal trust between the local people and their village chiefs. A feeling of guilt also motivated the local people to participate in community's activities. It was developed from the local people's feeling of responsibilities and a close social connectedness among them.

An altruistic volunteering of local people in mangrove restoring activities was a normative motive which was developed from their sense of responsibility to the community. They decided to volunteer with and aim to restore the mangrove

ecological production for generating an income and sustaining their fishery occupation and local livelihood without regarding personal benefits or monetary rewards.

A sense of ownership of local people at KK sub-district was indirectly developed from an allocation of communal rights on mangrove forest to local people to harvest the MGES for food consumption and trade. It motivated the local people to voluntarily participated in mangrove restoring because the local people were aware that a restored mangrove forest finally returned them an income and local livelihood. It implied that the sense of ownership which was induced by the common property right became both affective and material or utilitarian incentives for volunteering.

5.1.2 Ecological factor

A perception of local fishermen during two phases of mangrove stand initiation and young forest regrowth was mainly influenced by a change of mangrove ecological production. A major change of mangrove ecosystem that was perceived by the fishermen was a reduction of mangrove provisioning services especially, seafood such as blood cockles, krill, and fishes. This impact was mostly mentioned by the fishermen because fishery resources were their main source of food and income. According to their perception, the former village chiefs and volunteering local fishermen initiated the mangrove restoring project to restore the MGES.

5.1.3 Social factor

Social factors of the study focused on local knowledge application, and employment and job opportunities. An application of local knowledge was generated from a local knowledge sharing and transfer through a participation of local people in designing and validating the mangrove restoring and the SU of restored MGES plan which was regarded as a bottom-up approach. It resulted in a restoration of mangrove ecological production for solving poverty and maintaining local fishery livelihood at KK sub-district.

An increasing employment and job opportunities implied an increasing income of local people at KK sub-district. After the mangrove ecological production was gradually restored, the utilization of mangrove cultural services for ecotourism

was initiated in 2007 to diversify an income and create new jobs and occupations for local people at KK sub-district. It resulted in a development of an ecotourism community enterprise to distribute income to participants. Several jobs such as boat rental service providers, cooking group, and mangrove seedlings nursery group were developed to separate tasks for specialized groups and to service the ecotourism.

5.1.4 Economic factor

An income was the only economic factor that influenced a goal setting in the phase II of young forest regrowth stage. It was increased after the mangrove ecological production was restored, and community-based mangrove ecotourism was initiated in 2007.

5.1.5 Managerial factor

Managerial factors including laws and regulations, land use zoning, common property right, and availability of working staffs were very important to regulate and support the sustainable mangrove forest utilization.

Forest reserve laws, marine and coastal resources protection act, cabinet resolutions related to a land use zoning for conservation and utilization areas were major factors that influenced the plan design, plan validation, implementation, and monitoring of practices in both two phases of stand initiation and young forest regrowth. These laws and regulations were enforced to control the local people's practices in order to avoid a creation of any disturbances on mangrove ecological functions.

A common property right was the most influencing factor on the local people's perception, their participation and practices as well as monitoring of their utilization. An allowance of local people to harvest the mangrove system services for generating income and sustaining their means of livings motivated them to perceive values of MGES and enhance their sense of ownership. Therefore, the common property right did not only focus on a self-interest in term of monetary benefits. It also involved with a creation of local people's sense of ownership of mangrove forest.

A human resource or working staffs was a key factor influencing the monitoring the local people's practices for sustainable utilization. There were several

groups of people who had different roles, functions, knowledge, and skills participated to follow up the mangrove restoring and SU of restored MGES. An engagement of these groups of people provided them opportunities to exchange and share their knowledge and skills for monitoring the utilization of mangrove forest in sustainable manner.

5.2 Major Factors in the LKLC Enabling the SU of Restored MGES

The major factors did not only influence the local knowledge development, but they also implied the SU of MGES at KK community (Table 5.2). They were used to create the local knowledge framework which can be applied to develop a new phase of LKLC in respond to the incoming external threats. These major factors can be used by the local governmental agencies, village chief, and local people to develop the local knowledge for community's capacity building under the change of ecological, social, cultural, economic and legal conditions.

Table 5.2 Summary of Major Factors Enabling the SU of MGES at KK Sub-district

Major factors in LKLC	Implication for SU
<p>A change of mangrove ecosystem services</p> <ul style="list-style-type: none"> • Raise the local people's awareness, perception, understanding, and sense of ownership on mangrove ecosystem 	<ul style="list-style-type: none"> • Mangrove ecological succession • Recovery of mangrove habitat and nursery function, reproductive function, and root system for trapping more sediment and increase of nutrients • Availability of planktons and other organic matter • Growth and survival of mangrove plants under the changing ecological conditions
<p>Common property right</p> <ul style="list-style-type: none"> • Regulate and monitoring behaviors and performances Enhance a sense of ownership • Increase land tenure and food security 	<ul style="list-style-type: none"> • Continuous restoration, conservation and SU of MGES • Fair and equitable sharing of benefits arising from the utilization of natural resources

Table 5.2 Summary of Major Factors Enabling the SU of MGES at KK Sub-district
(Cont.)

Major factors in LKLC	Implication for SU
<p>Trust and loyalty</p> <ul style="list-style-type: none"> • Encourage an interaction and participation among the people • Enhance an individual and group motivation and commitment 	<ul style="list-style-type: none"> • Participation of local people • Knowledge sharing and transfer • Reduce conflicts associated with mangrove management between governmental agencies and local community • Integration of traditional values, social norms, and local livelihood in a sustainable utilization plan
<p>Volunteering with altruism</p> <ul style="list-style-type: none"> • Influence and regulate the local people's behavior • Strengthen a social relation and interaction 	<ul style="list-style-type: none"> • Become a community's norms • Participation of local people • Awareness of public interest • Sense of community and ownership
<p>Local knowledge application</p> <ul style="list-style-type: none"> • Adapt the utilizing activities of MGES under the changing conditions 	<ul style="list-style-type: none"> • Adaptability of practices for sustainable utilization under the ecological, social, cultural and economic change • Motivate local people's participation • Reduce conflicts associated with mangrove management between governmental agencies and local community
<p>Scientific knowledge and technological support</p> <ul style="list-style-type: none"> • Support the utilizing activities of MGES in sustainable manner 	<ul style="list-style-type: none"> • Creation of new knowledge and techniques for dealing with change of ecological, social and cultural conditions • Address with problems specifically to community through integrating with local knowledge

Table 5.2 Summary of Major Factors Enabling the SU of MGES at KK Sub-district (Cont.)

Major factors in LKLC	Implication for SU
Employment and job opportunities <ul style="list-style-type: none"> • Provide income and sustain local people's livelihood 	<ul style="list-style-type: none"> • Various sources of income • Increasing income
Income <ul style="list-style-type: none"> • Sustain local people's livelihood 	<ul style="list-style-type: none"> • Existence of mangrove ecological production • Availability of aquatic animals for trading • Increasing job opportunities
Land use zoning <ul style="list-style-type: none"> • Determine and control the practices of local people 	<ul style="list-style-type: none"> • The SU of MGES for seafood consumption and trade, and ecotourism
Laws and regulations <ul style="list-style-type: none"> • Control the practices of local people 	<ul style="list-style-type: none"> • The SU of MGES for seafood consumption and trade, and ecotourism
Availability of working staffs <ul style="list-style-type: none"> • Support and monitoring of mangrove restoring and utilization 	<ul style="list-style-type: none"> • Continuous process of monitoring of the local people's utilization of restored mangrove forest
Budget and financial support <ul style="list-style-type: none"> • Support an operation of staffs and activities 	<ul style="list-style-type: none"> • Creation of activities or projects for mangrove conservation and sustainable utilization • Continuous process of monitoring of the local people's utilization of restored mangrove forest

5.3 Recommendations from Research Findings

Regarding the factors in the LKLC and local knowledge framework for SU of MGES, the recommended actions to maintain the mangrove ecological production and sustain the local fishery livelihood at KK sub-district included as follow:

- Applying a trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn to encourage the local people's participation, adaptation, and monitoring their practices for SU of restored MGES.
- Building trust between local people and governmental agencies through developing leadership characteristics in governmental officials.
- Enhancing the local people's sense of ownership on mangrove through allowing them in decision making, planning, and monitoring mangrove management.
- Integrating the local knowledge on mangrove ecosystem in policies and plan for mangrove management by taking the major factors in the proposed local knowledge framework into account.
- Building a community capacity to restore and utilize the MGES in sustainable manner by taking the major factors in the proposed local knowledge framework into account.

5.4 Suggestions for KK Sub-district

The local knowledge development during two phases of mangrove stand initiation and young forest regrowth is recognized as effective tool for mangrove restoration and SU of MGES at KK sub-district. According to the field observation and in-depth interview, the local people concerned that the mangrove forest and utilization of restored MGES were threatened by external threats such as wastewater, industrial development, urban expansion, and climate change impacts. As a result, the local knowledge has to be continuously developed to fill this gap for conserving the mangrove ecosystem and sustaining the local people's livelihood. The local knowledge framework can be applied to develop a new cycle of local knowledge to deal with these external threats by considering the major factors in the LKLC.

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APPENDICES

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

APPENDIX A

FISHERY HOUSEHOLD QUESTIONNAIRE

แบบสอบถามเลขที่.....

Questionnaire number.....

แบบสอบถาม

Survey Questionnaire

เรื่อง กรอบองค์ความรู้ท้องถิ่นเพื่อการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืน:
กรณีศึกษา ตำบลคลองโคน อำเภอเมือง จังหวัดสมุทรสงคราม ประเทศไทย

Local Knowledge Framework for Sustainable Utilization of Mangrove Forest:

A Case Study of Klong Khone Sub-district, Mueang District, Samut Songkhram Province,
Thailand

คำชี้แจง

Instruction

1. แบบสอบถามนี้จัดทำขึ้นโดย นางสาว วิภาพรรณ อดุลย์เจริญ นิสิตปริญญาเอก สาขาสิ่งแวดล้อม การพัฒนา และความยั่งยืน บัณฑิตวิทยาลัย จุฬาลงกรณ์มหาวิทยาลัย

This questionnaire is a part of dissertation research which is developed by Miss Wipapan Adulcharoen, a doctoral candidate in the Environment, Development and Sustainability Program at Chulalongkorn University.

2. วัตถุประสงค์ เพื่อสอบถามความคิดเห็นของชาวประมง 140 คนเกี่ยวกับปัจจัยต่างๆ ที่มีผลต่อการพัฒนาองค์ความรู้ท้องถิ่นเพื่อการฟื้นฟูและใช้ประโยชน์จากป่าชายเลน ภายใต้วิทยานิพนธ์เรื่อง กรอบองค์ความรู้ท้องถิ่นเพื่อการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืน: กรณีศึกษา ตำบลคลองโคน อำเภอเมือง จังหวัดสมุทรสงคราม ประเทศไทย

The purpose of this questionnaire is to survey thought and attitudes of stakeholders involving with mangrove restoration and conservation towards local knowledge for sustainable utilization of mangrove forest as a part of the study of Local Knowledge Framework for Sustainable Utilization of Mangrove Forest: A Case Study of Klong Khone Sub-district, Mueang District, Samut Songkhram Province, Thailand.

3. แบบสอบถามประกอบไปด้วยคำถาม 4 ตอน มีทั้งหมด 14 หน้า โปรดตอบทุกข้อ

This questionnaire consists of 4 sections for 14 pages. Please answer all question.

ข้อมูลที่ท่านให้ไว้ในแบบสอบถามนี้ ทั้งข้อมูลส่วนบุคคล และข้อคิดเห็นต่าง ๆ ผู้ศึกษาจะนำมาวิเคราะห์และประมวลผล เพื่อประกอบการศึกษาสำหรับวิทยานิพนธ์นี้เท่านั้น

Your answers in this questionnaire both private information and attitudes will be analyzed and processed to specifically support this dissertation.

ผู้ศึกษาขอขอบคุณที่ท่านให้ความร่วมมือเป็นอย่างดีในการตอบแบบสอบถามครั้งนี้

Your cooperation in this research is greatly appreciated.

ขอแสดงความนับถือ

Yours sincerely,

นางสาว วิภาพรรณ อุดุลย์เจริญ

Miss Wipapan Adulcharoen

คำชี้แจง แบบสอบถามฉบับนี้แบ่งออกเป็น 4 ตอน ได้แก่

Instruction: This questionnaire consists of 4 sections including:

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม จำนวน 6 ข้อ

Section 1 General information of respondents including 6 questions.

ตอนที่ 2 การใช้ทรัพยากรป่าชายเลนของคนในชุมชนคลองโคกนาค จำนวน 2 ข้อ

Section 2 Utilization of mangrove ecosystem services of local people at Klong Khone sub-district including 2 questions

ตอนที่ 3 ปัจจัยที่บ่งบอกถึงการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนของคนในชุมชนคลองโคกนาค จำนวน 24 ข้อ

Section 3 Factors indicating the sustainable utilization of mangrove resources of local people at Klong Khone sub-district including 24 questions

ตอนที่ 4 ปัจจัยที่มีอิทธิพลต่อการพัฒนาองค์ความรู้ท้องถิ่น จำนวน 8 ตอนย่อย

Section 4 Factors influencing the local knowledge development including 8 sub-sections

ตอนที่ 1 ข้อมูลทั่วไปของผู้ตอบแบบสอบถาม

Section 1 General information of respondents

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ และ โปรดเติมคำตอบลงในช่องว่าง

Instruction: Please putting a check X mark in for your answer and please fill your answer in a blank

1. เพศ (Sex) ชาย (Male) หญิง (Female)
2. อายุ (Age).....ปี (years old)
3. ท่านเกิดและเติบโตในชุมชนคลองโคกนหรือไม่ ใช่ (Yes) ไม่ใช่ (No)
Are you born and grow up in Klong Khone sub-district?
4. วุฒิการศึกษาสูงสุด (Level of education)
 - ประถมศึกษา (Primary school)
 - มัธยมศึกษา/อาชีวศึกษา (High school)
 - ปริญญาตรีหรือเทียบเท่า (Bachelor degree)
 - ปริญญาโทหรือสูงกว่า (Master degree or higher)
 - อื่นๆ (โปรดระบุ) (Others, please identify).....

ตอนที่ 2 การใช้ทรัพยากรป่าชายเลนของคนในชุมชนคลองโคก

**Section 2 Utilization of mangrove ecosystem services of local people at Klong Khone
sub-district**

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ในช่วงก่อนการฟื้นฟูป่าชายเลน ปี พ.ศ. 2533 ท่านได้ใช้ประโยชน์จากป่าชายเลนในเรื่องใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

What kinds of the mangrove provisioning and cultural services were utilized before a mangrove restoration by mangrove planting in 1990? (select to answer more than 1 choice)

- เป็นแหล่งหาอาหาร เช่น กุ้ง หอย ปู ปลา เคย
Source of food such as shrimps, cockles, crap, fish, and krill
- เป็นสมุนไพรรักษาโรค (Biochemical)
- ใช้เผาถ่าน และเป็นไม้ฟืน (Fuelwood)
- ใช้ไม้สำหรับสร้างบ้านเรือน (Fiber)
- ใช้เมล็ดหรือฝักมาปลูกเพื่อขยายพันธุ์ไม้ชายเลน (Mangrove seedlings plant propagation)
- ใช้เพาะเลี้ยงสัตว์น้ำ เช่น กุ้ง หอยแครง หอยแมลงภู่
Aquaculture such as shrimp, blood cockle, and mussel
- ใช้ประกอบพิธีกรรมทางศาสนาและความเชื่อ (Religious rituals and beliefs)
- เป็นแหล่งเรียนรู้อาชีพและวิถีชีวิตของคนในชุมชน
Mangrove and local people's livelihood educational area
- เป็นสถานที่ท่องเที่ยว (Tourism)
- อื่นๆ (โปรดระบุ).....
Others (please identify).....

2. ในช่วงหลังการฟื้นฟูป่าชายเลน ตั้งแต่ ปี พ.ศ. 2534 จนถึงปัจจุบัน ท่านได้ใช้ประโยชน์จากป่าชายเลนในเรื่องใดบ้าง (ตอบได้มากกว่า 1 ข้อ)

What kinds of the mangrove provisioning and cultural services were utilized after a mangrove restoration from 1991 to present? (select to answer more than 1 choice)

- เป็นแหล่งหาอาหาร เช่น กุ้ง หอย ปู ปลา เคย
Source of food such as shrimps, cockles, crap, fish, and krill
- เป็นสมุนไพรรักษาโรค (Biochemical)
- ใช้เผาถ่าน และเป็นไม้ฟืน (Fuelwood)
- ใช้ไม้สำหรับสร้างบ้านเรือน (Fiber)
- ใช้เมล็ดหรือฝักมาปลูกเพื่อขยายพันธุ์ไม้ชายเลน (Mangrove seedlings plant propagation)
- ใช้เพาะเลี้ยงสัตว์น้ำ เช่น กุ้ง หอยแครง หอยแมลงภู่
Aquaculture such as shrimp, blood cockle, and mussel
- ใช้ประกอบพิธีกรรมทางศาสนาและความเชื่อ (Religious rituals and beliefs)
- เป็นแหล่งเรียนรู้ป่าชายเลนและวิถีชีวิตของคนในชุมชน
Mangrove and local people's livelihood educational area
- เป็นสถานที่ท่องเที่ยว (Tourism)
- อื่นๆ (โปรดระบุ).....
Others (please identify).....

ตอนที่ 3 ปัจจัยที่บ่งบอกถึงการใชัทรัพยากรป่าชายเลนอย่างยั่งยืนของคนในชุมชนคลองโคก

Section 3 Factors indicating the sustainable utilization of mangrove resources of local people at Klong Khone sub-district

คำชี้แจง กรุณาทำเครื่องหมาย X ลงในช่อง ใช่ หรือ ไม่ใช่ หรือ ไม่รู้ เพียงช่องเดียว
เมื่อท่านอ่านข้อความในแต่ละข้อ

Instruction: Please putting a check X mark in a block of Yes or No or Do not know only one block after you read each sentence

<p>ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p>Your attitudes after reading these following sentences</p>	<p>ใช่</p> <p>Yes</p>	<p>ไม่ใช่</p> <p>No</p>	<p>ไม่รู้</p> <p>Don't know</p>
<p>1. ท่านยังคงสามารถหาเมล็ดพันธุ์และฝักโกงกางตามธรรมชาติเพื่อนำไปปลูกและเจริญเติบโตต่อไปได้</p> <p>You still can find natural mangrove seedlings and propagules for planting.</p>			
<p>2. มีสัตว์น้ำในป่าชายเลนเพียงพอให้ท่านจับเพื่อกิน ขาย และเพาะพันธุ์ต่อไป</p> <p>There are sufficient aquatic animals to harvest for consuming, selling and propagating.</p>			
<p>3. ดินตะกอนในป่าชายเลนมีปริมาณเพิ่มขึ้น</p> <p>Sediment on mangrove coastal area is increased.</p>			
<p>4. ผลจากการฟื้นฟูและอนุรักษ์ป่าชายเลนทำให้คนในชุมชนมีอาชีพ</p> <p>After restoring and conserving the mangrove forest, the local people have more occupations.</p>			
<p>5. มีการนำองค์ความรู้ท้องถิ่นเกี่ยวกับป่าชายเลนของชุมชนมาใช้ในการฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>A local knowledge on mangrove forest is applied in mangrove restoration and conservation.</p>			
<p>6. ป่าชายเลนเป็นสมบัติของคนในชุมชนที่ต้องช่วยกันฟื้นฟูและอนุรักษ์</p> <p>A mangrove forest is a property of local people that has to be restored and conserved.</p>			

<p style="text-align: center;">ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้ Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>7. คนในชุมชนมีส่วนร่วมในการฟื้นฟูและอนุรักษ์ป่าชายเลน Local people participated in mangrove restoration and conservation.</p>			
<p>8. ผู้นำชุมชนเป็นคณริเริ่มและชักชวนให้คนในชุมชนเข้าร่วมการฟื้นฟูและอนุรักษ์ป่าชายเลน A village chief is an initiator who persuaded the local people to participate in mangrove restoration and conservation.</p>			
<p>9. มีการตั้งกลุ่มฟื้นฟูและอนุรักษ์ป่าชายเลนภายในชุมชน There is an establishment of mangrove forest conservation groups in community.</p>			
<p>10. มีการสร้างเครือข่ายความร่วมมือกับหน่วยงานรัฐ บริษัทเอกชน สถาบันการศึกษา และองค์กรต่างประเทศ เพื่อการฟื้นฟูและอนุรักษ์ป่าชายเลน There is a network building with governmental agencies, private companies, academic institutions, and foreign organizations to restore and conserve the mangrove forest.</p>			
<p>11. มีข้อตกลงร่วมกันในชุมชนว่าจะช่วยกันฟื้นฟูและอนุรักษ์ป่าชายเลน There is a community commitment to coordinately restore and conserve mangrove forest.</p>			
<p>12. การศึกษาช่วยให้คนรับรู้คุณค่าของการฟื้นฟูและอนุรักษ์ป่าชายเลน An education raises the people to perceive values of mangrove restoration and conservation.</p>			
<p>13. ผู้นำชุมชน หน่วยงานรัฐ เอกชน หรือสถาบันการศึกษา ช่วยทำให้คนในชุมชนเห็นความสำคัญของการฟื้นฟูและอนุรักษ์ป่าชายเลน Village chiefs, state and private agencies or academic institutions supported the local people to perceive an importance of mangrove restoration and conservation.</p>			
<p>14. การฟื้นฟูและอนุรักษ์ป่าชายเลนทำให้คนในชุมชนที่เคยออกไปหางานทำนอก</p>			

<p style="text-align: center;">ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้ Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>ชุมชนกลับมาทำงานในชุมชนและอาศัยอยู่กับครอบครัว</p> <p>A restoration and conservation of mangrove forest induces the local people, who used to find jobs and work outside the community, return to work in community and stay with their family.</p>			
<p>15. ท่านมีรายได้เพิ่มขึ้นจากการใช้ทรัพยากรป่าชายเลนที่ได้รับการฟื้นฟู</p> <p>You obtain an increasing income from utilization of restored mangrove resources.</p>			
<p>16. การตั้งกลุ่มวิสาหกิจชุมชนทำให้เกิดการจ้างงานและกระจายรายได้ให้แก่คนในชุมชน</p> <p>An establishment of community enterprises resulted in an employment and distribution of income to local people in community.</p>			
<p>17. ท่านช่วยฟื้นฟูและอนุรักษ์ป่าชายเลนด้วยความเต็มใจ</p> <p>You willingly assist the mangrove restoration and conservation.</p>			
<p>18. ท่านช่วยฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านเชื่อว่ามีสิ่งศักดิ์สิทธิ์ในป่าชายเลน</p> <p>You assist the mangrove restoration and conservation because you believe that there is a sacred thing in the mangrove forest.</p>			
<p>19. ถ้าคนใดบุกรุกหรือทำลายป่าชายเลน คนๆ นั้นจะถูกกล่าวหาหรือลงโทษโดยคนในชุมชน</p> <p>If anyone encroach or destroy the mangrove forest, they will be reprimanded or punished by the local people.</p>			
<p>20. มีการบังคับใช้กฎหมายลงโทษคนที่ทำให้ป่าชายเลนเสื่อมโทรม</p> <p>There is an enforcement of laws to punish the people who destroy the mangrove forest.</p>			
<p>21. มีนโยบายของรัฐสนับสนุนให้คนในชุมชนช่วยกันฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>There is a governmental policy supporting the local people to restore and</p>			

<p>ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p>Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
conserve the mangrove forest.			
<p>22. มีการให้เงินทุนและเทคโนโลยีเพื่อสนับสนุนการฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>There is a financial and technological support for mangrove restoration and conservation.</p>			
<p>23. การร่วมแรงกันของคนในชุมชนเป็นส่วนสำคัญที่ช่วยให้ป่าชายเลนได้รับการฟื้นฟูและอนุรักษ์</p> <p>A collaboration of local people is an important mechanism that supports the mangrove restoration and conservation.</p>			
<p>24. มีการแบ่งเขตการใช้ประโยชน์ป่าชายเลนเพื่อการฟื้นฟูและใช้ป่าชายเลน</p> <p>There is a land use zoning of mangrove forest for restoration and utilization</p>			

ตอนที่ 4 ปัจจัยที่มีอิทธิพลต่อการพัฒนาองค์ความรู้ท้องถิ่น

Section 4 Factors influencing the local knowledge development

ตอนที่ 4.1 การรับรู้และการตระหนักของท่านต่อการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.1 Perception and awareness toward restoration and sustainable utilization of mangrove resources

คำชี้แจง กรุณาทำเครื่องหมาย X ลงในช่อง ใช่ หรือ ไม่ใช่ หรือ ไม่รู้ เพียงช่องเดียว เมื่อท่านอ่านข้อความในแต่ละข้อ

Instruction: Please putting a check X mark in a block of Yes or No or Do not know only one block after you read each sentence

<p>ความรู้สึของท่านเมื่อได้อ่านข้อความดังต่อไปนี้ Your attitudes after reading these following sentences</p>	<p>ใช่ Yes</p>	<p>ไม่ใช่ No</p>	<p>ไม่รู้ Don't know</p>
<p>1. ผู้ชายและผู้หญิงในชุมชนสามารถรับรู้ถึงคุณค่าของป่าชายเลนแตกต่างกัน Men and women in community can differently perceive values of mangrove forest.</p>			
<p>2. ผู้สูงอายุมักจะรับรู้ถึงคุณค่าของป่าชายเลนมากกว่าเด็กหรือคนหนุ่มสาว Elders perceive values of mangrove forest higher than adolescents.</p>			
<p>3. คนที่เกิดและเติบโตในชุมชนจะรับรู้ถึงคุณค่าของป่าชายเลนมากกว่าคนที่เกิดและเติบโตนอกชุมชน People who born and grew up in community perceive values of mangrove forest higher than outsiders.</p>			
<p>4. การลดลงของป่าชายเลนส่งผลต่อวิถีชีวิต อาชีพ และรายได้ของท่าน A reduction of mangrove forest affected your livelihood, occupation and income.</p>			
<p>5. คนที่คอยอาสาช่วยเหลือกิจกรรมฟื้นฟูป่าชายเลนเป็นเพราะคนๆ นั้นรับรู้ถึงคุณค่าของป่าชายเลน People volunteer in mangrove restoration activities because they perceive values of mangrove forest.</p>			

<p>ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p>Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>6. ชุมชนมีการสร้างและปลูกฝังให้คนในชุมชนรู้ถึงคุณค่าของป่าชายเลน</p> <p>A community build and educate the local people to perceive values of mangrove forest.</p>			
<p>7. ระดับการศึกษาทำให้คนแต่ละคนสามารถรับรู้ถึงคุณค่าของป่าชายเลนแตกต่างกัน</p> <p>An education level affects an individual's different perception on values of mangrove forest.</p>			
<p>8. คนที่มีอาชีพเกี่ยวกับการใช้ทรัพยากรป่าชายเลนจะรับรู้ถึงคุณค่าของป่าชายเลนมากกว่าคนที่ทำอาชีพอื่น</p> <p>People, who have occupation involved with a utilization of mangrove resources, perceive values of mangrove forest higher than other occupations.</p>			
<p>9. คนที่มีตำแหน่งหน้าที่เกี่ยวกับการจัดการป่าชายเลนจะรับรู้ถึงความสำคัญของป่าชายเลนมากกว่าคนที่ไม่ได้มีตำแหน่งหน้าที่เกี่ยวข้อง</p> <p>People, who have roles and responsibilities involved with mangrove forest management, perceive values of mangrove forest higher than other people who are not involved.</p>			
<p>10. การลดลงของป่าชายเลนและสัตว์น้ำ ทำให้ท่านรับรู้ถึงความสำคัญของการฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>A reduction of mangrove forest and aquatic animals raises your perception on an importance of mangrove restoration and conservation.</p>			
<p>11. เมื่อป่าชายเลนลดลงทำให้คลื่นลมทะเลที่พัดเข้าฝั่งมีความรุนแรงมากขึ้น ทำให้ท่านรับรู้ถึงความสำคัญของการฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>You perceive an importance of mangrove restoration and conservation after the mangrove forest was reduced and sea wave</p>			

<p>ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p>Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
and wind on a coastal area were more intense.			
<p>12. ตั้งแต่ปี พ.ศ. 2533 ที่มีการฟื้นฟูป่าชายเลนจนถึงปัจจุบัน พื้นที่ป่าชายเลนเพิ่มขึ้นเรื่อยๆ</p> <p>Since there was a mangrove restoration in 1990 to present, the mangrove forest areas have continuously expanded.</p>			
<p>13. คนที่อาศัยอยู่ในบ้านที่ตั้งอยู่ใกล้ป่าชายเลนสามารถรับรู้ถึงการเปลี่ยนแปลงของป่าชายเลนได้เร็วกว่าคนที่อาศัยอยู่บ้านที่ตั้งอยู่ไกล</p> <p>People who live in a house that located near the mangrove forest can perceive a change of mangrove forest faster than people who live in houses that located far away.</p>			
<p>14. ป่าชายเลนถือเป็นพื้นที่สาธารณะและเป็นสมบัติที่คนในชุมชนต้องช่วยกันดูแล</p> <p>A mangrove forest is a public area and property that local people have to coordinately take care.</p>			

ตอนที่ 4.2 เป้าหมายของการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.2 Goal of mangrove restoration and sustainable utilization of mangrove resources

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ท่านคิดถึงผลที่จะได้ก่อนที่จะเริ่มปลูกป่าชายเลนหรือไม่

Do you expect about an outcome from mangrove restoring before planting mangrove forest?

คิด

ไม่คิด (ถ้าตอบ ไม่คิด ให้ข้ามไปตอบคำถามในข้อ 5)

Yes

No (If answer No please skip to answer a question no. 5)

2. ก่อนการปลูกป่าชายเลน นอกจากท่านจะต้องคิดถึงผลที่จะได้จากการปลูกป่าชายเลนแล้ว มีสิ่งอื่นใดต่อไปนี่ที่ท่านต้องนึกถึงอีกบ้าง (ตอบได้มากกว่า 1 ข้อ)

Do you think about other things further than an outcome from mangrove restoring activities before mangrove planting? (select to answer more than 1 choice)

นโยบายรัฐ

State policies

กฎหมายและข้อบังคับ

Laws and regulations

ข้อกำหนดของชุมชน

Community's rules

งบประมาณค่าใช้จ่าย

Budget and expense

เครื่องมือและเทคโนโลยีที่ใช้

Instruments and technologies

พื้นที่ป่าชายเลนที่ต้องการฟื้นฟู

Selected mangrove forest areas for restoration

ฤดูกาล

Season

น้ำขึ้นน้ำลง

Tidal currents

ความร่วมมือจากคนในชุมชน หน่วยงานรัฐ เอกชน และสถาบันการศึกษา

A collaboration of local people, governmental agencies, private companies, and academic institutions

การประยุกต์ใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน

An application of local people's knowledge on mangrove forest

อื่นๆ (โปรดระบุ).....

Others (please identify).....

3. มีคนกลุ่มอื่นมาช่วยท่านคิดเกี่ยวกับผลที่จะได้จากการปลูกป่าชายเลนหรือไม่

Are there other groups of people assist you to set a goal or outcome from mangrove restoring?

มี

ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามข้อที่ 5)

Yes

No (If answer No please skip to answer a question no. 5)

4. มีคนกลุ่มใดบ้างที่มาช่วยท่านคิดเกี่ยวกับผลที่จะได้จากการปลูกป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to set a goal or outcome from mangrove restoring? (select to answer more than 1 choice)

คนในชุมชน

Local people

ผู้นำชุมชน

Village chiefs

หน่วยงานรัฐ

Governmental agencies

โรงเรียน หรือสถาบันการศึกษา

Schools or academic institutions

บริษัทเอกชน

Private companies

อื่นๆ (โปรดระบุ).....

Others (please identify).....

5. ก่อนที่ท่านจะใช้ทรัพยากรป่าชายเลนในแต่ละครั้ง ท่านคิดก่อนหรือไม่ว่าท่านจะใช้อะไรในปริมาณเท่าใด

Do you think about mangrove resources and its required quantities before utilizing mangrove resources?

คิด

ไม่คิด (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.3)

Yes

No (If answer No please skip to answer questions in section 4.3)

6. ในการใช้ทรัพยากรป่าชายเลนในแต่ละครั้ง ท่านต้องคิดถึงสิ่งใดต่อไปนี้บ้าง (ตอบได้มากกว่า 1 ข้อ)

What are following things that you concern about when utilizing mangrove resources?

(select to answer more than 1 choice)

- | | |
|--|---|
| <input type="checkbox"/> นโยบายรัฐ
State policies | <input type="checkbox"/> กฎหมายและข้อบังคับ
Laws and regulations |
| <input type="checkbox"/> ข้อกำหนดของชุมชน
Community's rules | <input type="checkbox"/> งบประมาณค่าใช้จ่าย
Budget and expense |
| <input type="checkbox"/> เครื่องมือและเทคโนโลยีที่ใช้
Instruments and technologies | |
| <input type="checkbox"/> พื้นที่ป่าชายเลนที่สามารถเข้าไปใช้ประโยชน์ได้
Mangrove forest areas for utilization | |
| <input type="checkbox"/> ความร่วมมือจากคนในชุมชน หน่วยงานรัฐ เอกชน และสถาบันการศึกษา
A collaboration of local people, governmental agencies, private companies, and academic institutions | |
| <input type="checkbox"/> รายได้ที่ต้องการ
Expected income | <input type="checkbox"/> ฤดูกาล
Season |
| <input type="checkbox"/> น้ำขึ้นน้ำลง
Tidal currents | <input type="checkbox"/> อื่นๆ (โปรดระบุ).....
Others (please identify)..... |

ตอนที่ 4.3 การมีส่วนร่วมของท่านในการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน
Section 4.3 Participation in mangrove restoration and sustainable utilization of mangrove resources

ตอนที่ 4.3.1 ปัจจัยที่มีอิทธิพลต่อการมีส่วนร่วมของท่านในการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Sub-section 4.3.1 Factors influencing your participation in mangrove restoration and sustainable utilization of mangrove resources

คำชี้แจง กรุณาทำเครื่องหมาย X ลงในช่อง ใช่ หรือ ไม่ใช่ หรือ ไม่รู้ เพียงช่องเดียว
เมื่อท่านอ่านข้อความในแต่ละข้อ

Instruction: Please putting a check X mark in a block of Yes or No or Do not know only one block after you read each sentence

ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้ Your attitudes after reading these following sentences	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
1. ท่านคอยอาสาช่วยเหลือและเข้าร่วมกิจกรรมที่เกี่ยวกับการฟื้นฟูและอนุรักษ์ป่าชายเลนอยู่เสมอ You always voluntarily assist and participate in activities involving mangrove restoration and conservation.			
2. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลนเพราะท่านรู้ว่ากิจกรรมนี้จะให้ประโยชน์แก่ชุมชน You participate in mangrove restoration and conservation activities because you know that these activities will provide benefit to the community.			
3. ท่านจะรู้สึกผิด ถ้าท่านไม่เข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน You will have a feeling of guilt, if you do not participate in mangrove restoration and conservation activities.			
4. ท่านจะได้รับการยอมรับและชื่นชม ถ้าท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน You will be acknowledged and admired, if you participate in mangrove restoration and conservation activities.			

<p style="text-align: center;">ความรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้ Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>5. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านกลัวการถูกต้อว่าหรือนินทา</p> <p>You participate in mangrove restoration and conservation activities because you are afraid of reprimand or condemnation</p>			
<p>6. ท่านจะเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน ถ้าคนที่ชักชวนท่านเป็นคนที่ท่านเชื่อถือ</p> <p>You will participate in mangrove restoration and conservation activities, if a persuader is your trusted person.</p>			
<p>7. ท่านจะเข้าร่วมกิจกรรมการฟื้นฟูและอนุรักษ์ป่าชายเลน ถ้าคนที่ชักชวนท่านเป็นคนมีความรู้และความเชี่ยวชาญเกี่ยวกับป่าชายเลน</p> <p>You will participate in mangrove restoration and conservation activities, if a persuader has knowledge and expertise in mangrove forest.</p>			
<p>8. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านเห็นว่ามีคนในชุมชนหลายคนเข้าร่วม</p> <p>You participate in mangrove restoration and conservation activities because other local people participate.</p>			
<p>9. การเสด็จมาทรงปลูกป่าชายเลนของสมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี ทำให้ท่านเข้าร่วมการฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>A royal visit of Her Royal Highness Princess Maha Chakri Sirindhorn for mangrove planting motivate you to participate in mangrove restoration and conservation.</p>			
<p>10. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านเคารพและเชื่อถือในผู้ว่าราชการจังหวัดที่เข้ามาสนับสนุนการฟื้นฟูป่าชายเลน</p> <p>You participate in mangrove restoration and conservation activities because you respect and trust in former provincial governor who supported a mangrove restoration.</p>			

<p style="text-align: center;">ความรู้สึกรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p style="text-align: center;">Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>11. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านเคารพและเชื่อถือในผู้นำชุมชนที่ริเริ่มและสนับสนุนการฟื้นฟูป่าชายเลน</p> <p>You participate in mangrove restoration and conservation activities because you respect and trust in former village chiefs who initiated and supported a mangrove restoration.</p>			
<p>12. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านเชื่อว่าป่าชายเลนมีสิ่งศักดิ์สิทธิ์คุ้มครอง</p> <p>You participate in mangrove restoration and conservation activities because you believe that the mangrove forest is protected by sacred things.</p>			
<p>13. มีผู้นำชุมชนและผู้ว่าราชการจังหวัดเข้ามาพูดจาชักชวน ทำให้ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>A persuasive conservation of village chief or provincial governor influence your participation in mangrove restoration and conservation activities.</p>			
<p>14. ผู้ชายและผู้หญิงมีความสนใจเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลนแตกต่างกัน</p> <p>Men and women have different interest to participate in mangrove restoration and conservation activities.</p>			
<p>15. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะ ท่านถูกปลูกฝังให้รู้จักคุณค่าของป่าชายเลน</p> <p>You participate in mangrove restoration and conservation activities because you are nurtured to be aware of values of mangrove forest.</p>			
<p>16. ระดับการศึกษาของท่านมีผลต่อการตัดสินใจในการเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน</p>			

<p>ความรู้สึกรู้สึกของท่านเมื่อได้อ่านข้อความดังต่อไปนี้</p> <p>Your attitudes after reading these following sentences</p>	ใช่ Yes	ไม่ใช่ No	ไม่รู้ Don't know
<p>Your education level affect to your decision in participating the mangrove restoration and conservation activities.</p>			
<p>17. มีนโยบายของรัฐกระตุ้นให้ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>There is a state policy that stimulate you to participate in mangrove restoration and conservation activities.</p>			
<p>18. มีการใช้กฎหมายบังคับให้ท่านต้องเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>There are laws and regulations enforcing you to participate in mangrove restoration and conservation activities.</p>			
<p>19. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลนโดยไม่หวังรางวัลหรือค่าจ้างตอบแทน</p> <p>You participate in mangrove restoration and conservation activities without expecting rewards or monetary benefits.</p>			
<p>20. ท่านตัดสินใจเข้าร่วมกิจกรรม เพราะท่านได้รับฟังข้อมูลข่าวสารเกี่ยวกับประโยชน์ของกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน</p> <p>You decide to participate in mangrove restoration and conservation activities because you received information about its benefits.</p>			
<p>21. ท่านเข้าร่วมกิจกรรมฟื้นฟูและอนุรักษ์ป่าชายเลน เพราะท่านถือว่าป่าชายเลนเป็นสมบัติของชุมชนที่ต้องช่วยกันดูแลรักษา</p> <p>You participate in mangrove restoration and conservation activities because the mangrove forest is community's property which has to be protected.</p>			

ตอนที่ 4.3.2 ลักษณะของผู้นำที่มีผลต่อความไว้วางใจเชื่อใจของคนในชุมชน

Sub-section 4.3.2 Leadership characteristics influencing trust of local people

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ท่านคิดว่าลักษณะของผู้นำลักษณะใดที่ทำให้ท่านเชื่อใจ และพร้อมที่จะทำตามคำชักชวนด้วยความเต็มใจ (ตอบได้มากกว่า 1 ข้อ)

What kind of leadership characteristics that build your trust and motivate you to willingly follow their persuasion? (select to answer more than 1 choice)

- | | |
|---|---|
| <input type="checkbox"/> มีความเมตตากรุณา
Benevolence | <input type="checkbox"/> มีความรู้ความสามารถ
Competence |
| <input type="checkbox"/> มีความซื่อสัตย์
Integrity | <input type="checkbox"/> มีความยุติธรรม
Justice |
| <input type="checkbox"/> มีความเอื้อเฟื้อเผื่อแผ่
Hospitality | <input type="checkbox"/> มีความขยันและมุ่งมั่น
Diligence |
| <input type="checkbox"/> เป็นกันเองและไม่ถือตัว
Friendliness | <input type="checkbox"/> มีความอ่อนน้อมถ่อมตน
Humility |
| <input type="checkbox"/> มีความกระตือรือร้น
Enthusiasm | <input type="checkbox"/> มีวิสัยทัศน์ มองการณ์ไกล
Visionary and foresight |
| <input type="checkbox"/> มีความคิดสร้างสรรค์
Creative thinking | <input type="checkbox"/> มีความเชื่อมั่นในตนเอง
Confidence |
| <input type="checkbox"/> เป็นผู้ฟังที่ดี
Good listener | <input type="checkbox"/> มีทักษะในการพูดและติดต่อสื่อสาร
Skillful in communication |
| <input type="checkbox"/> มีความสนิทสนมคุ้นเคยกัน
Familiarity | <input type="checkbox"/> มีตำแหน่งหรือฐานะสูงกว่า
Higher rank or status |
| <input type="checkbox"/> เป็นญาติพี่น้อง
Kindship | <input type="checkbox"/> เป็นเพื่อนสนิท
Close friend |
| <input type="checkbox"/> อื่นๆ (โปรดระบุ)..... | |
| Others (please identify)..... | |

ตอนที่ 4.4 การรวบรวมข้อมูลความรู้เพื่อนำไปใช้ในการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.4 Information and knowledge elicitation for restoration and sustainable utilization of mangrove resources

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ท่านเคยพยายามหาข้อมูลหรือความรู้เกี่ยวกับการฟื้นฟูป่าชายเลนหรือไม่

Have you ever searched information or knowledge about mangrove restoration?

เคย

Yes

ไม่เคย (ถ้าตอบว่า ไม่เคย ให้ข้ามไปตอบคำถามในข้อ 4)

No (If answer No please skip to answer a question no. 4)

2. หากท่านต้องการข้อมูลเกี่ยวกับการฟื้นฟูป่าชายเลน ท่านสามารถหาได้ด้วยวิธีการใด (ตอบได้มากกว่า 1 ข้อ)

What are methods will you use to acquire information related to mangrove restoration? (select to answer more than 1 choice)

การสังเกตด้วยตนเอง

Self-observation

การพูดคุยหรือบอกเล่าจากคนอื่น

Dialogue or narration from other people

หนังสือ

Books or documents

รายการโทรทัศน์/วิทยุ/หนังสือพิมพ์

TV programs/radio/newspaper

การฝึกอบรมหรือร่วมประชุมหารือ

Training or workshop

อินเทอร์เน็ตและสื่อสังคมออนไลน์ เช่น เฟซบุ๊ก

Internet and social media such as facebook

อื่นๆ (โปรดระบุ).....

Others (please identify).....

3. ท่านคิดว่าสิ่งใดต่อไปนี้มีผลต่อการเก็บรวบรวมข้อมูลเกี่ยวกับการฟื้นฟูป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

What are factors that affect an elicitation of information related to mangrove restoration?

(select to answer more than 1 choice)

- | | |
|---|--|
| <input type="checkbox"/> นโยบายรัฐ
State policies | <input type="checkbox"/> กฎหมายและข้อบังคับ
Laws and regulations |
| <input type="checkbox"/> เงินทุน
Financial support | <input type="checkbox"/> การเข้าถึงข้อมูลผ่านสื่อต่างๆ
Ability to access sources of information |
| <input type="checkbox"/> หน่วยงานรัฐ บริษัท หรือสถาบันการศึกษาที่สามารถให้ข้อมูล
Ability of governmental agencies, private sectors or academic institutions in providing information | |
| <input type="checkbox"/> อื่นๆ (โปรดระบุ).....
Others (please identify)..... | |

4. ท่านเคยพยายามหาข้อมูลหรือความรู้เกี่ยวกับการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่

Have you ever searched information or knowledge about sustainable mangrove utilization?

- | | |
|-------------------------------------|--|
| <input type="checkbox"/> เคย
Yes | <input type="checkbox"/> ไม่เคย (ถ้าตอบว่า ไม่เคย ให้ข้ามไปตอบในตอนที่ 4.5)
No (If answer No please skip to answer a question in section 4.5) |
|-------------------------------------|--|

5. หากท่านต้องการข้อมูลเกี่ยวกับการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน ท่านสามารถหาได้จากวิธีการใด (ตอบได้มากกว่า 1 ข้อ)

What are methods will you use to acquire information related to sustainable mangrove utilization? (select to answer more than 1 choice)

- | | |
|---|---|
| <input type="checkbox"/> การสังเกตด้วยตนเอง
Self-observation | <input type="checkbox"/> การพูดคุยหรือบอกเล่าจากคนอื่น
Dialogue or narration from other people |
| <input type="checkbox"/> หนังสือ
Books or documents | <input type="checkbox"/> รายการโทรทัศน์วิทยุ/หนังสือพิมพ์
TV programs/radio/newspaper |

- การฝึกอบรมหรือร่วมประชุมหารือ
Training or workshop
- อินเทอร์เน็ตและสื่อสังคมออนไลน์ เช่น เฟซบุ๊ก
Internet and social media such as facebook
- อื่นๆ (โปรดระบุ).....
Others (please identify).....

6. ท่านคิดว่าสิ่งใดต่อไปนี้มีผลต่อการเก็บรวบรวมข้อมูลเกี่ยวกับการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน (ตอบได้มากกว่า 1 ข้อ)

What are factors that affect an elicitation of information related to sustainable mangrove utilization? (select to answer more than 1 choice)

- นโยบายรัฐ
State policies
- กฎหมายและข้อบังคับ
Laws and regulations
- เงินทุน
Financial support
- การเข้าถึงข้อมูลผ่านสื่อต่างๆ
Ability to access sources of information
- หน่วยงานรัฐ บริษัท หรือสถาบันการศึกษาที่สามารถให้ข้อมูล
Ability of governmental agencies, private sectors or academic institutions in providing information
- อื่นๆ (โปรดระบุ).....
Others (please identify).....

ตอนที่ 4.5 การวางแผนเพื่อการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.5 Designing mangrove restoration and sustainable mangrove utilization plans

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ท่านได้มีการวางแผนก่อนการปลูกป่าชายเลนหรือไม่

Do you plan before planting mangrove forest?

มี ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในข้อ 5)

Yes

No (If answer No please skip to answer a question no. 5)

2. ในการวางแผนการปลูกป่าชายเลน ท่านต้องคิดถึงสิ่งใดต่อไปนีบ้าง (ตอบได้มากกว่า 1 ข้อ)

What are factors that you concern during designing mangrove planting plan? (select to answer more than 1 choice)

นโยบายรัฐ

State policies

กฎหมายและข้อบังคับ

Laws and regulations

งบประมาณค่าใช้จ่าย

Budget and expense

พื้นที่ป่าชายเลนที่ต้องการฟื้นฟู

Selected mangrove forest areas for restoration

เครื่องมือและเทคโนโลยีที่ใช้

Instruments and technologies

จำนวนและชนิดของเมล็ดพันธุ์ไม้ชายเลนที่หาได้เพื่อนำไปปลูก

Quantity and types of mangrove seedlings for planting

ความร่วมมือจากคนในชุมชน หน่วยงานรัฐ เอกชนและสถาบันการศึกษา

Collaboration of local people, governmental agencies, private companies and academic institutions

แรงงานคน

Manpower

ฤดูกาล

Season

น้ำขึ้นน้ำลง

Tidal currents

ดินตะกอน

Sediment

- คลื่นลมทะเล น้ำเสีย
Wave and wind Wastewater
- ปริมาณและคุณภาพของน้ำจืดน้ำเค็ม
Quantity and quality of freshwater and seawater
- วิถีชีวิตของคนในชุมชน
Livelihood of local people
- การประยุกต์ใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน
Application of local knowledge on mangrove forest
- ความเชื่อและวัฒนธรรมของชุมชน ข้อกำหนดของชุมชน
Beliefs and culture of community Community's rules
- อื่นๆ (โปรดระบุ)
Others (please identify).....

3. มีคนกลุ่มอื่นมาช่วยวางแผนการปลูกป่าชายเลนหรือไม่

Are there other groups of people assist you to design mangrove planting plan?

- มี ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามข้อที่ 5)
Yes No (If answer No please skip to answer a question no.5)

4. มีคนกลุ่มใดบ้างที่เกี่ยวข้องกับการวางแผนการปลูกป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to design mangrove planting plan? (select to answer more than 1 choice)

- คนในชุมชน ผู้นำชุมชน
Local people Village chiefs
- หน่วยงานรัฐ โรงเรียน หรือสถาบันการศึกษา
Governmental agencies Schools or academic institutions
- บริษัทเอกชน อื่นๆ (โปรดระบุ).....
Private companies Others (please identify).....

5. ท่านได้มีการวางแผนก่อนการใช้ทรัพยากรป่าชายเลนในแต่ละครั้งหรือไม่

Do you plan before utilizing mangrove resources?

มี

Yes

ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.6)

No (If answer No please skip to answer a question in section 4.6)

6. ในการวางแผนการใช้ทรัพยากรป่าชายเลนของท่าน ท่านต้องนึกถึงสิ่งใดต่อไปนี้บ้าง (ตอบได้มากกว่า 1 ข้อ)

What are factors that you concern during designing sustainable mangrove utilization plan? (select to answer more than 1 choice)

นโยบายรัฐ

State policies

กฎหมายและข้อบังคับ

Laws and regulations

งบประมาณค่าใช้จ่าย

Budget and expense

พื้นที่ป่าชายเลนที่สามารถเข้าไปใช้ประโยชน์ได้

Mangrove forest areas for utilization

เครื่องมือและเทคโนโลยีที่ใช้

Instruments and technologies

แรงงานคน

Manpower

ฤดูกาล

Season

น้ำขึ้นน้ำลง

Tidal currents

ดินตะกอน

Sediment

คลื่นลมทะเล

Wave and wind

น้ำเสีย

Wastewater

ปริมาณและคุณภาพของน้ำจืดน้ำเค็ม

Quantity and quality of freshwater and seawater

วิถีชีวิตของคนในชุมชน

Livelihood of local people

การใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน

Application of local knowledge on mangrove forest

- | | |
|---|--|
| <input type="checkbox"/> ความเชื่อและวัฒนธรรมของชุมชน
Beliefs and culture of community | <input type="checkbox"/> ข้อกำหนดของชุมชน
Community's rules |
| <input type="checkbox"/> รายได้ที่ต้องการ
Expected income | <input type="checkbox"/> อื่นๆ (โปรดระบุ)
Others (please identify)..... |

7. นอกจากท่านแล้ว มีคนกลุ่มอื่นเข้ามาช่วยวางแผนในการใช้ทรัพยากรป่าชายเลนของท่านบ้างหรือไม่

Are there other groups of people assist you to design sustainable mangrove utilization plan?

- | | |
|------------------------------------|---|
| <input type="checkbox"/> มี
Yes | <input type="checkbox"/> ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.6)
No (If answer No please skip to answer a question in section 4.6) |
|------------------------------------|---|

8. มีคนกลุ่มใดบ้างที่ช่วยในการวางแผนการใช้ทรัพยากรป่าชายเลนของท่าน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to design sustainable mangrove utilization plan?
(select to answer more than 1 choice)

- | | |
|---|--|
| <input type="checkbox"/> คนในชุมชน
Local people | <input type="checkbox"/> ผู้นำชุมชน
Village chiefs |
| <input type="checkbox"/> หน่วยงานรัฐ
Governmental agencies | <input type="checkbox"/> โรงเรียน หรือสถาบันการศึกษา
Schools or academic institutions |
| <input type="checkbox"/> บริษัทเอกชน
Private companies | <input type="checkbox"/> อื่นๆ (โปรดระบุ).....
Others (please identify)..... |

ตอนที่ 4.6 การประเมินแผนการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.6 Validating mangrove restoration and sustainable mangrove utilization plans

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ท่านได้มีการตรวจสอบก่อนหรือไม่ว่าแผนการปลูกป่าชายเลนที่วางไว้จะช่วยฟื้นฟูป่าชายเลนได้

Do you validate mangrove planting plan before implementing?

มี

ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในข้อ 5)

Yes

No (If answer No please skip to answer a question no.5)

2. ในการตรวจสอบแผนการปลูกป่าชายเลนที่วางไว้ ท่านต้องคิดถึงสิ่งใดต่อไปนี้บ้าง (ตอบได้มากกว่า 1 ข้อ)

What are factors that you concern during validating mangrove planting plan? (select to answer more than 1 choice)

นโยบายรัฐ

State policies

กฎหมายและข้อบังคับ

Laws and regulations

งบประมาณค่าใช้จ่าย

Budget and expense

พื้นที่ป่าชายเลนที่ต้องการฟื้นฟู

Selected mangrove forest areas for restoration

เครื่องมือและเทคโนโลยีที่ใช้

Supporting instruments and technologies

จำนวนและชนิดของเมล็ดพันธุ์ไม้ชายเลนที่หาได้เพื่อนำไปปลูก

Quantity and types of mangrove seedlings for planting

ความร่วมมือจากคนในชุมชน หน่วยงานรัฐ เอกชนและสถาบันการศึกษา

Collaboration of local people, governmental agencies, private companies and academic institutions

แรงงานคน

Manpower

ฤดูกาล

Season

- น้ำขึ้นน้ำลง
Tidal currents
- ดินตะกอน
Sediment
- คลื่นลมทะเล
Wave and wind
- น้ำเสีย
Wastewater
- ปริมาณและคุณภาพของน้ำจืดน้ำเค็ม
Quantity and quality of freshwater and seawater
- วิถีชีวิตของคนในชุมชน
Livelihood of local people
- การประยุกต์ใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน
Application of local knowledge on mangrove forest
- ความเชื่อและวัฒนธรรมของชุมชน
- ข้อกำหนดของชุมชน
Community's rules
- อื่นๆ (โปรดระบุ)
Others (please identify).....

3. มีคนกลุ่มอื่นมาช่วยตรวจสอบแผนการปลูกป่าชายเลนที่วางไว้หรือไม่

Are there other groups of people assist you to validate mangrove planting plan?

- มี
- ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามข้อที่ 5)
- Yes No (If answer No please skip to answer a question no.5)

4. มีคนกลุ่มใดบ้างที่ช่วยตรวจสอบแผนการปลูกป่าชายเลนที่วางไว้ (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to validate mangrove planting plan? (select to answer more than 1 choice)

- คนในชุมชน
Local people
- ผู้นำชุมชน
Village chiefs
- หน่วยงานรัฐ
Governmental agencies
- โรงเรียน หรือสถาบันการศึกษา
Schools or academic institutions

บริษัทเอกชน

Private companies

 อื่นๆ (โปรดระบุ).....

Others (please identify).....

5. ท่านมีการตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่านหรือไม่ว่าวิธีการนั้นจะไม่ทำให้ป่าชายเลนเสื่อมโทรม

Do you validate your mangrove utilization plan before implementing to ensure that your utilization will not degrade mangrove?

 มี

Yes

 ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.7)

No (If answer No please skip to answer a question in section 4.7)

6. ท่านต้องคิดถึงสิ่งใดต่อไปนี้อย่างในการตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่าน เพื่อไม่ให้วิธีการของท่านนั้นทำให้ป่าชายเลนเสื่อมโทรม (ตอบได้มากกว่า 1 ข้อ)

What are factors that you concern during validating sustainable mangrove utilization plan to ensure that your utilization will not degrade mangrove? (select to answer more than 1 choice)

 นโยบายรัฐ

State policies

 กฎหมายและข้อบังคับ

Laws and regulations

 งบประมาณค่าใช้จ่าย

Budget and expense

 พื้นที่ป่าชายเลนที่สามารถเข้าไปใช้ประโยชน์ได้

Mangrove forest areas for utilization

 เครื่องมือและเทคโนโลยีที่ใช้

Instruments and technologies

 แรงงานคน

Manpower

 ฤดูกาล

Season

 น้ำขึ้นน้ำลง

Tidal currents

 ดินตะกอน

Sediment

 คลื่นลมทะเล

Wave and wind

 น้ำเสีย

Wastewater

- ปริมาณและคุณภาพของน้ำจืดน้ำเค็ม
Quantity and quality of freshwater and seawater
- วิถีชีวิตของคนในชุมชน
Livelihood of local people
- การใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน
Application of local knowledge on mangrove forest
- ความเชื่อและวัฒนธรรมของชุมชน ข้อกำหนดของชุมชน
Beliefs and culture of community Community's rules
- รายได้ที่ต้องการ อื่นๆ (โปรดระบุ)
- Expected income Others (please identify).....

7. มีคนกลุ่มอื่นเข้ามาช่วยตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่านหรือไม่

Are there other groups of people assist you to validate sustainable mangrove utilization plan?

- มี ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.7)
- Yes No (If answer No please skip to answer a question in section 4.7)

8. มีคนกลุ่มใดบ้างที่ช่วยตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่าน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to validate sustainable mangrove utilization plan? (select to answer more than 1 choice)

- คนในชุมชน ผู้นำชุมชน
Local people Village chiefs
- หน่วยงานรัฐ โรงเรียน หรือสถาบันการศึกษา
Governmental agencies Schools or academic institutions
- บริษัทเอกชน อื่นๆ (โปรดระบุ).....
Private companies Others (please identify).....

ตอนที่ 4.7 พฤติกรรมของท่านในการฟื้นฟูและการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

Section 4.7 Practices for mangrove restoration and sustainable mangrove utilization

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ในช่วงของการฟื้นฟูป่าชายเลน ปี พ.ศ. 2533 ท่านได้เปลี่ยนพฤติกรรมของท่านเพื่อช่วยฟื้นฟูป่าชายเลนหรือไม่

Do you change your practices to support the mangrove restoration after mangrove planting in 1990?

เปลี่ยน ไม่เปลี่ยน (ถ้าตอบ ไม่เปลี่ยน ให้ข้ามไปตอบคำถามในข้อ 5)

Yes No (If answer No please skip to answer a question no.5)

2. ท่านคิดว่าสิ่งใดต่อไปนี้ที่ทำให้ท่านเปลี่ยนพฤติกรรมของท่านเพื่อช่วยฟื้นฟูป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

What are following factors that change your practices to support mangrove restoration?
(select to answer more than 1 choice)

นโยบายรัฐ กฎหมาย และข้อบังคับ
State policies Laws and regulations

การแบ่งพื้นที่ป่าชายเลนที่จะใช้ในการฟื้นฟู ระบบการศึกษา
Mangrove zoning for restoration Education system

การให้รางวัล หรือค่าจ้างตอบแทน
Rewards or monetary incentives

การโฆษณาประชาสัมพันธ์ของหน่วยงานรัฐและเอกชน
Advertisement from state and private sectors

การชักชวนโดยคนในครอบครัว การชักชวนโดยเพื่อนสนิท
Persuasion by family members Persuasion by close friends

การชักชวนโดยผู้นำชุมชนหรือผู้ว่าฯ
Persuasion by village chiefs or provincial governor

การชักชวนหรือชักจูงโดยคนที่ท่านเคารพและนับถือ

Persuasion by your respected and trusted person

ความรักและความผูกพันกับชุมชน

Sense of community

จิตอาสา

Volunteering

การทำตามพระราชประสงค์ของสมเด็จพระเทพรัตนราชสุดาฯ ให้อนุรักษ์ป่าชายเลน

Conformity to the intention of HRH Princess Maha Chakri Sirindhorn in conserving and restoring mangrove forest

ความไว้วางใจของคนในชุมชนต่อผู้นำชุมชนหรือผู้ว่าฯ

Trust of local people towards village chiefs or provincial governor

ข้อตกลงร่วมกันภายในชุมชน

Community's rules

อื่นๆ (โปรดระบุ).....

Others (please identify)

3. มีคนกลุ่มอื่นมาช่วยเปลี่ยนแปลงพฤติกรรมของท่านเพื่อช่วยฟื้นฟูป่าชายเลนหรือไม่

Are there other groups of people assist you to change or adapt your practices for restoring mangrove forest?

มี

Yes

ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามข้อที่ 5)

No (If answer No please skip to answer a question no.5)

4. มีคนกลุ่มใดบ้างที่ทำให้ท่านเปลี่ยนแปลงพฤติกรรมของท่านเพื่อช่วยฟื้นฟูป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to change or adapt your practices for mangrove restoration? (select to answer more than 1 choice)

คนในชุมชน

Local people

เพื่อน

Friends

ผู้นำชุมชน

Village chiefs

ผู้ว่าราชการจังหวัด

Provincial governor

หน่วยงานรัฐ

Governmental agencies

โรงเรียน หรือสถาบันการศึกษา

Schools or academic institutions

บริษัทเอกชน

Private companies

 อื่นๆ (โปรดระบุ).....

Others (please identify)

5. ตั้งแต่เริ่มฟื้นฟูป่าชายเลน ปี พ.ศ. 2533 จนถึงปัจจุบัน ท่านได้มีการเปลี่ยนวิธีการใช้ทรัพยากรป่าชายเลนหรือไม่

Do you change your practices to sustainably utilize the restored mangrove ecosystem after mangrove planting in 1990?

 เปลี่ยน

Yes

 ไม่เปลี่ยน (ถ้าตอบ ไม่เปลี่ยน ให้ข้ามไปตอบคำถามในตอนี่ 4.8)

No (If answer No please skip to answer a question in section 4.8)

6. ท่านคิดว่าสิ่งใดต่อไปนี่ที่ทำให้ท่านเปลี่ยนวิธีการใช้ทรัพยากรป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

What are following factors that influence you to change your utilization? (select to answer more than 1 choice)

 นโยบายรัฐ

State policies

 กฎหมาย และข้อบังคับ

Laws and regulations

 การแบ่งพื้นที่ป่าชายเลนที่จะใช้ในการฟื้นฟู

Mangrove zoning for restoration

 ระบบการศึกษา

Education system

 การให้รางวัล หรือค่าจ้างตอบแทน

Rewards or monetary incentives

 การโฆษณาประชาสัมพันธ์ของหน่วยงานรัฐและเอกชน

Advertisement from state and private sectors

 การชักชวนโดยคนในครอบครัว

Persuasion by family members

 การชักชวนโดยเพื่อนสนิท

Persuasion by close friends

 การชักชวนโดยผู้นำชุมชนหรือผู้ว่าฯ

Persuasion by village chiefs or provincial governor

 การชักชวนหรือชักจูงโดยคนที่ท่านเคารพและนับถือ

Persuasion by your respected and trusted person

 ความรักและความผูกพันกับชุมชน

Sense of community

 จิตอาสา

Volunteering

- การทำตามพระราชประสงค์ของสมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารี ในการอนุรักษ์ป่าชายเลน
Conformity to the intention of HRH Princess Maha Chakri Sirindhorn in conserving and restoring mangrove forest
- ความไว้วางใจเชื่อใจของคนในชุมชนต่อผู้นำชุมชนหรือผู้ว่าฯ
Trust of local people towards village chiefs or provincial governor
- ข้อตกลงร่วมกันภายในชุมชน
Community's rules
- อื่นๆ (โปรดระบุ).....
Others (please identify)

7. มีคนกลุ่มอื่นมาช่วยปรับเปลี่ยนวิธีการใช้ทรัพยากรป่าชายเลนของท่านเพื่อรักษาป่าชายเลนไว้บ้างหรือไม่

Are there other groups of people assist you to change or adapt your practices for sustainable mangrove utilization?

- มี
Yes
- ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในตอนี่ 4.8)
No (If answer No please skip to answer question 4.8)

8. มีคนกลุ่มใดบ้างที่ทำให้ท่านปรับเปลี่ยนวิธีการใช้ทรัพยากรป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)
Who are the group of people that assist you to change or adapt your practices for sustainable mangrove utilization? (select to answer more than 1 choice)

- คนในชุมชน
Local people
- เพื่อน
Friends
- ผู้นำชุมชน
Village chiefs
- ผู้ว่าราชการจังหวัด
Provincial governor
- หน่วยงานรัฐ
Governmental agencies
- โรงเรียน หรือสถาบันการศึกษา
Schools or academic institutions
- บริษัทเอกชน
Private companies
- อื่นๆ (โปรดระบุ).....
Others (please identify)

ตอนที่ 4.8 การตรวจสอบและติดตามผลจากการฟื้นฟูและการใช้ทรัพยากรป่าชายเลน
อย่างยั่งยืน

Section 4.8 Monitoring mangrove restoration and sustainable mangrove utilization

คำชี้แจง กรุณาทำเครื่องหมาย X ลงใน ที่ท่านเลือกตอบ

Instruction: Please putting a check X mark in for your answer

1. ในช่วงของการฟื้นฟูป่าชายเลน ปี พ.ศ. 2534 ท่านได้ไปสำรวจดูผลที่ได้จากการปลูกป่าชายเลนหรือไม่

Do you follow up your practices from planting mangrove seedlings in 1990?

มี ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามในข้อ 5)

Yes No (If answer No please skip to answer a question no.5)

2. ท่านคิดว่าสิ่งใดต่อไปนี้เป็นสิ่งที่ท่านต้องนึกถึงในการสำรวจดูผลที่ได้จากการปลูกป่าชายเลนบ้าง (ตอบได้มากกว่า 1 ข้อ)

What are factors that you have to concern during monitoring mangrove restoring?

(select to answer more than 1 choice)

นโยบายรัฐ กฎหมาย และข้อบังคับ

State policies Laws and regulations

ข้อกำหนดของชุมชน งบประมาณค่าใช้จ่าย

Community's rules Budget and expense

เครื่องมือและเทคโนโลยีที่ใช้สนับสนุน คนที่จะทำหน้าที่สำรวจ

Instruments and technological support Working staffs

การประยุกต์ใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลน

Application of local knowledge on mangrove forest

ความร่วมมือจากคนในชุมชน หน่วยงานรัฐ เอกชน และสถาบันการศึกษา

Collaboration of local people, governmental agencies, private companies and academic institutions

อื่นๆ (โปรดระบุ).....

Others (please identify)

3. มีคนกลุ่มอื่นมาช่วยท่านในการสำรวจดูผลจากการปลูกป่าชายเลนหรือไม่

Are there other groups of people assist you to monitor mangrove planting?

- มี ไม่มี (ถ้าตอบ ไม่มี ให้ข้ามไปตอบคำถามข้อที่ 5)

Yes

No (If answer No please skip to answer a question no.5)

4. มีคนกลุ่มใดบ้างที่ช่วยท่านในการสำรวจดูผลจากการปลูกป่าชายเลน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to monitor mangrove planting? (select to answer more than 1 choice)

- | | |
|---|--|
| <input type="checkbox"/> คนในชุมชน
Local people | <input type="checkbox"/> ผู้นำชุมชน
Village chiefs |
| <input type="checkbox"/> หน่วยงานรัฐ
Governmental agencies | <input type="checkbox"/> โรงเรียน หรือสถาบันการศึกษา
Schools or academic institutions |
| <input type="checkbox"/> บริษัทเอกชน
Private companies | <input type="checkbox"/> อื่นๆ (โปรดระบุ).....
Others (please identify) |

5. ตั้งแต่เริ่มฟื้นฟูป่าชายเลน ปี พ.ศ. 2533 จนถึงปัจจุบัน ท่านมีการตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่านบ้างหรือไม่

Do you follow up your utilization after restoring mangrove ecosystem from 1990 to present?

- มี ไม่มี (ถ้าตอบ ไม่มี ไม่ต้องตอบคำถามในข้อ 6, 7 และ 8)

Yes

No (If answer No do not answer questions no 6, 7, and 8)

6. ท่านคิดว่าสิ่งใดต่อไปนี้ทำให้ท่านต้องคอยตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่าน (ตอบได้มากกว่า 1 ข้อ)

What are factors that influenced you to monitor your utilization of mangrove resources? (select to answer more than 1 choice)

- | | |
|--|--|
| <input type="checkbox"/> นโยบายรัฐ
State policies | <input type="checkbox"/> กฎหมาย และข้อบังคับ
Laws and regulations |
| <input type="checkbox"/> การแบ่งพื้นที่ป่าชายเลนเพื่อการใช้ประโยชน์
Mangrove zoning for utilization | <input type="checkbox"/> ระบบการศึกษา
Education system |

- การให้รางวัล หรือค่าจ้างตอบแทน
Rewards or monetary incentives
- การโฆษณาประชาสัมพันธ์ของหน่วยงานรัฐและเอกชน
Advertisement from state and private sectors
- การชักชวนโดยคนในครอบครัว
Persuasion by family members
- การชักชวนโดยเพื่อนสนิท
Persuasion by close friends
- การชักชวนโดยผู้นำชุมชนหรือผู้ว่าฯ
Persuasion by village chiefs or provincial governor
- การชักชวนหรือชักจูงโดยคนที่ท่านเคารพและนับถือ
Persuasion by your respected and trusted person
- ความรักและความผูกพันกับชุมชน
Sense of community
- จิตอาสา
Volunteering
- การทำตามพระราชประสงค์ของสมเด็จพระเทพรัตนราชสุดาฯ ให้อนุรักษ์ป่าชายเลน
Conformity to the intention of HRH Princess Maha Chakri Sirindhorn in conserving and restoring mangrove forest
- ความไว้วางใจและความศรัทธาของคนในชุมชนต่อผู้นำชุมชนหรือผู้ว่าฯ
Trust of local people towards village chiefs or provincial governor
- ข้อตกลงร่วมกันภายในชุมชน
Community's rules
- อื่นๆ (โปรดระบุ).....
Others (please identify).....

7. มีคนกลุ่มอื่นมาช่วยตรวจสอบวิธีการใช้ทรัพยากรป่าชายเลนของท่านหรือไม่

Are there other groups of people assist you to monitor your sustainable utilization of mangrove resources?

มี

Yes

ไม่มี (ถ้าตอบ ไม่มี ไม่ต้องตอบคำถามข้อที่ 8)

No (If answer No do not answer questions no 8)

8. มีคนกลุ่มใดบ้างที่ช่วยตรวจสอบ**วิธีการใช้ทรัพยากรป่าชายเลน**ของท่าน (ตอบได้มากกว่า 1 ข้อ)

Who are the group of people that assist you to monitor your sustainable utilization of mangrove resources? (select to answer more than 1 choice)

- | | |
|---|--|
| <input type="checkbox"/> คนในชุมชน
Local people | <input type="checkbox"/> ผู้นำชุมชน
Village chiefs |
| <input type="checkbox"/> หน่วยงานรัฐ
Governmental agencies | <input type="checkbox"/> โรงเรียน หรือสถาบันการศึกษา
Schools or academic institutions |
| <input type="checkbox"/> บริษัทเอกชน
Private companies | <input type="checkbox"/> อื่นๆ (โปรดระบุ).....
Others (please identify) |



APPENDIX B

INTERVIEW GUIDELINES FOR COMMUNITY ENTERPRISES

ชื่อ-นามสกุลของผู้ให้สัมภาษณ์.....ตำแหน่ง.....

Name of interviewee.....Position.....

สถานที่ให้สัมภาษณ์.....วันที่.....เวลา.....

Interview location.....Date.....Time.....

1. วัตถุประสงค์หลักของการจัดตั้งกลุ่มวิสาหกิจชุมชนทำกะปิ/การท่องเที่ยวเชิงนิเวศ

What is an objective of establishment of community enterprise for shrimp paste production and ecotourism?

2. ในการจัดตั้งกลุ่ม/ ศูนย์ มีขั้นตอนเตรียมตัวอย่างไรบ้าง

How to prepare in establishing community enterprises?

2.1 การหาคนเข้าร่วม

Recruit members to join enterprise

2.2 การจัดหาสถานที่เพื่อผลิตกะปิ/ เพื่อดำเนินการธุรกิจท่องเที่ยว

Provision of place for shrimp paste production/ ecotourism business operation

2.2 การออกแบบบรรจุภัณฑ์/แผนหรือกิจกรรมการท่องเที่ยว

Design package/ ecotourism plan or activities

2.4 การสร้างมาตรฐานและคุณภาพให้กับสินค้า/ การท่องเที่ยวเชิงนิเวศ

Establishment of quality standards for shrimp paste product/ ecotourism

2.5 การจัดหาแหล่งขายและกระจายสินค้า

Provision of place for selling and distributing shrimp paste product

2.6 การทำการตลาด โฆษณาประชาสัมพันธ์

Marketing and advertisement

2.7 การพัฒนาคุณภาพสินค้าและสร้างจุดเด่นให้กับกะปิคลองโคน/ การท่องเที่ยวเชิงนิเวศ

Quality development and identity establishment for shrimp paste product/ ecotourism

3. ปัญหาที่เกิดขึ้นที่ส่งผลต่อการผลิตและพัฒนาสินค้า/ การท่องเที่ยวเชิงนิเวศ

Problems that affect to shrimp paste production and development/ ecotourism

4. ความเสี่ยงต่อกะปิเคยคลองโคนในอนาคต/ การท่องเที่ยวเชิงนิเวศ

Future risks to Klong Khone shrimp paste product/ ecotourism



APPENDIX C

INTERVIEW GUIDELINES FOR VILLAGE CHIEFS

ชื่อ-นามสกุลของผู้ให้สัมภาษณ์.....ตำแหน่ง.....

Name of interviewee.....Position.....

สถานที่ให้สัมภาษณ์.....วันที่.....เวลา.....

Interview location.....Date.....Time.....

1. ท่านได้ใช้ประโยชน์จากป่าชายเลนในเรื่องใดบ้าง ในช่วงก่อนที่จะมีการปลูกป่าชายเลนในปี พ.ศ. 2533

What kinds of the mangrove ecosystem services were utilized before a mangrove planting in 1990?

2. ท่านได้ใช้ประโยชน์จากป่าชายเลนในเรื่องใดบ้าง ในช่วงหลังการฟื้นฟูป่าชายเลน ตั้งแต่ ปี พ.ศ. 2534 จนถึงปัจจุบัน

What kinds of the mangrove ecosystem services were utilized after a mangrove restoration from 1991 to present? (select to answer more than 1 choice)

3. ท่านคิดว่าการท่องเที่ยวป่าชายเลนเชิงอนุรักษ์ช่วยสร้างอาชีพและรายได้ให้แก่คนในชุมชนหรือไม่
Do you think that mangrove ecotourism can generate occupations and increase income to local people?

4. หลังฟื้นฟูป่าชายเลน ปริมาณสัตว์น้ำเปลี่ยนแปลงไปหรือไม่ อย่างไรบ้าง และเพราะเหตุใด
Do the aquatic animals change after restoring mangrove forest?
How they change and why?

5. สิ่งใดต่อไปนี่ที่บ่งบอกว่าการใช้ประโยชน์จากป่าชายเลนของคนในชุมชนคลองโคกนอในปัจจุบันไม่ส่งผลกระทบต่อป่าชายเลนและยังสามารถให้ประโยชน์แก่คนรุ่นต่อไปได้
What are factors that indicated that a current utilization of local people in Klong Khone community does not affect mangrove ecological production for future generation?

6. มีข้อกำหนด กฎเกณฑ์ในการใช้ประโยชน์จากป่าชายเลนหรือไม่ กฎหมายและระเบียบข้อจำกัด หรือกฎเกณฑ์ที่มีผลต่อการใช้ประโยชน์ป่าชายเลนในช่วงก่อนการฟื้นฟูป่าชายเลน และในปัจจุบัน

Are there any laws and regulations enforcing a utilization of mangrove forest?

Please identify and describe those laws and regulations that affect to your utilization both before mangrove restoration and at the present.

7. มีกฎหรือข้อห้ามอื่นๆ นอกเหนือจากกฎหมาย ที่ชุมชนกำหนดขึ้นและรับรู้เฉพาะในชุมชน ซึ่งเกี่ยวข้องกับการใช้ประโยชน์จากป่าชายเลนหรือไม่ และข้อห้ามหรือระเบียบนั้นคืออะไร

Are there any other community rules involved with mangrove utilization? What are those rules?

8. ปัจจัยใดที่ทำให้คนแต่ละคนเกิดการเรียนรู้หรือมีความรู้เกี่ยวกับการฟื้นฟู และใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนแตกต่างกัน

What are factors that affect to an individual learning or knowledge related to mangrove restoration and sustainable utilization?

9. ท่านมีส่วนช่วยให้คนในชุมชนรู้จักการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนเพื่อไม่ให้ส่งผลกระทบต่อป่าชายเลนบ้างหรือไม่ อย่างไร

Do you assist your villagers to sustainably utilize the mangrove resources without affecting mangrove ecological production and how?

10. ท่านคิดว่าปัญหาที่เกิดขึ้นกับทรัพยากรป่าชายเลนในอดีตและปัจจุบันมีอะไรบ้าง สาเหตุคืออะไร ท่านแก้ปัญหาเหล่านั้นอย่างไร

What are problems on mangrove forest in 1990 and present?

What are causes of problems?

How do you solve those problems?

11. ท่านทราบได้อย่างไรว่าการปลูกป่าชายเลนจะช่วยฟื้นฟูระบบนิเวศป่าชายเลน

How do you know that the mangrove planting is able to restore the mangrove ecological production?

12. ท่านได้หาข้อมูลเพิ่มเติมเกี่ยวกับการปลูกป่าชายเลนเพื่อช่วยฟื้นฟูป่าชายเลนหรือไม่ จากแหล่งข้อมูลใด

Do you search for more information about the mangrove planting for restoring mangrove ecological production? Where are your sources of information?

13. ทำไมท่านถึงเชื่อว่าการปลูกป่าจะช่วยฟื้นฟูป่าชายเลนได้

Why do you believe that the mangrove planting can restore mangrove ecological production?

14. ในช่วงฟื้นฟูป่าชายเลน ชุมชนของท่านมีการตั้งเป้าหมายหรือคาดหวังผลที่จะเกิดจากการปลูกป่าชายเลนไว้บ้างหรือไม่ อะไรบ้าง

Do you set a goal or expect an outcome from mangrove restoring?

15. มีการใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลนมาใช้ในการวางแผนการฟื้นฟูป่าชายเลนด้วยหรือไม่ อย่างไร

Do you apply a local knowledge on mangrove forest for designing mangrove restoration plan? How do you apply it?

16. มีใครเข้ามาช่วยเหลือหรือให้การสนับสนุนการปลูกป่าเพื่อฟื้นฟูป่าชายเลนหรือไม่

Are there any other group of people support the mangrove restoration?

17. ในปัจจุบันป่าชายเลนในชุมชนของท่านยังคงอนุรักษ์อยู่หรือไม่ ทำอย่างไรบ้าง

Does the mangrove forest in your community is conserved at the present? How do you conserve it?

18. มีใครเข้ามาช่วยเหลือหรือให้การสนับสนุนในการดูแลและอนุรักษ์ป่าชายเลนหรือไม่

Are there any other group of people support the mangrove conservation?

19. ปัจจัยใดที่ทำให้คนในชุมชนเข้าร่วมการปลูกป่าเพื่อฟื้นฟูป่าชายเลน

What are factors that motivate the local people to participate in mangrove planting activities for mangrove restoration?

20. ปัจจัยใดที่ทำให้คนในชุมชนรู้จักการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนเพื่อไม่ให้ส่งผลต่อระบบนิเวศป่าชายเลน

What are factors that motivate the local people to utilize the mangrove resources sustainably without affecting mangrove ecological production?

21. ท่านเคยชักชวนให้ใครเข้าร่วมกิจกรรมปลูกป่าชายเลนหรือไม่

Have you ever persuaded anyone to participate in mangrove planting activities?

22. ท่านเคยเห็นตัวอย่างการฟื้นฟูป่าชายเลนที่ประสบความสำเร็จจากชุมชนหรือหน่วยงานอื่นหรือไม่

และตัวอย่างนั้นช่วยกระตุ้นให้ท่านอยากฟื้นฟูป่าชายเลนหรือไม่

Have you ever seen or learned an example of successful community-based mangrove restoration?

Do those examples motivate you to restore the mangrove forest?

23. ท่านคิดว่าการเสด็จเยือนของสมเด็จพระเทพรัตนราชสุดาฯ สยามบรมราชกุมารีมาที่ตำบลคลองโคนเพื่อทรงปลูกต้นโกงกาง ช่วยกระตุ้นและเป็นแรงผลักดันให้ผู้นำชุมชน คนในชุมชน หน่วยงานภาครัฐและเอกชน ร่วมกันฟื้นฟูอนุรักษ์ และใช้ประโยชน์ป่าชายเลนอย่างยั่งยืนหรือไม่ เพราะเหตุใด

Do you think that a royal visit of HRH Princess Maha Chakri Sirindhorn to plant mangrove saplings motivate an inspire the local people, governmental agencies and private sectors to participate in mangrove restoration, conservation and sustainable utilization? Why?

24. ท่านคิดว่าความน่าเชื่อถือของผู้ใหญ่บ้านหรือผู้ว่าราชการจังหวัดมีผลทำให้คนในชุมชนเข้าร่วมการปลูกป่าและใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่

Do you think that a trust of local people toward village chiefs or provincial governor motivate them to participate in mangrove planting and sustainable utilization?

25. ท่านคิดว่าการศึกษามีผลต่อการรับรู้ของคนในชุมชนเกี่ยวกับคุณค่าของป่าชายเลนและช่วยกระตุ้นการมีส่วนร่วมของคนในชุมชนในการปลูกป่าชายเลนและการใช้ประโยชน์ป่าชายเลนอย่างยั่งยืนหรือไม่

Do you think that an education affect a perception of local people on values of mangrove forest and motivate a participation of local people in mangrove planting and sustainable mangrove utilization?

26. มีการแลกเปลี่ยนความรู้ท้องถิ่นกับความรู้ทางวิชาการระหว่างคนในชุมชนกับนักวิชาการหรือไม่ แล้วการแลกเปลี่ยนความรู้ดังกล่าวช่วยเพิ่มความรู้เกี่ยวกับป่าชายเลนให้ท่านหรือไม่

Are there a sharing and transfer of local and scientific knowledge between local people and academic institutions? Does it increase your knowledge on mangrove ecological production?

27. การแบ่งพื้นที่ป่าชายเลนเพื่อการอนุรักษ์และการใช้ประโยชน์มีส่วนในการควบคุมพฤติกรรมของคนในชุมชนเกี่ยวกับการอนุรักษ์และการใช้ประโยชน์ป่าชายเลนหรือไม่

Does the mangrove forest zoning for conservation and utilization influence the local people's practices in mangrove conservation and utilization?

28. มีการให้รางวัลหรือค่าจ้างตอบแทนแก่คนในชุมชนเพื่อดึงดูดให้เข้าร่วมกิจกรรมปลูกป่าและอนุรักษ์ป่าชายเลนหรือไม่ อย่างไร

Are there any rewards or monetary incentives to attract the local people to participate mangrove planting and conservation? What are those rewards?

29. ท่านได้เผยแพร่ประชาสัมพันธ์ให้คนในชุมชนเข้าร่วมการปลูกป่าหรือไม่

Do you advertise or persuade the local people to participate in mangrove planting?

30. ท่านได้เผยแพร่ประชาสัมพันธ์ให้คนในชุมชนทราบถึงประโยชน์ของการปลูกป่าชายเลนหรือไม่ ด้วยวิธีการใด

Do you advertise or educate the local people to know about the benefits of mangrove planting? What are your methods used in disseminating the information?

31. ท่านวางแผนการฟื้นฟูป่าชายเลนไว้อย่างไรบ้าง

How do you design mangrove restoration plan?

32. สิ่งใดต่อไปนี้มีผลต่อการวางแผนเพื่อฟื้นฟูป่าชายเลน

What are factors that you have to concern during designing mangrove restoration plan

33. สิ่งใดต่อไปนี้มีผลต่อการวางแผนเพื่อการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืน

What are factors that you have to concern during designing sustainable mangrove utilization plan

34. ท่านรู้ได้อย่างไรว่าการปลูกป่าช่วยฟื้นฟูป่าชายเลนได้ สังเกตจากอะไร วัดได้อย่างไร

How do you know that the mangrove planting can restore mangrove ecological production? How to measure its results?

35. ท่านรู้ได้อย่างไรว่าการใช้ทรัพยากรป่าชายเลนของคนในชุมชนไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน มีการสังเกตหรือวัดผลหรือไม่ อย่างไร

How do you know that the mangrove utilization does not affect to mangrove ecological production? How to evaluate the local people's utilization?

36. มีใครเข้ามามีส่วนร่วมในการปลูกป่าชายเลนบ้าง แล้วแต่ละกลุ่ม/คนมีหน้าที่อย่างไรบ้าง

Are there any group of people participate in mangrove planting? What are their functions?

37. มีปัญหาหรืออุปสรรคระหว่างที่มีการปลูกป่าชายเลนหรือไม่ อะไรบ้าง และท่านแก้ไขปัญหานั้นอย่างไร

Are there any problems or obstacles during mangrove planting? What are those problems? How do you solve them?

38. มีใครเข้ามามีส่วนร่วมในการดูแลรักษาป่าชายเลนหลังจากการปลูกป่าบ้างและมีหน้าที่อย่างไรบ้าง

Are there any group of people participate in taking care of mangrove forest after restoration? What are their functions?

39. มีปัญหาหรืออุปสรรคในการดูแลรักษาป่าชายเลนหรือไม่ อะไรบ้าง และท่านแก้ปัญหานั้นอย่างไร

Are there any problems or obstacles in mangrove conservation? What are those problems? How do you solve them?

40. มีปัญหาความขัดแย้งเกี่ยวกับการปลูกป่าชายเลนหรือการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนระหว่างคนในชุมชนและหน่วยงานรัฐหรือไม่

Are there any conflicts related mangrove planting and sustainable utilization between local people and governmental agencies?

41. ท่านมีการประเมินหรือติดตามตรวจสอบผลจากการปลูกป่าหรือไม่ อย่างไร

Do you follow up an outcome from mangrove planting? How do you monitor?

42. ท่านมีการประเมินหรือติดตามตรวจสอบการใช้ทรัพยากรป่าชายเลนของคนในชุมชนหรือไม่ว่าจะไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน และมีการติดตามตรวจสอบอย่างไร

Do you follow up the mangrove utilization of local people that will not affect to mangrove ecological production? How do you monitor?

43. หลังจากการฟื้นฟูป่าชายเลน การใช้ทรัพยากรป่าชายเลนของคนในชุมชนมีการปรับเปลี่ยนหรือไม่ อย่างไรและเพราะเหตุใด

Do the local people adapt their practices in utilizing mangrove resources since the mangrove forest had restored? How and why they change their utilization?

APPENDIX D

INTERVIEW GUIDELINES FOR

MANGROVE FOREST CONSERVATION GROUPS

ชื่อ-นามสกุลของผู้ให้สัมภาษณ์.....ตำแหน่ง.....

Name of interviewee.....Position.....

สถานที่ให้สัมภาษณ์.....วันที่.....เวลา.....

Interview location.....Date..... Time.....

1. ศูนย์อนุรักษ์ป่าชายเลน/ กลุ่มคนรักคลองโคก/ ศูนย์ประสานงานเพื่อการอนุรักษ์ป่าชายเลน ตั้งขึ้นเมื่อไหร่ และมีสมาชิกในตอนนี้อย่างไร

When is the Klong Khone Mangrove Forest Conservation Center/ Kon Rak Klong Khone group/ Coordination Center for Mangrove Forest Conservation established?

How many members in this center/ group?

2. สาเหตุที่ท่านตั้งศูนย์อนุรักษ์ป่าชายเลน/ กลุ่มคนรักคลองโคก/ ศูนย์ประสานงานเพื่อการอนุรักษ์ป่าชายเลนคืออะไร

Why do this center/ group is established?

3. เป้าหมายของการตั้งศูนย์อนุรักษ์ป่าชายเลน/ กลุ่มคนรักคลองโคก/ ศูนย์ประสานงานเพื่อการอนุรักษ์ป่าชายเลนคืออะไร

What is an objective of an establishment of this center/ group?

4. หน้าที่ของศูนย์อนุรักษ์ป่าชายเลน/ กลุ่มคนรักคลองโคก/ ศูนย์ประสานงานเพื่อการอนุรักษ์ป่าชายเลน คืออะไร

What is function of this center/ group?

5. มีใครเข้ามาช่วยเหลือหรือให้การสนับสนุนในการตั้งศูนย์อนุรักษ์ป่าชายเลน/กลุ่มคนรักคลองโคกบ้างหรือไม่ ใครบ้าง และในเรื่องอะไรบ้าง

Are there any group of people support an establishment of center/ group?

What are they supporting?

6. มีการใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลนมาใช้ในการวางแผนการฟื้นฟูป่าชายเลนด้วยหรือไม่ และความรู้เรื่องอะไรบ้างที่นำมาใช้ในการวางแผนการฟื้นฟูป่าชายเลน

Is there an application of local knowledge on mangrove forest for designing mangrove restoration plan?

What kinds of local knowledge that is applied in mangrove restoration plan design?

7. ในการอนุรักษ์ทรัพยากรป่าชายเลน กลุ่มของท่านได้มีการกำหนดพื้นที่หรือประเภททรัพยากรในการอนุรักษ์หรือไม่ อย่างไร

Do your center or group have chances in determining conservation and utilization areas or types of mangrove resources for conservation?

8. ในปัจจุบัน กลุ่มของท่านยังคงดำเนินการอนุรักษ์ป่าชายเลนหรือไม่ ทำอะไรบ้าง

Do your center or group still active in conserving the mangrove forest?

9. ท่านรู้ได้อย่างไรว่าวิธีการอนุรักษ์ป่าชายเลนที่กลุ่มของท่านทำอยู่นั้นสามารถฟื้นฟูและอนุรักษ์ป่าชายเลนได้ สังเกตจากอะไร วัดได้อย่างไร

How do you know that your practices in planting and conserving mangrove forest are able to restore the mangrove ecological production?

How do you evaluate?

10. ท่านรู้ได้อย่างไรว่าการใช้ทรัพยากรป่าชายเลนของคนในชุมชนในปัจจุบันนั้น ไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน มีการสังเกตหรือวัดผลหรือไม่ อย่างไร

How do you know that the local people's current utilization of mangrove resources will not affect to the mangrove ecological production? Do you have any evaluation?

11. มีปัญหาหรืออุปสรรคในการปลูกป่าเพื่อฟื้นฟูป่าชายเลนหรือไม่ อะไรบ้าง และท่านแก้ปัญหาเหล่านั้นอย่างไร

Are there any problems or obstacles during mangrove restoring? What are those problems? How do you solve them?

12. ในปัจจุบัน กลุ่มของท่านยังคงทำหน้าที่ดูแลรักษาป่าชายเลนเพื่อให้คนในชุมชนยังคงสามารถ
ใช้ทรัพยากรป่าชายเลนได้อยู่หรือไม่ อย่างไร

Do your group still conserve the mangrove forest for the local people's utilization? How
do you conserve it?

13. มีปัญหาหรืออุปสรรคในการดูแลรักษาป่าชายเลนเพื่อให้ทรัพยากรป่าชายเลนยังคงอยู่ต่อไป
หรือไม่ อะไรบ้าง และท่านแก้ปัญหาเหล่านั้นอย่างไร

Are there any problems or obstacles in mangrove conservation? What are those
problems? How do you solve them?

14. ท่านมีการประเมินหรือติดตามตรวจสอบผลจากการปลูกป่าหรือไม่ อย่างไร

Do you follow up an outcome from mangrove planting? How do you monitor?

15. ท่านมีการประเมินหรือติดตามตรวจสอบการใช้ทรัพยากรป่าชายเลนของคนในชุมชนหรือไม่ว่า
จะไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน และมีการติดตามตรวจสอบอย่างไร

Do you follow up the mangrove utilization of local people that will not affect to mangrove
ecological production? How do you monitor?

16. หลังจากการฟื้นฟูป่าชายเลน การใช้ทรัพยากรป่าชายเลนของคนในชุมชนมีการปรับเปลี่ยน
หรือไม่ อย่างไรและเพราะเหตุใด

Do the local people adapt their practices in utilizing mangrove resources since the
mangrove forest had restored? How and why they change their utilization?

APPENDIX E

INTERVIEW GUIDELINES FOR

KLONG KHONE SUBDISTRICT ADMINISTRATIVE

ORGANIZATION/ MANGROVE FOREST DEVELOPMENT

STATION 7

ชื่อ-นามสกุลของผู้ให้สัมภาษณ์.....ตำแหน่ง.....

Name of interviewee.....Position.....

สถานที่ให้สัมภาษณ์.....วันที่.....เวลา.....

Interview location.....Date.....Time.....

1. องค์การบริหารส่วนตำบลคลองโคน

1.1 องค์การบริหารส่วนตำบลคลองโคนตั้งขึ้นเมื่อไหร่ และมีเจ้าหน้าที่ปฏิบัติงานจำนวนเท่าไร

When is the Klong Khone Sub-district Administrative Organization (KK-SAO) established?

How many officials in organization?

1.2 องค์การบริหารส่วนตำบลคลองโคนมีเป้าหมายที่เกี่ยวข้องกับการฟื้นฟู อนุรักษ์และจัดการป่าชายเลนหรือไม่ อย่างไรบ้าง

Does the KK-SAO have an objective in restoration, conservation and management of mangrove forest?

1.3 องค์การบริหารส่วนตำบลคลองโคนมีหน้าที่เกี่ยวข้องกับการฟื้นฟู อนุรักษ์และจัดการป่าชายเลนหรือไม่ อย่างไรบ้าง

Does the KK-SAO has functions involving restoration, conservation and management of mangrove forest?

1.4 หน่วยงานของท่านได้มีส่วนร่วมวางแผนเพื่อการอนุรักษ์ป่าชายเลนหรือไม่ อย่างไรบ้าง

Do your organization participate in designing mangrove conservation plan? How do your organization support the mangrove conservation plan design?

1.5 มีการใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลนมาใช้ในการวางแผนการฟื้นฟูป่าชายเลนด้วยหรือไม่ อย่างไร และความรู้เรื่องอะไรบ้างที่นำมาใช้ในการวางแผนการฟื้นฟูป่าชายเลน

Is there an application of local knowledge on mangrove forest for designing mangrove restoration plan?

What kinds of local knowledge that is applied in mangrove restoration plan design?

1.6 ในการอนุรักษ์ทรัพยากรป่าชายเลน หน่วยงานของท่านมีส่วนในการกำหนดพื้นที่หรือประเภททรัพยากรในการอนุรักษ์หรือไม่ อย่างไร

Do your organization involve in mangrove zoning or mangrove resources for conservation?

1.7 หน่วยงานของท่านเคยแนะนำหรือถ่ายทอดความรู้หรือประสบการณ์เกี่ยวกับประโยชน์ของป่าชายเลนและการฟื้นฟูป่าชายเลนให้แก่คนในชุมชน หน่วยงาน บริษัทหรือชุมชนภายนอกหรือไม่ ด้วยวิธีการใด

Have do your organization ever transferred knowledge or experience related to benefits of mangrove forest and mangrove restoration to local people, governmental and private organizations, and other communities? What is your knowledge transfer methods?

1.8 หน่วยงานของท่านได้มีการเผยแพร่ประชาสัมพันธ์ให้คนในชุมชนของท่านทราบถึงประโยชน์ของการอนุรักษ์ป่าชายเลน และการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่ ด้วยวิธีการใด

Have do your organization ever transferred knowledge or experience related to benefits of mangrove restoration and sustainable utilization of mangrove resources to local people, governmental and private organizations, and other communities? What is your knowledge transfer methods?

1.9 หน่วยงานของท่านได้มีการวางแผนหรือแลกเปลี่ยนความคิดเห็น ความรู้และประสบการณ์ร่วมกับหน่วยงาน ผู้นำชุมชน ศูนย์อนุรักษ์ป่าชายเลน หรือคนในชุมชนเกี่ยวกับการอนุรักษ์และการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่ อย่างไร

Do your organization have a planning or an exchanging opinions, knowledge and experience with other organizations, village chiefs, Mangrove Forest Development

Station 7, or local people who involve with mangrove restoration and sustainable mangrove utilization? What is your knowledge sharing methods?

1.10 ท่านมีการประเมินหรือติดตามตรวจสอบการใช้ทรัพยากรป่าชายเลนของคนในชุมชนหรือไม่
ว่าจะไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน และมีการติดตามตรวจสอบอย่างไร

Do you follow up the mangrove utilization of local people that will not affect to mangrove ecological production? How do you monitor?

1.11 หลังจากการฟื้นฟูป่าชายเลน การใช้ทรัพยากรป่าชายเลนของคนในชุมชนมีการปรับเปลี่ยนหรือไม่ อย่างไรและเพราะเหตุใด

Do the local people adapt their practices in utilizing mangrove resources since the mangrove forest had restored? How and why they change their utilization?

2. สถานีพัฒนาป่าชายเลนที่ 7

2.1 สถานีพัฒนาป่าชายเลนที่ 7 ตั้งขึ้นเมื่อไหร่ และมีเจ้าหน้าที่ปฏิบัติงานจำนวนเท่าไร

When is the Mangrove Forest Development Station 7 established?

How many officials in organization?

2.2 สถานีพัฒนาป่าชายเลนที่ 7 มีเป้าหมายที่เกี่ยวข้องกับการฟื้นฟู อนุรักษ์และจัดการป่าชายเลนหรือไม่ อะไรบ้าง

Does the MGFDS 7 has an objective in restoration, conservation and management of mangrove forest?

2.3 สถานีพัฒนาป่าชายเลนที่ 7 มีหน้าที่เกี่ยวข้องกับการฟื้นฟู อนุรักษ์และจัดการป่าชายเลนอะไร และอย่างไรบ้าง

What are the MGFDS 7 functions in restoration, conservation and management of mangrove forest?

2.4 หน่วยงานของท่านได้มีส่วนร่วมวางแผนเพื่อการอนุรักษ์ป่าชายเลนหรือไม่ อย่างไรบ้าง

Do your organization participate in designing mangrove conservation plan? How do your organization support the mangrove conservation plan design?

2.5 มีการใช้ความรู้ของคนในชุมชนเกี่ยวกับป่าชายเลนมาใช้ในการวางแผนการฟื้นฟูป่าชายเลนด้วยหรือไม่ อย่างไร และความรู้เรื่องอะไรบ้างที่นำมาใช้ในการวางแผนการฟื้นฟูป่าชายเลน

Is there an application of local knowledge on mangrove forest for designing mangrove restoration plan?

What kinds of local knowledge that is applied in mangrove restoration plan design?

2.6 ในการอนุรักษ์ทรัพยากรป่าชายเลน หน่วยงานของท่านมีส่วนในการกำหนดพื้นที่หรือประเภททรัพยากรในการอนุรักษ์หรือไม่ อย่างไร

Do your organization involve in mangrove zoning or mangrove resources for conservation?

2.7 หน่วยงานของท่านเคยแนะนำหรือถ่ายทอดความรู้หรือประสบการณ์เกี่ยวกับประโยชน์ของป่าชายเลนและการฟื้นฟูป่าชายเลนให้แก่คนในชุมชน หน่วยงาน บริษัทหรือชุมชนภายนอกหรือไม่ ด้วยวิธีการใด

Have do your organization ever transferred knowledge or experience related to benefits of mangrove forest and mangrove restoration to local people, governmental and private organizations, and other communities? What is your knowledge transfer methods?

2.8 หน่วยงานของท่านได้มีการเผยแพร่ประชาสัมพันธ์ให้คนในชุมชนของท่านทราบถึงประโยชน์ของการอนุรักษ์ป่าชายเลน และการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่ ด้วยวิธีการใด

Have do your organization ever transferred knowledge or experience related to benefits of mangrove restoration and sustainable utilization of mangrove resources to local people, governmental and private organizations, and other communities? What is your knowledge transfer methods?

2.9 หน่วยงานของท่านได้มีการวางแผนหรือแลกเปลี่ยนความคิดเห็น ความรู้และประสบการณ์ร่วมกับหน่วยงาน ผู้นำชุมชน ศูนย์อนุรักษ์ป่าชายเลน หรือคนในชุมชนเกี่ยวกับการอนุรักษ์และการใช้ทรัพยากรป่าชายเลนอย่างยั่งยืนหรือไม่ อย่างไร

Do your organization have a planning or an exchanging opinions, knowledge and experience with other organizations, village chiefs, Mangrove Forest Development Station 7, or local people who involve with mangrove restoration and sustainable mangrove utilization? What is your knowledge sharing methods?

2.10 ท่านมีการประเมินหรือติดตามตรวจสอบการใช้ทรัพยากรป่าชายเลนของคนในชุมชนหรือไม่
ว่าจะไม่ส่งผลกระทบต่อระบบนิเวศป่าชายเลน และมีการติดตามตรวจสอบอย่างไร

Do you follow up the mangrove utilization of local people that will not affect to mangrove
ecological production? How do you monitor?

2.11 หลังจากการฟื้นฟูป่าชายเลน การใช้ทรัพยากรป่าชายเลนของคนในชุมชนมีการปรับเปลี่ยน
หรือไม่ อย่างไรและเพราะเหตุใด

Do the local people adapt their practices in utilizing mangrove resources since the
mangrove forest had restored? How and why they change their utilization?



APPENDIX F

SUMMARY OF ANALYZED DATA

PART I UTILIZATION OF MANGROVE ECOSYSTEM SERVICES

1.1 Utilization of MGES during mangrove stand initiation (N=140)

Mangrove ecosystem services	Yes		No	
	N	%	N	%
Food	126	90	14	10
Biochemical	15	11	125	89
Fuelwood	35	25	105	75
Fiber	36	26	104	74
Mangrove seedlings	40	29	100	71
Aquaculture	15	11	121	89
Spiritual and religious values	9	6	131	94
Educational values	42	30	98	70
Recreation and ecotourism	23	16	117	84

Note: Multiple responses were possible.

1.2 Utilization of MGES during young forest regrowth (N=140)

Mangrove ecosystem services	Yes		No	
	N	%	N	%
Food	122	87	18	13
Biochemical	16	11	124	89
Fuelwood	16	11	124	89
Fiber	19	13	121	86
Mangrove seedlings	53	38	87	62
Aquaculture	66	47	74	53
Spiritual and religious values	8	6	132	94
Educational values	70	50	70	50
Recreation and ecotourism	65	46	75	54

Note: Multiple responses were possible.

PART II FACTORS IN THE LOCAL KNOWLEDGE LIFE CYCLE

2.1 Perception of local people during two phases of mangrove stand initiation and young forest regrowth (N=140)

Ranking	Factors	Yes		No		Do not know	
		N	%	N	%	N	%
1	Common property right	131	94	4	3	5	3
2	Mangrove forest areas	123	88	5	3	12	9
3	Intensity of wave and wind	121	87	13	9	6	4
4	Mangrove ecosystem services	121	87	13	9	6	4
5	Birthplace	118	84	16	11	6	4
6	Social norms	117	84	10	7	13	9
7	Income from mangrove ecosystem services	110	78	25	18	5	4
8	Volunteering with altruism	107	76	15	11	18	13
9	Occupation	105	75	25	18	10	7
10	Location of house	102	73	26	18	12	9
11	Age	90	64	40	29	10	7
12	Position and responsibility	62	44	62	44	16	12
13	Education	54	39	73	52	13	9
14	Sex	46	33	81	58	13	9

Note: Multiple responses were possible.

2.2 Factors influencing the goal setting

2.2.1 Factors influencing the goal setting during mangrove stand initiation (N = 140)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Mangrove reforestation areas	78	56	58	41
2	Participation	44	31	92	66
3	Laws and regulations	38	27	98	70
	Tidal current	38	27	98	70
4	Budget and expense	31	22	105	75

Ranking	Factors	Selected		Unselected	
		N	%	N	%
5	Policy	25	18	111	79
6	Local knowledge application	24	17	112	80
7	Social norms	22	16	114	81
8	Technological support	20	14	116	83
9	Season	17	12	119	85
10	Other factors	6	4	130	93
Missing values		4 (3%)			

Note: Multiple responses were possible.

2.2.2 Factors enabling objective setting during young forest regrowth (N = 140)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Mangrove utilization areas	76	54	60	43
2	Laws and regulations	48	34	88	63
3	Participation	44	31	92	66
	Expected income	36	26	100	71
4	Social norms	33	23.5	103	73.5
5	Technological support	26	18.5	110	78.5
6	Budget and expense	25	18	111	79
7	Tidal current	16	11	120	86
8	Policy	15	11	121	86
9	Season	11	8	125	89
10	Other factors	2	1	134	96
Missing values		4 (3%)			

Note: Multiple responses were possible.

2.3 Factors influencing participation during stand initiation and young forest regrowth ($N = 140$)

Ranking	Factors	Yes		No		Do not know	
		N	%	N	%	N	%
1	Common property right	126	90	6	4	8	6
2	Trust and loyalty in HRH Princess Maha Chakri Sirindhorn	125	89	12	9	3	2
3	Public interest	107	76	22	16	11	8
4	Social norms	101	72	26	19	13	9
5	Communication and advertisement	100	72	31	22	9	6
6	Trust in village chiefs	95	68	32	23	13	9
7	Persuasion from experts	89	64	34	24	17	12
8	Volunteer with altruism	89	63	47	34	4	3
9	Guilt	85	61	46	33	9	6
10	Persuasion from respected and trusted people	79	56	51	37	10	7
11	Communication skills	74	53	48	34	18	13
12	Self-esteem	69	49	47	34	24	17
13	Policy	69	49	54	39	17	12
14	Trust in provincial governor	67	48	63	45	10	7
15	Conformity to other people	43	31	91	65	6	4
16	Sex	43	31	74	53	23	16
17	Educational level	38	27	90	64	12	9
18	Spiritual beliefs and rituals	34	24	69	49	37	27
19	Laws and regulations	30	21	96	69	14	10
20	Fear of censure	24	17	112	80	4	3
21	Rewards and economic incentives	17	12	118	84	5	4

Note: Multiple responses were possible.

2.4 Knowledge acquisition methods

2.4.1 Knowledge acquisition methods for mangrove restoring ($N = 140$)

Ranking	Knowledge acquisition methods	Selected		Unselected	
		N	%	N	%
1	Trial and error and observation	52	37	84	60
2	Discussion and training	50	36	86	61
3	Document reviews	35	25	101	72
4	TV/Radio/Newspaper	30	21	106	76
5	Internet and social media	23	16	113	81
6	Story telling	15	11	121	86
Missing values		4 (3%)			

Note: Multiple responses were possible.

2.4.2 Knowledge acquisition methods for the SU of MGES from restored mangrove forest ($N = 140$)

Ranking	Knowledge acquisition methods	Selected		Unselected	
		N	%	N	%
1	Discussion and training	57	41	80	57
2	Trial and error and observation	47	34	90	64
3	Document reviews	35	25	102	73
4	Story telling	26	19	111	79
5	TV/Radio/Newspaper	23	16	114	81
6	Internet and social media	20	14	117	84
Missing values		3 (2%)			

Note: Multiple responses were possible.

2.5 Factors influencing a plan design

2.5.1 Factors influencing a design of mangrove restoring plan ($N = 140$)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Mangrove reforestation areas	82	58	53	38
2	Availability and distribution of mangrove seedlings	61	43	74	53
3	Tidal current	60	43	75	53
4	Wave and wind	53	38	82	58
5	Budget and financial support	50	35	85	61
6	Livelihood of local people	39	28	95	68
7	Human resources	39	28	96	68
8	Participation	36	25	99	71
9	Local knowledge application	27	19	108	77
10	Policy	22	15	113	81
11	Laws and regulations	20	14	115	82
12	Wastewater	19	13	116	83
13	Quality of freshwater and salinity	18	13	117	83
14	Sedimentation	17	12	118	84
15	Season	16	11	119	85
16	Technological support	15	10	120	86
17	Spiritual beliefs and rituals	12	8	123	88
18	Social norms	11	8	124	88
Missing values		5 (4%)			

Note: Multiple responses were possible.

2.5.2 Factors influencing a plan design during the young forest regrowth ($N = 140$)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Availability and distribution of mangrove seedlings	61	43	74	52
2	Mangrove utilization areas	52	37	81	58
3	Laws and regulations	46	33	87	62
4	Participation	36	25	99	70
5	Tidal current	29	21	104	74
6	Livelihood of local people	28	20	105	75
7	Technological support	27	19	106	76
8	Wave and wind	27	19	106	76
9	Policy	25	18	108	77
10	Local knowledge application	22	11	111	79
11	Social norms	18	13	115	82
12	Human resources	17	12	116	83
13	Budget and financial support	16	11	117	84
14	Wastewater	16	11	117	84
15	Season	14	10	119	85
16	Spiritual beliefs and rituals	12	9	121	86
17	Quality of freshwater and salinity	11	8	122	87
18	Sedimentation	9	6	124	89
Missing values		7 (5%)			

Note: Multiple responses were possible.

2.6 Factors influencing a validation of plan

2.6.1 Factors influencing a validation of mangrove restoring plan (N = 140)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Mangrove reforestation areas	54	39	79	56
2	Policy	47	34	86	61
3	Laws and regulations	45	32	88	63
4	Tidal current	38	27	95	68
5	Budget and financial support	29	21	104	74
6	Availability and distribution of mangrove seedlings	26	19	107	76
7	Participation	23	16	110	79
8	Technological support	20	14	113	81
9	Livelihood of local people	20	14	113	81
10	Human resources	20	14	113	81
11	Quality of freshwater and salinity	17	12	116	83
12	Local knowledge application	14	10	119	85
13	Season	13	9	120	86
14	Sedimentation	11	8	122	87
15	Wave and wind	10	7	123	88
16	Wastewater management	10	7	123	88
17	Spiritual beliefs and rituals	9	6	124	89
18	Social norms	9	6	124	89
19	Other factors	1	1	132	94
Missing values		7 (5%)			

Note: Multiple responses were possible.

2.6.2 Factors influencing a validation of the SU of restored MGES plan (N = 140)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Laws and regulations	43	31	89	63
2	Mangrove utilization areas	35	25	97	69
3	Technological support	35	25	97	69
4	Local knowledge application	26	18	106	76
5	Livelihood of local people	23	16	109	78
6	Wave and wind	20	14	112	80
7	Policy	18	13	114	81
8	Tidal current	17	12	115	82
9	Social norms	15	11	117	83
10	Budget and financial support	14	10	118	84
11	Spiritual beliefs and rituals	13	9	119	85
12	Human resources	13	9	119	85
13	Quality of freshwater and salinity	11	8	121	86
14	Sedimentation	11	8	121	86
15	Season	10	7	122	87
16	Expected income	8	6	124	88
17	Wastewater	8	6	124	88
18	Other factors	1	1	131	93
Missing values		8 (6%)			

Note: Multiple responses were possible.

2.7 Factors influencing practices of local people

2.7.1 Factors influencing practices of local people for restoring mangrove ($N = 140$)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn	79	57	55	39
2	Land use zoning	46	33	88	63
3	Persuasion by village chiefs	44	32	90	64
4	Volunteering with altruism	42	30	92	66
5	Laws and regulations	34	24	100	72
6	Trust in the village chiefs	33	24	101	72
7	Sense of community	30	22	104	74
8	Advertisement from governmental organization and private sectors	25	18	109	78
9	Policy	22	16	112	80
10	Persuasion by trusted people	20	14	114	82
11	Social norms	17	12	117	84
12	Educational level	15	11	119	85
13	Persuasion by family members	14	10	120	86
14	Persuasion by close friends	11	8	123	88
15	Rewards and economic incentives	6	4	128	92
16	Other factors	1	1	133	95
Missing values		6 (4%)			

Note: Multiple responses were possible.

2.7.2 Factors influencing practices of local people for the SU of restored MGES

(N = 140)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn	68	48	67	48
2	Laws and regulations	51	36	84	60
3	Land use zoning	41	30	94	70
4	Volunteering with altruism	37	26	98	70
5	Persuasion by village chiefs	31	22	104	74
6	Advertisement from governmental organization and private sectors	29	21	106	75
7	Trust of local people in the village chiefs	27	19	108	77
8	Sense of community	24	17	111	79
9	Social norms	19	13	116	83
10	Policy	16	11	119	85
11	Persuasion by trusted people	14	10	121	86
12	Educational level	12	8	123	88
13	Persuasion by family members	12	8	123	88
14	Persuasion by close friends	11	8	124	88
15	Rewards and economic incentives	7	5	128	91
16	Other factors	1	0	134	96
Missing values		5 (4%)			

Note: Multiple responses were possible.

2.8 Post-evaluation of practices

2.8.1 Factors in a post-evaluation of mangrove restoring during mangrove stand initiation ($N = 140$)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Human resources	56	40	75	54
2	Local knowledge application	40	29	91	65
3	Laws and regulations	39	28	92	76
4	Participation	32	23	99	71
5	Budget and financial support	30	22	101	72
6	Social norms	28	20	103	74
7	Policy	27	19	104	75
8	Technological support	19	14	112	80
9	Other factors	1	1	130	93
Missing values		9 (6%)			

Note: Multiple responses were possible.

2.8.2 Factors in a post-evaluation of SU of restored MGES during the young forest regrowth ($N = 140$)

Ranking	Factors	Selected		Unselected	
		N	%	N	%
1	Trust and loyalty of local people in HRH Princess Maha Chakri Sirindhorn	60	43	70	50
2	Land use zoning	53	38	77	55
3	Laws and regulations	36	26	94	67
4	Persuasion by village chiefs	28	20	102	73
5	Trust of local people in the village chiefs	27	19	103	74
6	Sense of community	25	18	105	75
7	Volunteering with altruism	23	16	107	77
8	Advertisement from governmental organizations and private sectors	21	15	109	78

Ranking	Factors	Selected		Unselected	
		N	%	N	%
9	Policy	19	14	111	79
10	Persuasion by family members	18	13	112	80
11	Social norms	17	12	113	81
12	Educational level	12	9	118	84
13	Persuasion by trusted people	10	7	120	86
14	Persuasion by close friends	9	6	121	87
15	Rewards and economic incentives	9	6	121	87
Missing values		10 (7%)			

Note: Multiple responses were possible.



PART III CONDITIONS INDICATING THE SU OF MGES

3. Conditions enabling the SU of MGES during two phases of mangrove stand initiation and young forest regrowth ($N = 140$)

Ranking	Factors	Yes		No		Do not know	
		N	%	N	%	N	%
1	Availability of marine animals for collection	130	93	4	3	6	4
2	Common property right	128	91	11	8	1	1
3	Participation	121	86	10	7	9	6
4	Availability of natural mangrove seedlings for collection and plantation	120	86	11	8	9	6
5	Human resources	119	85	6	4	15	11
6	Increase of sedimentation	116	83	2	1	22	16
7	Employment and occupation	110	79	16	11	14	10
8	Local knowledge application	108	77	8	6	24	17
9	Policy	105	75	13	9	22	16
10	Communication skills	101	72	20	14	19	14
11	Income	98	70	24	17	18	13
12	Leadership	97	69	23	16	20	14
13	Land use zoning	97	69	16	11	27	19
14	Education	95	68	29	21	16	11
15	Community commitment	94	67	8	6	38	27
16	Generation of community groups for mangrove conservation	93	66	15	11	32	23
17	Social norms	81	58	36	26	23	16
18	Laws and regulations	80	57	32	23	28	20
19	Community enterprises	78	56	35	25	27	19
20	Return of local people to hometown	75	54	43	31	22	16

Ranking	Factors	Yes		No		Do not know	
		N	%	N	%	N	%
21	Partnership of various groups of people	68	49	17	12	55	39
22	Spiritual beliefs and rituals	37	26	60	43	43	31
23	Financial and technological support	41	29	29	21	70	50
24	Rewards and economic incentives	10	7	124	89	6	4

Note: Multiple responses were possible.



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