

*Original Paper*

Integrating Strategic Environmental Assessment to Climate  
Change Adaption in the Chao Phraya River Basin: Case Study  
Flood Management Plans in Ayutthaya

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**Abstract**

*Traditionally, flood management has concentrated on providing protection against floods using technical measures, but there is currently an international shift towards a more integrated system of flood risk management, whereby flood risk is defined as the probability of flooding multiplied by the potential consequences. Climate change is a great challenge to sustainable development and the Millennium Development Goals (MDGs) in Thailand. The main purpose of this paper is to highlight the challenges associated with the current situation and projected impacts of climate change on the disasters and the human environment in Thailand, to review and explore the potential of Strategic Environmental Assessment (SEA), and to propose SEA in making informed decisions relevant to the implementation of the new adaptation framework in a flood management plan. Thus, current measures on how Thailand is responding to the recent impacts of climate change in river basin planning are presented. It is imperative that an appropriate environmental assessment tool, such as SEA be employed in making rational decisions regarding adaptation frameworks. SEA offers a structured and proactive environmental tool for integrating of climate change adaption into formulating Policies, Plans, and Programs (PPPs) among relevant sectors.*

**Keywords**

*ayutthaya, climate change, flood management, strategic environmental assessment (SEA)*

## 1. Introduction

The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) fully confirmed the occurrence of global climate change. The UNFCCC has already identified adaptation as an option to address climate change. “Adaptation includes several types of actions that can be implemented in several sectors, associated with different climatic challenges depending on geographic zones and using widely diversified instruments” (IPCC, 2007b). Thailand is one of the countries around the world that is most severely affected by the consequences of climate change. Climate change impacts in Thailand, namely prolonged droughts, more frequent heavy rainfall, sea level rise and season changed. Climate change rising in sea level has been affected in many rivers. Climate change has been watched have local and global effects. The remarkable phenomena are affected by extreme weather events, such as heavy rains, high precipitation, heat waves, flood and drought. Climate change has led to a critical risk to the well-being of nature and humans in the world.

Even though Thailand has mega experienced a flood disaster several times, especially the mega-flood event in 2011, which with several caused such excessive and continuous rainfall, powerful monsoons, and water management plans and systems. The Chao Phraya River basin is flooded naturally because of its topography and climate change. Climate change is likely to increase both flood risk and its severity in the future. Nevertheless, the primary driver of the increase in severe floods in the basin in recent years is human intrusiveness in environmental circumstances such as expanded urbanization, deforestation, irrigation and power generation (Hungspreug et al., 2000; Poaponsakorn, 2012; Poaponsakorn et al., 2013).

In terms of flood management, the lesson learned with this history and experiences of flood disasters, better keys should be developed to prevent or manage its calamitous recurrence. The movements, responding and succor the victims or the community to manage against flood disasters still have shortcomings (Tanwattana et al., 2014). This conspicuously exposes the limitations of flood management plans, disaster risk reduction, and emergency responses by the community, government and stakeholders in general (Roachanakanan, 2016; Koontanakulvong, 2016; Chanjirawuttikun, 2016). Because of unsystematic is lack of disaster management system and a coordinated flood response system (Koontanakulvong, 2016). These drivers caused indecisive and inadequate flood management at both the local and national levels of government. This certainly discloses the shortcomings and limitations in the organization of flood management plans and emergency responses by the community and government (Jukrkorn et al., 2014). There have been several studies on climate change related flood risk management conducted in a number of countries (Tanwattana, 2018; Ward et al., 2013; Meesuk et al., 2017., Chinnarasri and Porthaew, 2015; Attavanich, 2013; Belton and Miller, 2014; Hameed, 2013; Limjirakan et al., 2010; Mark, 2011; Naruchaikusol, 2016; Singkran, 2017, 2016).

To address the impacts of climate variability and change in Thailand, especially flooding events, there is a need for robust adaptation measures to be implemented. The United Nations Framework Convention on Climate Change (UNFCCC), which entered into force in 1994 provides the basis to

adapting the impacts of climate change. The UNFCCC urges all members to “take climate change considerations into account, to the extent feasible, in the relevant social, environmental, economic and environmental policies and actions and use appropriate methods, formulated and determined nationally, with a review to minimizing effects of projects, programs and measures undertaken by them to mitigate or adapt to climate change”. The objective of this paper is to explore how SEA could be introduced into the planning such the flood management planning in the Thai context with an appropriate framework, to identify the benefits and constraints of this integration SEA into the existing framework.

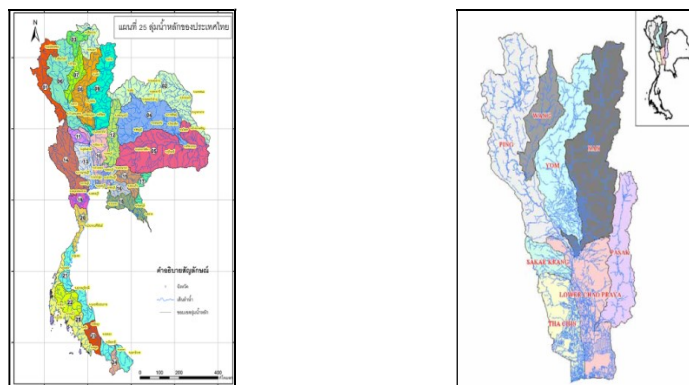
## **2. Method**

### *2.1 Study Area*

Based water resources development and management systems, Thailand has begun using river basin in 2002 by divided into 25 river basins (Figure 1).

#### *2.1.1 Overview*

The Chao Phraya River Basin (CPRB) is the largest river basin in the central region of Thailand. It is also the most important in economic terms, as it encompasses the bulk of the irrigated area as well as the Bangkok Metropolitan Administration (BMA). It is the principal water resource in the country for domestic consumption, agricultural irrigation, and hydropower. It is the most fertile region with the largest irrigated area with a catchment area of 162,800 square kilometer or approximately 35 per cent of the country’s areas. The CPRB can be divided into eight sub-basins including the Ping, Wang Yom, Nan, Chao Phraya, Sakae Krang, Pasak and Tha Chin rivers. The upper CPRB in the northern region of the country consists of the Ping, Wang, Yom, and Nan rivers. These tributaries flow to meet at Nakhon Sawan Province namely the Chao Phraya River as the lower CPRB. In the central region, the Sakae Krang and the Pasak meet the Chao Phraya River, and then the Tha Chin River branches at the main stream before through to the Gulf of Thailand. There are two main reservoirs, namely the Bhumibol Dam, located on the upper Ping River and Sirikit Dam is located on the upper Nan River. Both generate electricity and service water capacity (Komori et al., 2012). The river goes through the Central Plain and flows to the Gulf of Thailand.



a) The 25 River Basins in Thailand

b) the Chao Phraya River basin area

Figure 1. The River Basin in Thailand (DWR, 2016)

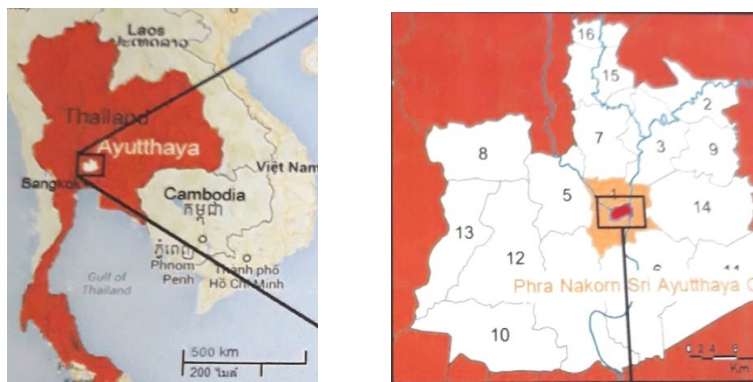
Thailand has a tropical wet climate, which is divided into three main seasons: 1) the rainy season starts with the monsoon from May to October, contributing 75% of total rainfall; 2) winter season from October to February when the northeast monsoon begins to cover the country and 3) summer seasons from February to May during the transition between northeast monsoon and the southwest monsoon, during which temperatures range from approximately 35.0 to 39.9° Celsius. Rainfall is significant and rainfall patterns vary considerably across the country, and Thailand has historically been considered a country with abundant water resources and relies heavily on monsoon rainfall patterns. The total average annual rainfall is about 1,572.2 millimeter.

With 25 river basins, some of them have been considered ‘hot spots’ given the economic and social pressure combined with limited water resources. Although rapid economic growth is not at the same rates as in previous decades, rapid urbanization and industrialization are still happening. These processes, at the same time, beneficial for poverty reduction and income increase, are putting serious pressure on natural resources, especially water resources. This fact is witnessed in Thailand which is facing in recent years two extremes of water-related disasters, namely floods and droughts, which is causing severe water issues across the country.

2.1.2 Ayutthaya Province and Municipality

Ayutthaya province is in the Central Plains of the country, 80 km from the capital Bangkok. It covers 2,556 square kilometers and is situated on the flat river plain of the Chao Phraya River basin as shown Figure 2. This basin caused to become an important water resource for cultivated area, particular the rice crop. Ayutthaya province is located at the junction of the Chao Phraya, Loburi, Noi and Pa Sak rivers, divided into 16 districts, 209 sub districts and 1328 villages. Ayutthaya was the ancient capital of Thailand called Siam, the ruins of the ancient city now from the Ayutthaya Historical Park, an archaeological site that consists of palaces, temples, monasteries, and statues.

Ayutthaya City Municipality is the local levels, with 14.84 square kilometers together with ten sub-districts under its responsibility. The location of the Municipality is the island surrounded by the three rivers-Chao Phraya, Pa Sak and Lop Buri, respectively.



**Figure 2. Map of Ayutthaya Province and Ayutthaya Island**

*2.2 Methodology*

The study relies on fieldwork conducted in the Chao Phraya River basin and in Ayutthaya province in 2017. Interview with professional staffs in the government at the flood management planning and other authorities related in flood management planning such the Royal Irrigation Department (RID) and its regional branch offices, local administrative authorities, and the relevant stakeholders and field observation were happened at the same time. Out of 7 interviewees from central governments, 17 participants from local government, and 15 interviewees from community leaders, all of them were willing to be interviewed. It was difficult to increase the number of interviewees because of the relatively low response rate, time constraints of interviewees, lack of real data and lack of environmental awareness.

Each interview began with a semi structured discussion that sought to explore what and how they think about water resource management and flood management. In order to effectively and comprehensively explore the hot issues and the complex idea of adopting flood management through SEA. The results from the foregoing steps were taken into consideration for proposing management measures based on involving flood management, stakeholder’s participation related to flood management plan, improving poor performance, and focusing on key significant influential factors.

In addition, 30 participants for focus group discussion from different organizations in Ayutthaya province such provincial governor, irrigation projects of Ayutthaya province, provincial office for local administration, the coordination and management of the Chao Phraya Basin, Ayutthaya office of public works and Town & Country Planning, Prime Minister’s Office, Ayutthaya Provincial Public Health Office, Provincial of Social Development and Human Society, Ayutthaya Provincial Office for Department of Disaster Prevention and Mitigation, Policy and Planning Officer and Ayutthaya City Hall. The collected data was analyzed using simple statistic methods like mean, percentages and frequency distribution.

The secondary data for this exploratory research was obtained from a desk study using various international articles, journal papers, conference proceedings, related books, legislation and regulations, relevant plans, proposals, research programs and reports. The study used mixed methods, with a

combination of interviews, field observation, focus group discussion and document review, to explore drivers and impacts of localized flooding and to explain how local communities adapt to it.

### 3. Result

#### 3.1 *The Policy Formation and Implementation Contexts*

In the past, the government played the main role in disaster management such as the most of management process began after a disaster had occurred. Structural and non-structural measures were built. While knowledge, skills, experience, awareness, preparedness and practices were poor. The government structures of disaster management consisted of different ministries and departments in all level as central level, province level and local level. The sophisticated structure of the related government made to respond to the disaster slowly. There was a lack of systematic cooperation among central government, province government, local government and local people included other stakeholders.

In 2011, the disaster management aimed on prevention and response to disaster, reconstruction and rehabilitation (Build Back Better and Safer). The government adapted lessons learnt from other countries that highlight both prevention and rehabilitation. The structural and non-structural measures were still important measures. Structural measures were related to dams, dikes, levees and water flows. Non-structural measures were related to prevention, adaptation, awareness and preparedness. The communication channel is also crucial among government, local authorities, local people and other stakeholders. The most important key is various organizations related in disaster management as the Royal Irrigation Department (RID), the Department of Disaster Prevention and Mitigation (DDPM), Department of Water Resource, Department of Public Works and Town & Country Planning (DPT), the Hydro and Agro Informatics Information Institute (HAI) and Thai Meteorological Department (TMD). Thailand has three laws related in disaster management such as Civil Defense Act 1979, National Civil Defense Plan 2005 and Disaster Prevention and Mitigation Act 2007. National Civil Defense Plan 2005 was implemented under the Civil Defense 1979. This plan is to be guidelines the directions and policies for disaster management. This plan aims to prevent the disaster by proactive approaches, to reduce the risks and damages. Moreover, this plan focuses on warning systems, communication systems includes additional communication systems. Disaster Prevention and Mitigation Act 2007 focuses on the structure of the disaster management in order to integrate resources management, administration and cooperation among the related organization and all stakeholders.

#### 3.2 *Environmental of Ayutthaya Province and the Surrounding Areas*

##### 3.2.1 Location

Ayutthaya province was chosen to focus in this study. It is in the Central Plain of the country, 80 kilometers from the capital Bangkok. It covers 2,556 square kilometers and is situated on the flat river plain of the basin. This province is susceptible to fluvial flooding generated in the upstream area, as well as pluvial flooding that can result from intense rainfall. In addition, this area recently experienced

a devastating flood in 2011 when the entire area was inundated for over one month, and water depths exceeded 4 m in some areas. The province is also located at the junction of the Chao Phraya, Loburi, Noi and Pa Sak rivers. Ayutthaya City Municipality (ACM) is the local administrative unit, with 14.84 square kilometers with location is the island surrounded by the three rivers- Chao Phraya River, Pa Sak River, Lop Buri River, and Noi River, respectively. Moreover, there are natural channels such as Bang Ban canal, and Bang Luang canal. Furthermore, there are 13 irrigation projects to provide water resources to agricultural sector. The most of land use is paddy field more than 70 percent and build-up area around 18 percent in 2015.

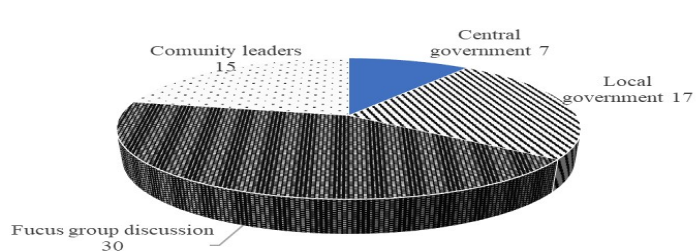
### 3.2.2 Climate Change Increases Precipitation

Ayutthaya province is the one area of Thailand that has high volume of precipitation. According to statistic of precipitation in Ayutthaya province from Thai Meteorological Department in 30 years period (1998-2013), during rainy season (May-October), total rain volume is 1,135.5. Each month has more than 140 ml/month, and rainy day is 15-20 day/month. While during November-February period (drought season), there are around 88.5 ml. Then in hot season (March-April), There are high precipitation from rainstorm, total precipitation in this period is 193.9 ml. Overall in one year, Ayutthaya province has long period of raining, around 8 months per year, and has high volume of precipitation. More over the trend of average annual rain volume is seemed increase every in period. This characteristic of the area made Ayutthaya province has flood in area along river and canal, as well as the area where drainage system is ineffective.

Because Ayutthaya is located in the middle of the CPRB and it has an Ayutthaya Agro Meteorological Station which the data is available from year 2009-present. The climate in Ayutthaya consists of hot, rainy and cool season. The hottest season is in April when the temperature can reach around 31.5 Celsius. In June to October is the wet season where precipitation varies between 100-365 mm./month. The cool season starts in December until February by the average temperature was 26.7-29.8 Celsius and the average humidity was 52.33- 84.00 from 2009 to 2012 (TMD, 2013).

### 3.3 Responsibility of the Related Organizations

There are several organizations concerning in climate related hydrological risks and adaptation in the CPRB. The result of the interview of the key informants about policy formation and management by the government, in response to disaster can be showed as Figure 3.



**Figure 3. The Number of Key Informants about Policy Formation and Management**

The first category is the central government. Interviewees from the central government were divided into five groups. The first group is the Royal Irrigation Department (RID) that has the main authority to allocate water to consumers. The RID's role is to follow up, check, and analyze the amount of water and coordinate with the governor provinces. While they set up the new unit namely Smart Water Operation Center: SWOC is under the RID to flood alert measure. They had already prepared flood mitigation plans and were working with relevant agencies such as Thai Meteorological (TMD) to keep update in the real time and plan flood mitigation measures. The RID has been working closely with all relevant agencies to make sure that the flood situation remains under the control. While the RID cannot prepare for unexpected storm including to predict the lowered water levels in the reservoir and prepare the amount of remaining room for water future. The RID cannot stop discharging water from dams to reduce the amount of water following into the Chao Phraya River and relieve downstream flooding. Reviewing past, ongoing and planned initiatives related to risk assessment and adaptation, they said that in the past there had been no specific laws or specific policies on disaster management.

The key issues, relevant indicators, vulnerable urban areas with baseline information and future direction that the interviewees indicated the pilot project by the RID to flood management. The interviewees indicated the gap related knowledge and alternative strategies action or policies for improved adaptation. Most of policies or plans were given from the national level or higher authority like "Top Down" that make the lack of integration from relevant organizations and stakeholders. In 2011 case, a lack of coordination and communication between government agencies, their operations only followed a specific problem to solve before, during and after disaster. Knowledge base for people is not enough and insufficient. The people did not take the warning seriously and did not evacuate. The duplication of the authority of government agencies caused delays in performance. Moreover, the government agencies collected duplicate information and did not undertake monitoring or verification of the information.

The second group of the central government was the Hydro and Agro Informatics Information Institute (HAI) that has roles and functions to involve with Thailand hydrological risk prevention and resolution. HAI operated the hydrological models and tools for forecasting the flood and water levels. They work with many organizations that contribute all aspects of water resource management. The data getting from this organization will be used for exchanging among the agencies that benefit for water resource management, disaster warning, minimizing the properties losses. There are many Weather Forecast Systems which have been operated by HAI. On the specific to CPRB, the model decision is based on the rainfall-runoff forecasting data to water resource management model.

The weather and water forecasting models are linked with the HAI computer system automatically as the computing network system. It shares the weather and climate information to the partner's organizations, which is operated by National Hydro informatics and Climate Data Center (NHC). The real time data is computed and automated with DHI Solution Software Program on the computer network. The sources of water related information can make an analysis on the water disaster risks. The



open source has been provided and possibly accessed to collect as the input data for the project.

The third group of the central government was the Department of Disaster Prevention and Mitigation (DDPM). The role of DDPM is to provide the humanitarian assistance to the people (emphasizing on disaster responsiveness—reduce and relief the human impacted). On the other role is to administrate the disaster impacted areas. Most of the disaster plans is on the national disaster management plan, provincial disaster management plan, and the local disaster management plan. On the local plan is encouraged by provincial DDPM authority to assess the risk and prepare for disaster responding. The DDPM has the regional authority as the equipment supplying to only respond the disaster event, and it has no authority to make a decision. All decision for disaster preparedness and mitigation is depended mostly on the provincial governor and the head of provincial DDPM.

The DDPM is the information receiver to determine on the disaster responding. The DDPM and Thammasat University are working on how the flood vulnerability adapts them to flood situation. The DDPM is supported by the UNDP for making the information system called DANA/DALA/PDNA for recording on the disaster impacted areas. The DDPM research and development department is developing spreadsheet data collecting. It is used for preparing to plan for disaster preparedness, respond, rehabilitation, and recovery under expectation of effective disaster management. The baseline that the DDPM is building for 5 years data, but Thailand has no previous data, and it is taking the time to building up the data information. The DDPM looks at the overall such as how to manage the upper basin, how to control the damage of disasters. However, the damage is mostly happened in the urban area and it should have more incentive plan on it.

In terms of the focus group discussion from all stakeholders in Ayutthaya province can indicate the status of hydrological risks and adaptive capacity in the Chao Phraya River basin with a focus on Ayutthaya province. All stakeholders about thirty participants from much organizations in Ayutthaya province were discussed.

The RID: In Ayutthaya province and the surrounding areas, the representative of the RID in the province indicated the causes of water disaster, current issues, plans and management. There are structural and non-structural measures to use for flood management. Non-structural measures such as crops overlapping calendar, crop harvest calendar and Monkey cheek were implemented. Along the Chao Phraya River basin, there are seven areas located in Ayutthaya province. Structural measures mean retention areas or Monkey cheek such as Thung Makham Yong and Thung Phu Kao Thong, maintenance water gates in the canals and adding the new water gates. He said:

*The communication is a crucial issue to connect between organizations, stakeholders and local people. We use the application with Video Call LINE groups by the community leaders. We have the thinking and planning system: forecast the weather condition by the information from relevant organizations for example, TMD, GISTDA to know the amount of rainfall and areas to storage water and how much water to keep or flood water or recharge water; which areas or which direction can recharge water with minimum effects. Moreover, we have a new plan to build the new canal project to pass the volume*

*of water to Thailand's golf directly namely Bang-Ban-Bang Sai project which has 22-kilometer length capacity recharge 1,200 cubic meter. (Interview November 22, 2017)*

The DDPM and the DPT: the representative of the DDPM in Ayutthaya province showed the plan for prevention and mitigation when disaster happen also as the RID. The representative of the DPT in Ayutthaya province described the plan to support the water management plan such as land use plan, law and regulation of land use, risk assessment map of water disaster. In addition, the roles and responsibilities of the stakeholders in the province to address the water disaster can indicate that; the RID aimed to regard the irrigated areas before other areas both before and after water disaster happen. While DDPM aimed to prevent and mitigate as the RID in three steps as before, during and after water disaster happen that consistent with DDPM's policy.

The local organization in Ayutthaya City Municipality (ACM) can divided in three groups; director technical service and planning division, director of fire and rescue and assistance fire, and rescue officer. All of them confirmed that they cannot spread the matter or plans or projects to the public without allowing from the mayor. All of plans were designed and sent through the same pattern from central government without integration from local organization.

Moreover, the practitioners in this office cannot understand in some tasks, so they cannot fill the facts in these tasks. From these indicated that knowledge and awareness of the related flood management practitioners are insufficient and unclear these can lead to misunderstanding and lacking in local people participation.

The last group is the representatives from the communities which consist of 15 leaders (male 11, female 4). These communities located near water channel such as Loburi river, CPR and Muang canal, Pasak river and Hantra canal, Muang canal, CPR, Pasak river, Pasak river and Loburi river, and outside of the dyke. The finding revealed that the respondents expressed a preference to awareness through the flooding in their residences; almost 2 weeks to one month and half on flood events, some members try to change the material to build their houses with concrete. They knew the information of an incoming flood from local radio, social media and each other in community. Most of members of communities knew before flood water come, they would move their property to the safety areas. During early flood event, there are no organizations in community level involve in the relief. The role of community leaders was meeting every month with the local organizations to discuss and share information to others. However, they confirmed that most of communities cannot prepare and link to the municipality government agencies and other because they have to do by themselves, supporting from government agencies were belated and less effective. Some of communities' leaders said:

*The local government must to help and support disaster victims immediately. The communication from government to local people needs to be improved.*

(Interview September 29, 2017)

#### *3.4 The Benefits and Constraints of SEA into the Flood Management Plan in the Case Study*

From the interviews with all informants, the researcher found that addressing the problem in water

disaster, we need to consider the context of each area including environment causes and effects of floods. The measures should consist of the role of people in the community, and the communication among government, local people and other stakeholders. The government in all levels should be open for participation of all sectors to get well cooperation and communication. In addition, the factors affecting of policy information and disaster management consists of six factors such as operation system; political uncertainty; emergency management; communication and coordination; participation and integration.

The hierarchy of government operation is vague and ambiguous to control the water level in the major dams. The sluice gates to open and close cannot control because of some politicians might have influenced the decision. The emergency management when the disaster happens merely delay because the government systems. Communication within same organization and across organizations should be done consistently using the same communication system. From the interview shown the local practitioners and local people barely have less participation in flood management plan due to the most of policy and plan come from the central government namely "Top-down" which is the basic management in Thai government system. Without participation that is without integration the flood management plan also.

The concept of SEA can contribute to the sustainable development process such as SEA was widely recognized by more than half of the interviewees as a valuable component of the process. As same as the main objective of SEA system is its potential capacity to contribute to achievement of sustainability. Most of interviewees considered that SEA is based on several principles and more flexible than EIA, which provide the basis for the development of more sustainable policy, plan and program proposals.

The results of the interviews regarding to the benefits to be obtained from the SEA process into the flood management planning in Ayutthaya can be seen in Figure 4. These results showed that: community leaders agreed that emergency management is the first important to implementation in flood management ( $\bar{X} = 4.73$ ), communication ( $\bar{X} = 4.67$ ) and participation ( $\bar{X} = 4.40$ ), respectively. Since the community leaders revealed that the local people cannot participate in the flood management planning in the study area as like as abandoned. They believed that through an exchange of opinion between public, government, local people and planners may gain more environmental knowledge and flood management system and they may have higher awareness. While government agreed that communication, emergency management and operation system are important ( $\bar{X} = 4.62, \bar{X} = 4.38, \bar{X} = 4.19$ ) respectively. These showed that integrating SEA into flood management planning in Thailand will promote better practices for sustainable development. All of interviewees agreed that SEA will be an effective tool to fulfill consider the environmental issues in the early stages of planning process. Moreover, this will contribute for decision making process to become effective and efficient. They believed that SEA will enhance the public involvement participation in the planning process ( $\bar{X} = 4.4$  and  $\bar{X} = 3.92$ ). The integration will help in achieving planning systems integration among central government, provincial government and local agencies

( $\bar{X} = 3.73$  and  $\bar{X} = 3.92$ ).

The results benefits mentioned above similar in many case studies in several countries such as achieving sustainability, the public participation, integration and incorporating the environmental issues into the flood management planning process (Brown & Therivel, 2000; Stinchcombe & Gibson, 2001; Fisher et al., 2009). Considering to the constraints to integrate SEA into the flood management planning, in Thailand, the absence of SEA, SEA legislation in the national environmental legal framework of the country was appointed as the crucial issue. This fact will difficult its application into the spatial planning and the flood management planning process. Figure 4 shows that the political uncertainty will, lack of capacity in SEA and poor technical know how are the other constraints.

The international literature showed that many countries have implemented SEA either on voluntary basis or through a national legislation including other provision as instruments, boards, cabinet and ministerial decisions, circulars and advice records (Therivel & Walsh, 2006).

The advantages of implementing SEA as a mandatory system in several countries in order to ensure that strategic action with potential environmental effect do not flee assessment, managing adequate resourcing of SEA and define the appropriate legal force to SEA findings. Some of interviewees argued that a clear legal framework and implementation guideline will prove to be beneficial to SEA practice. Additionally, providing a least regulatory context and a prescriptive set of process. It can be concluded that there is no perfection method through which SEA can be introduced in different contexts as it depends on the stipulation of the country. Nevertheless, it can be argued that in developing countries, a legal basis for SEA is vital as it boost the effectiveness of SEA process and practices. Additionally, the legal basis can provide basic SEA requirements, standards, and responsibility.

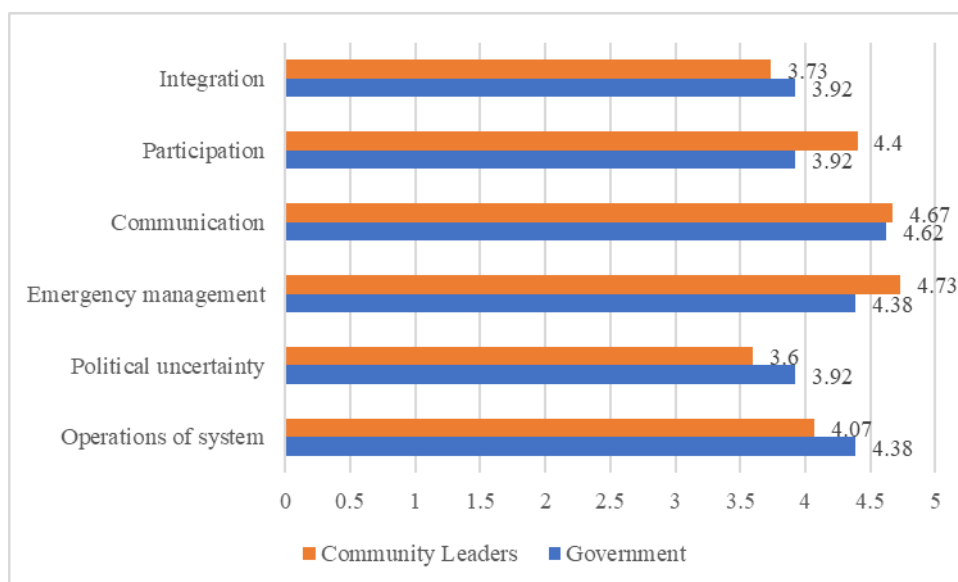


Figure 4. Overall Weakness of the Current Flood Management Practice in Ayutthaya Province

The political uncertainty was the important constraint by the sum of interviewees ( $\bar{X} = 3.60$  and  $\bar{X} = 3.92$ ) in terms of community leaders and governments respectively. Because of several government agencies and part of the national society environment issues are illustrated as in incompatibility with economic policy. Some fact is that no continuity and powerful political will SEA integration and implementation in the spatial planning process and flood management planning will be ineffective.

Most of the interviewees asserted that powerful political can support the strong environmental issues is considered as one of the crucial important factors in the approval of a SEA and push for it in Thailand. In the present situation, it is crucial important to define the environmental issues more precedence in decision making processes. Moreover, most of the interviewees argued that the existing flood management plans from several government agencies are the poor institutional coordination and without integrated planning system. They believed that the lapse in the plans between government agencies seem to be overhaul so that results in a non-integrated planning system. Poor institutional coordination is a regular problem in the Thai government.

Some of interviewees claimed that it is essential to achieve a readiness to coordinate in the SEA process, so confirming that those who are involve perceive themselves as real actors and their responsibility in the policy and planning making. Some of the interviewees believed that an effective implementation of the SEA process and procedures provides sufficient results and findings. However, the implementation guidelines and the dependable approaches are recognized to be potentially important to SEA application. Moreover, interviewees revealed that SEA will be a newest trend, and there will be unlimited knowledge of approaches and technical issues. Thus, it is important for operational guidelines to be in place to show planner, decision maker, relevant agencies and public how to carry out SEA.

All of the interviewees revealed that the absence of sufficient implementation guidelines would be a critical impediment to SEA application. Community leaders claimed that the poor planning and poor public participation may be rejected by decision makers in order to the dependable approaches will make SEA more difficult accurately. Most of the interviewees argued that the lack of precise understanding of needs, goals, values, and approach may be cause of a critical issue to encourage the SEA application. Furthermore, they believed that training and skilled practitioners are essential roles to the application of SEA. The results of interview regarding to the constraints to integrate SEA into the spatial planning as flood management planning in Thailand especially in Ayutthaya province. The fragile political will was appointed to be most key constraint.

The results of focus group discussion showed that they agreed who are involved perceive themselves as real actors and responsibility in policy, planning and implementing. Some of them still confirmed their role in the right way that are assigned from central government as and agreed that lack of coordination between planning and environmental authorities so that it should be integrated among the relevant agencies in terms of plans.

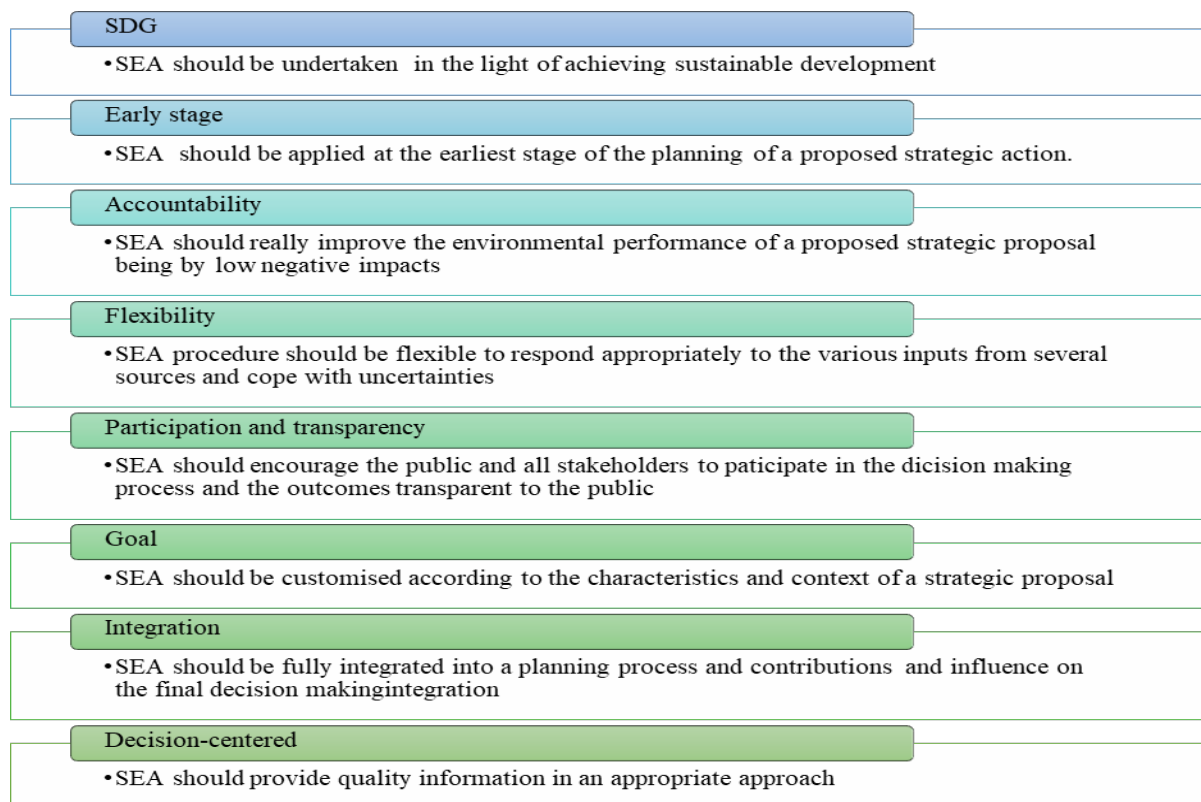
All interviewees and participants expected that it is deemed necessary to modify the existing planning systems so as to cope with the challenges developments are being confronted with the realize the purpose of sustainability. They said that SEA should be proposed in making informed decision relevant to the implementation of the new adaptation framework in the flood management plan to increase the environmental awareness of all stakeholders, planner and decision-makers.

The flood management of Ayutthaya province needs to improve, strategic framework and integration appropriate approaches need to build resilience and address the urbanization and climate related risks. If these factors are improved, that will help to the flood management more effective and can adapt to respond in the other disasters in the future.

### *3.5 SEA Application and the Effectiveness*

From the case study area, SEA can be seen as a tool to enhance decision making. Through SEA, data or information is produced for decision makers and the public, with the aim of providing a sound basis for decision making. Decision makers informed a good quality SEA on sustainability of strategic decisions, strategic framework, facilitates for the best practices and the best alternatives (Fischer, 2007). Therefore, it is indicated that it should be incorporated into the political system, operation system, communication system and emergency management.

From the literature review, there are many researchers indicated the fundamental effectiveness factors (Fisher & Seaton, 2002; Joao, 2005; Fischer, 2002; Runhaar & Driessen, 2007) that can apply to flood management plan in order to improve the existing flood management plan as Figure 5.



**Figure 5. The Fundamental Effectiveness Factors**

*3.6 The Linkage of SEA and Flood Management Planning*

SEA application was beyond the scope as long as the developing countries had appropriate PPPs planning procedures in environmental and social context and focus on central considerations in national and sectoral policy instruments (OECD, 2012). Therefore, this part presents the crucial keys questions in order to find the solutions as follow:

- Does the legal provision for SEA needed?
- Can SEA be integrated into the existing flood management planning?
- How can be the most appropriate model to integrate SEA into flood management planning process?

The results from the interview, most of them have same answers that SEA should be integrate into flood management planning with an appropriate legal framework, it will better. Since SEA can be easily formed to be appropriate to several parts of relevant government agencies. Then, precise legal frameworks will be useful for SEA practices in terms of providing at least regulatory context and a legal framework will help to encourage SEA requirements that can be implemented systemically. Moreover, the legal framework will point out their roles and responsibilities in applying SEA of the relevant agencies and the stakeholders.

The potential of SEA to be integrated into flood management planning, some of the interviewees

argued that SEA can be integrated into planning but it should have a new law to support the plan and implementation. This approach requires variety agreements of the relevant government agencies especially the National Environment Board, the National Economic and Social Development Council, and the Ministry of Natural Resources and Environment.

Even SEA was introduced into Thailand more than 10 years ago, it remains to be the concept although it will be useful to support and help the decision-making process in PPPs. Some of the interviewees were asked that how to introduce SEA into the existing law framework and the existing flood management plan and which agencies should be responsible for implementation. 4 out of 7 interviewees from government indicated that it should be proposed into the existing environment law. Most of the interviewees suggested that SEA could be integrated into the national master plan by NESDB as guidelines to prepare the national strategic plans. The several relevant agencies under Prime Minister's power are the agencies legally responsible for planning, development planning, strategic planning and implementing the master plans.

Because of the authority responsible for making flood management planning should be conclude SEA into the master plans. Most of the interviewees indicated that a higher commission for SEA should be established under the Prime Minister and Deputy Prime Minister that relevant the water management, disaster prevention and mitigation and environmental management. This high commission could ensure that SEA process would be managed with the participation of all stakeholders. This commission would be controlling the appraisal steps of the flood management plan and recommend the SEA report and the plan. The higher commission should be established in coordination with relevant agencies to ensure that SEA studies are taken into account at the early stage of the planning process. This commission would be made responsible for making decisions regarding the proposed flood management plan based on the findings and recommendations of SEA document. When the proposed flood management plan requires SEA study, the high commission should be indicated emergency management group, communication group, to prepare the study.

About the appropriate model to integrate SEA into the flood management planning process, it was indicated that three models of integration that can be considered. First, the model is considered as an ex-post assessment tool and separated from strategic action preparation. Second, SEA is partly integrated into strategic action preparation. Third, SEA is fully integrated into strategic preparation. Nevertheless, the interviewees agreed that the separate model cannot bring the benefit. Integrated planning receives the highest support, but it workable with the excellent agencies' coordination achieved.

The Thai government from central level to local level do not have experience of fully integrating environmental consideration into planning process, SEA and fully integrating SEA into planning, this would need serious transformation to the current administrative structure, this transformation will happen in the long term. Otherwise, most of interviewees indicated that a practicable method at present would be to partly integrate SEA into strategic action preparation and decision making. The partly



integrated model drives parallel to the main urban planning process (see Figure 6). It can work considerably if communication between government agencies and public, with the real condition and flood management plan are good, and which include information sharing, institutional coordination, emergency management, participation, operation system, and professional integration.

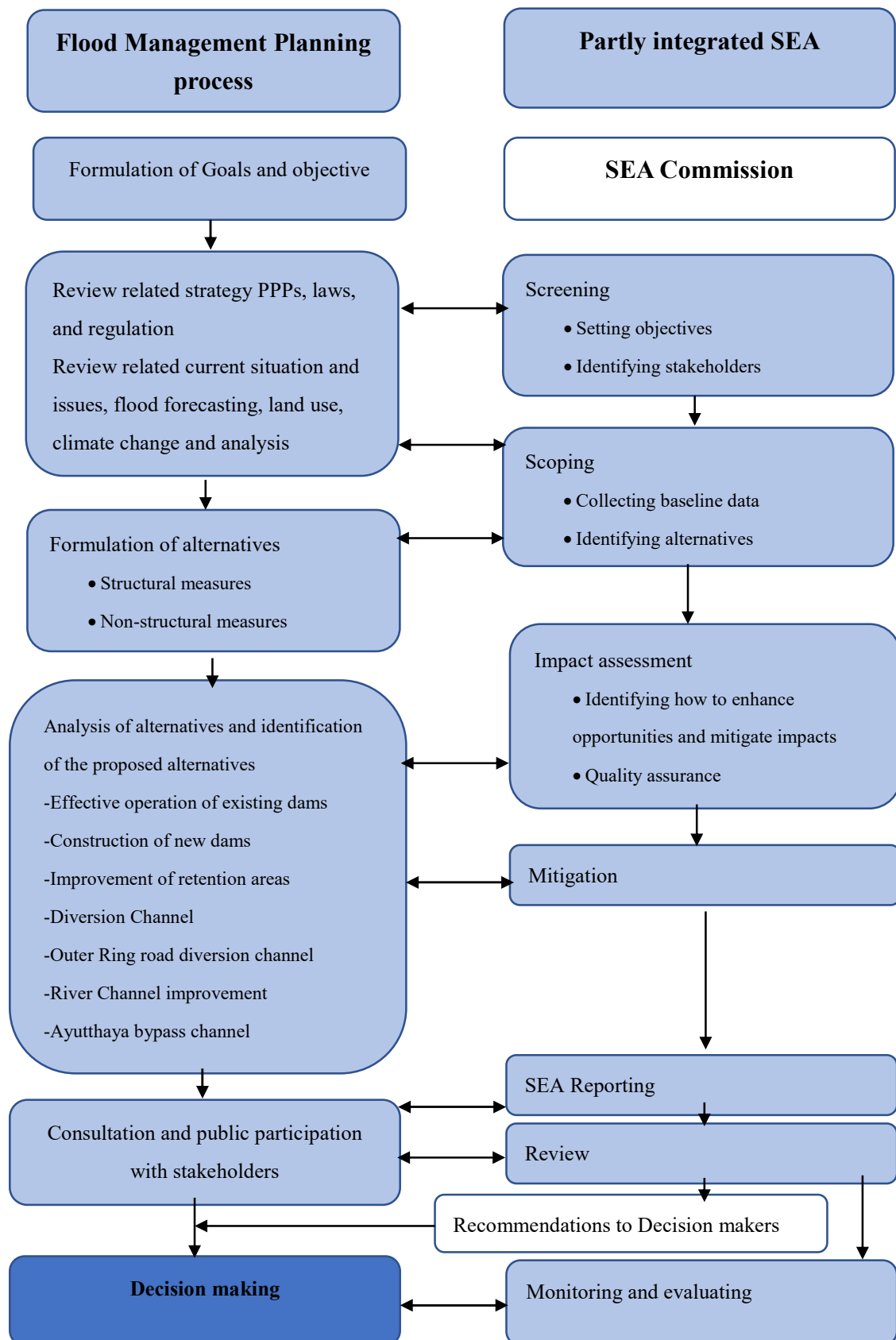
About the SEA processes and issues that can be included into key decision-making point in plan of flood management information system of Thailand by JICA. The process guidelines got partly integrated model for flood management planning in Thailand, and how planners and decision makers can work together and link several decision-making points to the specific planning stages. Each stage has specific questions to clarify its links. One the SEA report is concluded it is submitted for the high commission for reviewing, approving and implementing respectively.

#### **4. Discussion and Suggestion**

##### *4.1 Discussion*

The consideration of environmental issues within the spatial planning process such as flood management planning in Thailand is weak and faces variety obstacles in terms of cloudy mechanisms, inadequate environmental studies including priority for the environmental aspects, shortage of integration among the different agencies, different phases of the planning, and shortage of coordination among the environmental and planning authorities, stakeholder and public.

The best practices for sustainable development, integration of the environmental issues at early stages of planning and decision making process, improving the quality of the country, enhance the public participation in the planning process and contribution for improving the efficiency of the decision making process were the main benefits of integrating SEA into the spatial planning and flood management planning. The absence of SEA legislation in the national environmental legal framework of the country was appointed as the most important constraint followed by political uncertainty, lack of capacity in SEA and unavailable information.



**Figure 6. The Partly Integrated Approach to Integrate SEA into Flood Management Planning in Thailand**

The best way to introduce SEA into the spatial planning process as flood management planning in the Thailand context will be integrating SEA in an appropriate legal framework. As the results, we can mention that a legal requirements for SEA can be easily formed to be applicable to different sectors and different agencies including spatial planning sector, a clear legal frameworks will be beneficial for SEA practices in terms of providing a minimum regulatory context, a more prescriptive set of procedures, and a legal basis will help to create basic SEA requirements and standards that can be implemented more effectively.

As a contribution for the development of a future legal institutional framework for Thailand the authors using the finds of this research, the international literature and their own experience on the subject propose an institutional framework model. The model framework suggests that a higher commission for SEA should be established under the umbrella of the National Environmental Board (NEB), the National Resources and Environmental Policy and Planning, the National Resources and Environmental Policy and Planning Strategic Plan (2018-2038), the 12<sup>nd</sup> National Economic and Social Development Plan (2017-2021), the Environmental Quality Management Plan, Disaster Prevention and Mitigation Act of Thailand, B.E.2550, the National Strategy Committee (NSC) with the National Strategy (2018-2037) and the National strategy Act B.E.2560. The National Strategy (2018-2037), this is to ensure that the country achieved its vision of becoming “a development country with security, prosperity and sustainability in accordance with the Sufficiency Economy Philosophy”, and the Royal Irrigation Department Strategic Plan (2561-2580 B.E.). These high commissions could ensure that SEA process would be conducted with the maximum benefit. These commissions would be in charge of the review and appraisal steps of the plan and recommend or reject both the SEA report and the plan.

#### *4.2 Recommendation*

Drawing up the research conclusion, the author suggests recommendations to the responsible agencies as well as to other involved stakeholders in order to make the integration of SEA into the spatial planning as flood management planning more successful. It is very crucial that environmental considerations be taken into account as early stages of the different tiers of the spatial planning process as flood management planning in Thailand. On the results, it is recommended that SEA is the best instrument and the new trend to promote this integration. Communication between government and public is the main aim in order to understand in the right meaning and implementing. Public participation stage is still important in the spatial planning process. Political certainty is a key factor in forming policy practice. It is imperative that this political will would be develop in Thailand in order to prioritize environmental issues to achieve a sustainable development and better quality of human's life. Therefore, it is recommended that SEA should be introduced into the legal framework that would make it obligatory. But in Thailand, the SEA remains voluntarily work, no regulation or law to enforce. Many government agencies should brainstorm together in order to establish the measures and regulations in the same way. Lack of coordination between the different government agencies, different levels is an obvious burden in Thailand. Thus, the coordination between the different agencies involved in the

planning and policy making process and sector ministries should be improved upon. Capacity is a vital issue for SEA to be integrated into the spatial planning especially the flood management planning. Finally, what is what Thailand need to promote, implement and enhance the SEA of policies, plans and programs into its legal and institutional framework. The author proposes the following course of action:

- Extend the environmental assessment research as a line of research of critical importance for the country's context.
- Define the goal to follow strategic approach to develop the best practice.
- Conduct a comprehensive analysis of the Thailand legal framework to propose the best reforms that should be required.
- Trial the legal and institutional framework with the SEA approach proposed to report the advantages and improve the limitations that will emerge.
- Establish a whole new institutional arrangement to conduct the SEA in Thailand, but with the attribution to access to information needed to perform as SEA study in all level, and to promote an effective public participation in the decision-making process.

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