

Strategic Environmental Assessment for Flood Management Plan in Thailand: A Review of the New Framework

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Abstract:- Natural hazards are a complex problem. Addressing the floods associated with natural hazards require action at all levels from local to national yet coordinating these nets response to achieve across of action is challenging. An integrated approach is needed to lessen the damages. Several countries are adaptive and integrated systems of flood management planning in addition to standard structural and non-structural solutions. This paper points out the challenges with the situation on disasters and the human environment in Thailand, to investigate the potential of strategic environmental assessment (SEA), and to propose SEA approach to the implementation of the new framework. This paper recommends that SEA is the one way towards achieving more sustainable form of development plan and propose a paradigm to integrate SEA process within the flood management planning process in the country. The results of this study can be employed to countries that have similar situation.

Keywords:- Flood Management Plan; Strategic Environmental Assessment; Environmental Development.

I. INTRODUCTION

Flood disaster is increasing because of high population increase, high economic growth rate, and climatic change across the world. Several countries are susceptible to the results caused by climatic change, because their activities and environmental situation directly connect to climatic change [1]. The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) completely confirmed the happening of global climatic change. The UNFCCC has already established adaptation as an option to cope climate change. "Adaptation includes several types of actions that can be implemented in several sectors, associated with different climatic challenges depending on the geographical features of the areas and using widely diversified instruments" [2].

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.

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 flood risk, drought and its severe loss in the future. Nevertheless, the primary driver of the increase in severe floods in recent years is human intrusiveness in environmental circumstances such as expanded urbanization, deforestation, irrigation and power generation [3][4].

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 society to manage against flood disasters still have shortcomings [5]. This conspicuously exposes the limitations of flood management plans, disaster risk reduction, and emergency responses by the community, government and stakeholders in general [6][7][8]. Because of unsystematic is lack of disaster management system and a coordinated flood response system. These drivers caused indecisive and inadequate flood management at both the local and national levels of government. This certainly discloses the shortcomings and restrictions in the organization of flood management plans and emergency responses by the society and government [9]. There have been several studies on climate change related flood risk management carried out in many countries [10][11][12][13].

Strategic Environmental Assessment (SEA) is the key instrument to integrate the environmental issues into planning process effectively especially a spatial planning [14]. Whereas Environmental Impact Assessment (EIA) is the instrument to assess the environmental impacts of projects. The SEA is applied on a decision-making level to assess the environmental impacts of policies, plans, and programs (PPPs) [15][16]. SEA is a tool to improve decision making in terms

of PPPs toward to SDG goals under target 9: “to ensure sustainability by integrating the principles of sustainable development into country policies and programs and reserving environmental degradation” [17].

Several researchers revealed that SEA aims to ensure that environmental considerations are integrated into a decision-making process in the early stages [15]. Integrating and implementing SEA of spatial plans has the capability to decrease the environmental impacts to minimize. Additionally, SEA application can guarantee that environmental issues were incorporated into the planning process and SEA is beneficial in terms of delivering sustainability sides from its proactive, strategic nature and its capacity to integrate the environmental concerns with social, human and economic issue effectively [14]. Moreover, SEA can increase the environmental awareness, public participation, transparency and equity during the planning process.

As mentioned, this paper aims to explore how SEA could be introduced into the planning such the flood management planning in the Thai context with an appropriate framework and identify the benefits and constraints of integration SEA into the existing framework in order to guarantee that environmental issues are considered at an early stage into the existing flood management planning process.

II. METHOD

A. Study Area

The Chao Phraya River Basin (CPRB) is the largest basin in Thailand. It is also the most important in economic terms, because it is the principal water resource in Thailand for domestic consumption, agricultural irrigation, and hydropower. It is the most plentiful region of the country 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 distinguished 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 consists of the Ping, Wang, Yom, and Nan rivers. These tributaries flow to converge at Nakhon Sawan Province namely the Chao Phraya River in the central region as the lower CPRB. In the central region, the Sakae Krang and the Pasak converge the Chao Phraya River, and then the Tha Chin River branches at the main stream before through to the Gulf of Thailand as shown in Fig. 1. 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 of them produce electricity and serve water capacity [18].

Ayutthaya province is located at the junction of the Chao Phraya, Loburi, Noi and Pa Sak rivers, in the Central Plains of the country, around 80 kilometers from the capital. It covers 2,556 square kilometers and located on the flat river plain of the CPRB as shown Fig. 2. This basin caused to become an important water resource for cultivated area, particular the rice crop. Ayutthaya province is divided into 16 districts, 209 sub districts and 1328 villages. Ayutthaya was the ancient capital of Thailand called Siam, the ruins of the

ancient town now from the Ayutthaya Historical Park, an archaeological site that consists of many palaces, temples, monasteries, and statues.

Ayutthaya City Municipality is the local administration, with 14.84 square kilometers, together with ten sub-districts under its responsibility. The municipality is placed in the island surrounded by the three rivers such Chao Phraya, Pa Sak and Lop Buri, respectively as shown Fig. 2.

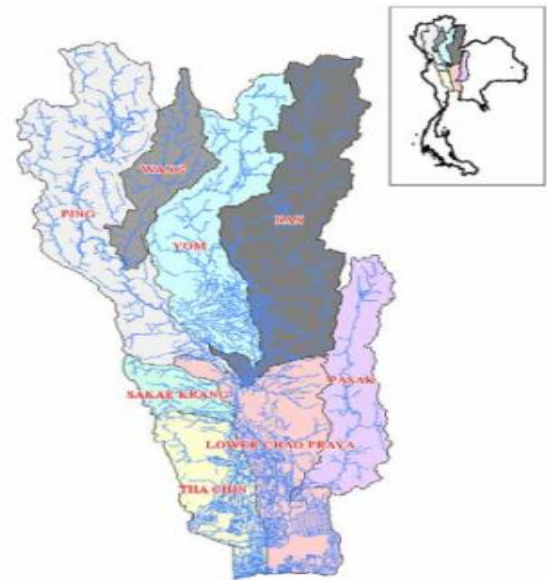


Fig.1. The Chao Phraya River basin (DWR, 2016)



Fig.2 Ayutthaya province and Ayutthaya city municipality

B. Data collection and Analysis

Data collection relies on fieldwork conducted in the CPRB and Ayutthaya province in 2017. Interview with professional staff in 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 condition and lack of environmental awareness.

The interview began with a semi structured discussion that looked to explore what and how they think and they know 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.

The secondary data for this research was obtained from a desk study using various international articles, journal papers, conference proceedings, related reports, related books, legislation and regulations, relevant plans, proposals, and research programs. The study used mixed methods, with a combination of interviews, field observation, focus group discussion and document review, to explore drivers and impacts of flooding and to explain how local communities adapt to it.

III. RESULTS

A. The Policy formation

In the past, the government played the main role in disaster management such as the most of management process began when 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).

There are three laws in Thailand that related in disaster management such as Civil Defense Act 1979, National Civil

Defense Plan 2005, Disaster Prevention and Mitigation Act 2007, and National Disaster Risk Management Plan 2015 (after mega-flood). The Civil Defense Act 1979, the governmental agencies which are responsible for disaster management consisted of two type: the strategic body and the functional agencies. In terms of the strategic body, that has the National Defense Committee (NCDC) which is compose of many representatives from multi ministries concerned. Whereas the functional agencies have three categories as: national level, provincial level, and local level. 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.

B. Ayutthaya province and the surrounding areas

Ayutthaya province was chosen to focus in this study. It is in the Central Plain of the country. This province is sensitive to fluvial flooding generated in the upstream area, as well as pluvial flooding that can result from extreme rainfall. In addition, this area recently experienced a mega 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 sq. km., 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.

Because of an Ayutthaya Agro meteorological Station is located in Ayutthaya province which the data is available from year 2009-present. The weather in Ayutthaya consists of hot, rainy and cool season. The highest temperature in the hot season is in April can reach around 31.5 Celsius. In June to October is the wet season where precipitation varies between 100-365 mm./month. In December, the cool season starts 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[19].

In terms of flood management, 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 divided into three categories. Firstly, 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 Department (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, because in the previous there had been no specific laws or 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 pilot project by the RID to water management that can occur some conflicts among stakeholders. An appropriate model for province level in order of priority, province governor, municipality, local authority and the surrounding areas should join the work plan. Some projects try to convert water and going on.

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 form 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 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 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 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 organization in Ayutthaya province were discussed. The RID in the study area 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 Thunh Phu Kao Thong, maintenance water gates in the canals and adding the new water gates.

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.

The last group is the representatives from the communities which consist of 15 leaders. 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 haft 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 organization 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.

C. The challenges and constraints of SEA in flood management plan

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

The interviews regarding to the benefits to be obtained from the SEA process into the flood management planning in Ayutthaya can be seen in Fig. 3. These results showed that: community leaders agreed that emergency management (EM) is the first important to implementation in flood management ($\bar{X} = 4.73$), communication (Comm.) ($\bar{X} = 4.67$) and participation (Part.) ($\bar{X} = 4.40$), 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 (Comm.), emergency management (EM) and operation system (OS) are important ($\bar{X} = 4.62, \bar{X} = 4.38, \bar{X} = 4.19$) respectively.

These showed that SEA can integrate into flood management planning in Thailand, it will promote better practices for sustainable development and environmental issues. All of interviewees agreed that SEA will be a capable measure to fulfill contemplate the environmental issues in the early stages of planning process. Moreover, this will support for decision making process to become effective and efficient. They believed that SEA will enhance the public involvement participation (Part.) in the planning process ($\bar{X} = 4.4$ and $\bar{X} = 3.92$). The integration (Inte.) 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 challenges mentioned above similar in many case studies in several countries such as achieving sustainability, the public participation, integration and including the environmental issues into the flood management planning process [20][21][22]. Considering the constraints to integrate SEA into the flood management planning, in Thailand, the absence of SEA, SEA regulation, SEA legislation in the national environmental legal framework of the country was assigned as the crucial issue. This fact is so tough to use its application into the flood

management planning process. Fig. 3 shows that the political uncertainty will challenge because of lack of capacity in SEA, meagre best practices, and poor technical and practitioners know how are the other constraints.

The international literature showed that many countries both developed countries and developing countries have implemented SEA either on voluntary basis or through a national legislation including other provision as instruments, boards or council, cabinet members, announcements, draft the new laws and advice records [23]. 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 resource of SEA and define the appropriate legal force to SEA results. Some of interviewees argued that a clear legal framework and implementation guideline will prove to be profitable to SEA action. Additionally, providing a least regulatory context, a prescriptive format of process should be taken effect as soon as possible. It can be concluded that there is no perfection approach 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 best practices. Additionally, the legal basis can provide basic SEA requirements, transparency, standards, flexibility and responsibility.

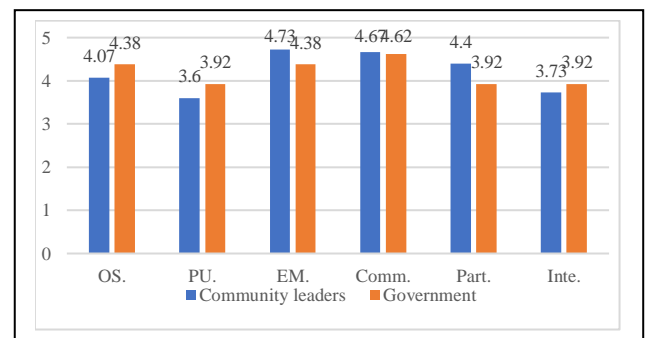


Fig.3. The current flood management practice in Ayutthaya

The political uncertainty (PU.) 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 enhance SEA integration and implementation in the 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 factors in the consent of an 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 systematically. They believed that the lapse in the plans between government agencies seem to be overhaul so that results in a non-integrated planning system. Inadequate institutional coordination is a regular problem in the Thai government.

It is essential to achieve a readiness to coordinate in the process of SEA, so confirming that those who are involve perceive themselves as real actors and their responsibility in the policy and planning making by some of interviewee claimed. Some of the interviewees believed that an effective implementation of the SEA process, best practice and procedures provides sufficient results. However, the implementation guidelines and the dependable approaches are recognized to be potentially important and challenging to apply 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 a significant feature for operational guidelines to show planner, decision maker, relevant agencies and public how to carry out SEA.

Moreover, all of the interviewees revealed that the lack of sufficient implementation guidelines would be a critical obstruction to apply SEA. Community leaders claimed that the lacking planning and poor public participation may be refused by decision makers in order to the dependable approaches will cause SEA more tough accurately. They discussed 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, practicing and skilled practitioners are essential roles to apply SEA. The results of interview regarding to the constraints to integrate SEA into the flood management planning in Thailand especially in Ayutthaya province. The fragile political will was assigned to be most key constraint.

The results of focus group discussion showed that they agreed who are the real actors and responsibility in policy, plan and implementing. Some of them still confirmed their roles in the right way that are assigned from central government and agreed that lack of coordination between planning, decision-maker, practitioners 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 necessary to reform the existing planning systems so as to cope with the challenges of sustainable developments are being confronted with the realize the aim of sustainability. They said that SEA should be proposed in making decision related to the implementation of the new adaptation framework in the flood management plan to increase the environmental awareness, participation, and preparedness 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.

D. SEA application and connection of SEA and FMP

From the case study area, SEA can be seen as an instrument to enhance decision making and to consider environmental issues in the early stage of planning. The data or information is produced for decision makers and the public participation, with the aim of providing a system for decision making. Decision makers informed a good SEA on sustainability of decision-making, strategic framework, facilitates for the best practices and the best alternatives [24]. 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 [25][26][27] that can apply to flood management plan in order to improve the existing flood management plan as followed in Fig.4.



Fig. 4. The fundamental effectiveness factors

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 frameworks will be useful for SEA practices such providing at regulatory context and a legitimate framework will help to encourage and enhance SEA requirements that can be implemented systemically. Moreover, this 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 flood management plan and which agencies should be responsible for implementation. 4 out of 7 interviewees from government indicated that SEA should be proposed into the existing environment law, national strategic plan and others. Most of 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 board for considered SEA should be appointed under the Prime Minister and Deputy Prime Minister that relevant the water management, disaster prevention and mitigation and environmental management. This board could express that SEA application would be managed with the participation of all stakeholders. This board would be controlling the assessment stages of the flood management plan and suggest the SEA report and approve the plan. The higher board should be established in arrangement with relevant agencies to ensure that SEA studies are taken into account at the early stage of the process. This board would be made responsible for making decisions regarding the proposed flood management plan based on the results, findings and suggestion of SEA document. When the proposed flood management plan requires SEA study, the high board should be indicated emergency management group, communication group, to prepare the study.

In terms of the appropriate model to integrate SEA into the flood management planning process, it was indicated that there are three models of integration that can be considered. First, the model is called as an ex-post assessment tool and it is separated from strategic action groundwork. Second, SEA is partly integrated into strategic action groundwork. Third, SEA is completely integrated into strategic action groundwork. Nevertheless, the interviewees agreed that the separate model cannot bring the benefit entirely. Thus, integrated planning gains the highest encouragement, but it workable with the excellent agencies' coordination achieved.

The Thai government from central level to local level do not have experience of completely integrating environmental consideration into planning process, including SEA, and integrating SEA into planning process, 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 partially integrate SEA into strategic action groundwork and decision making. The partly integrated model drives at the side of the existing flood management planning process (see Fig.5). 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.

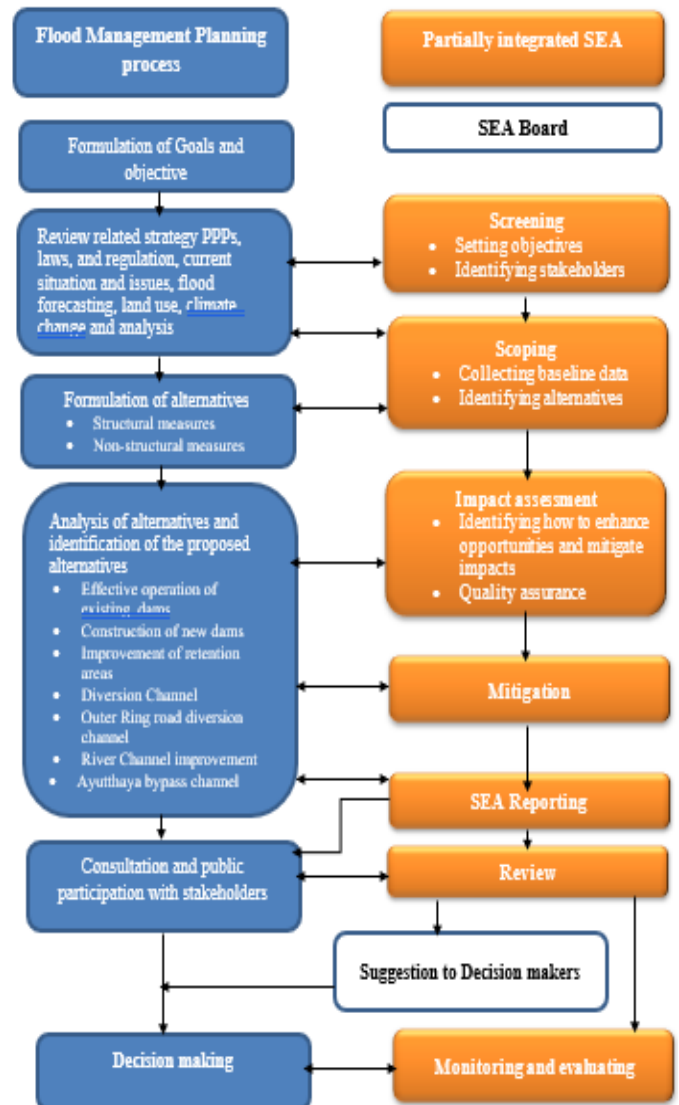


Fig.5. The partly integrated approach to integrate SEA into FMP in Thailand

About the SEA processes and issues that could be included into key decision-making point in plan of flood management information system of Thailand by JICA. The process guidelines got partially integrated model for flood management planning in Thailand, and how decision makers, practitioners and planners can play together and connect several points to the specific stages of the planning. So, each stage has tailor-made questions to clarify its connections. One the SEA report is recapitulated and then it is submitted for the high board for reviewing, approving and implementing respectively.

IV. CONCLUSION AND DISCUSSION

The reflection of environmental issues within the flood management planning process in Thailand is fragile and confront variety barrier in terms of cloudy mechanisms, measures, inadequate environmental studies and SEA practices including precedence for the environmental aspects, shortage of integration among the different agencies, different positions of the planning, and shortage of coordination among the environmental and planning authorities, stakeholder and public.

The best practices for development plan especially sustainable development plan, integration of the environmental issues at first stages of planning process and decision making process, improving the environmental quality of the country, increasing the public participation in the planning process and improving the efficiency of the decision making process were the main benefits and challenges of integrating SEA into the flood management planning. The deficiency of SEA legislation in the national environmental legal framework and national strategic plan of the country was assigned as the exceedingly important constraint followed by public participation, political uncertainty, short of capacity in SEA, less SEA practice and unable information.

The best way to introduce SEA into the flood management planning in the Thailand context will be integrating SEA in an appropriate legal framework and special legislation. As the results, this can mention that a legal requirements for SEA application can be readily formed to be applicable to several sectors and agencies, an explicit legal frameworks will be beneficial for SEA application practices in terms of providing at least regulatory context and enforcement of the law, a prescriptive form of procedures, and a legal basis will help to create basic SEA requirements and norms that can be implemented effectively.

As mentioned above, the development of a future legal institutional framework and enforcement of the legal for Thailand the authors using the findings and the results from this research, the international literature, case studies and their own experience and knowledge on the subject propose an institutional framework model. The model framework is suggested that a higher board 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 12nd 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 board could guarantee that SEA process

would be conducted with the maximum benefit, especially when the disasters occurred. These board would be managing the review and assessment steps of the planning process and suggest or reject both the SEA report and the plan.

In conclusion, the author offers the suggestions to the responsible agencies and other involved stakeholders in order to make the integration of SEA into the flood management planning more successful. It is very crucial that environmental issues and flood management considerations be taken into account at the early stages of the different tiers of the flood management planning in Thailand. On the results, it is suggested that SEA is the best instrument for application 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 one factor in forming policy practice. It is essential issue that this political will would be develop in Thailand to prioritize environmental issues and natural disasters to achieve a sustainable development, and better quality of human's life.

Therefore, it is proposed that SEA should be introduced into the legal framework in Thailand context 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 apparent responsibility in Thailand. Thus, the coordination between the different agencies and all levels involved in the planning and policy making process and all sectors of relevant ministries should be improved upon. Capacity is an issue for SEA to be integrated into the flood management planning. Eventually, what is what Thailand need to promote, implement, support and enhance the SEA in the policies, plans and programs into the legal and institutional framework. The author proposes the following track of action:

- Spread out the environmental assessment research as a line of research of critical importance for the country's context.
- Define the goal and objectives to follow strategic approach to develop the best practice.
- Address a broad analysis and comprehensive plan including national strategic master plan if the Thailand's legal framework to propose the best practices that should be required.
- Trial the legal framework and establish the institutional responsibility with the SEA approach proposed to report the advantages, disadvantages and improve the restrictions that will rise in the future.
- Establish a new institutional arrangement to address and enhance the SEA in Thailand, but with the attribution to drive through information needed to perform as SEA study in all levels, to promote an effective public participation in the decision-making process and to enhance SEA at the early stage of planning process.

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REFERENCES

- [1]. N.Stern. The Economics of Climate Change: The Stern Review. Cambridge University Press, Cambridge and New York (2007), p.2007.
- [2]. IPCC. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, & C. E. Hanson (Eds.), Cambridge ,p. 976, 2007b.
- [3]. Hungspreug, S., Khao-uppatum, W., Thanopanuwat, S. Flood Management in Chao Phraya river basin. In: Proceedings of the International Conference on The Chao Phraya Delta: Historical Development, Dynamics and Challenges of Thailand's Rice Bowl, Bangkok, Thailand, December 12-15, 293-312, 2000.
- [4]. Poaponsakorn, N. The Thai 2011 Flood and Impact on Household Expenditures and Income. The 13th International Convention of the East Asian Economic Association held in Singapore on 19-20 October 2012, 2012.
- [5]. Tanwattana, P., Murayama, H. Community planning and the policy process for regional revitalization against disasters: Thailand's readiness and the Japanese experience, *J. Policy Sci.* 21 (2), 27–42, 2014.
- [6]. Roachanakanan, T. Floodways and Flood Prevention in Thailand: Reflections of the Great Flood in 2011, in: Proceedings of the World Flood Protection, Response, Recovery and Drawing up of Flood Risk Management Conference, Bangkok, Thailand, September 12–13, 2012.
(<http://www.dpt.go.th/csp/images/stories/pdf/disaster/FloodwaysPreventionThailand.pdf>), (Accessed 5 August 2016).
- [7]. Koontanakulvong, S., and Chaowiwat, W. GCM data comparison and its application to water disaster adaptation measures in Thailand. Technical Report, Water Resources System Research Unit, Faculty of Engineering, Chulalongkorn University, Thailand, 2011.
- [8]. Chanjirawuttikun, N. Flood Disaster Management in Thailand: Summary and Issues. Policy Brief. Land Development Department, 2016 (in Thai) (<http://prp.trf.or.th/trfpolicy-brief/>) (Accessed 10 October 2016).
- [9]. Jukrkorn, N., Sachdev, H., and Panya, O. Community-based flood risk management lessons learned from the 2011 flood in central Thailand, *Flood Recovery Innov. Response* IV 184, 75–86, 2014.
<http://dx.doi.org/10.2495/FRIAR140071>.
- [10]. Ward, P.J., Pauw, W.P., and Buuren, A.V. Governance of flood risk management in a time of climate change: The cases of Jakarta and Rotterdam. *Environmental Politics*, 2013. DOI: 10.1080/09644016.2012.683155. (Accessed November 20, 2016)
- [11]. Meesuk, V., Vojinović, Z., & Mynett, A. E. Extracting inundation patterns from flood watermarks with remote sensing SfM technique to enhance urban flood simulation: The case of Ayutthaya, Thailand. *Computers Environment and Urban Systems*, 64, 239-253, 2017.
- [12]. <https://doi.org/10.1016/j.compenvurbsys.2017.03.004>
- [13]. Naruchaikusol, S. Climate change and its impact in Thailand: A short overview on actual and potential impacts of the changing climate in Southeast Asia. *TransRe Fact Sheet No. 2*, 2016.
- [14]. Singkran, N. Flood risk management in Thailand: Shifting from a passive to a progressive paradigm. *International Journal of Disaster Risk Reduction*, 25, 92-100, 2017.
- [15]. Heragazy, I.R. Integrating strategic environmental assessment into spatial planning in Egypt. *Environmental Development*, 15, 131-144, 2015.
- [16]. Sadler, B., Verheem, R., Strategic Environmental Assessment : Status, Challenges and Future Directions. Ministry of Housing, Spatial Planning and the Environment, The Hague, The Netherlands, 1996.
- [17]. Ahmed, K., Mercier, J.R., Verheem, R., Strategic Environmental Assessment -Concept and Practice. Environment Strategy Notes, Worldbank, 1-6, 2005.
- [18]. Théritel, R., Partidario, M. The future of SEA. In perspectives on Strategic Environmental Assessment, Partidario, M. and Clark, R. (Eds), Boca Raton: CRC Press, 271-280, 2000.
- [19]. Komori, D., Nakamura, S., Kiguchi, M. Nishijima, A., Yamazaki, D., Suzuki, S., Kawasaki, A., Oki, K., and Oki, T. Characteristics of the 2011 Chao Phraya River flood and Central Thailand. *Hydrol Res Lett*, 6, 41-6, 2012.
- [20]. TMD. Rainfall data, 2013. Retrieved from <http://hydromet.tmd.go.th/Reports/report-rf-year.aspx>
- [21]. Brown, A., & Therivel, R. (2000). Principles to guide the development of Strategic Environmental Assessment methodology. *Impact Assess. Project Apprais*, 18, 183-189.
<https://doi.org/10.3152/147154600781767385>
- [22]. Stinchcombe, K., Gibson, R., Strategic Environmental Assessment as a means of pursuing sustainability: ten advantages and ten challenges. *J. Environ. Assess. Policy* 3, 343-372, 2001.
- [23]. Fischer, T., Seaton, K. Strategic environmental assessment: effective planning instrument or lost concept. *Plann. Pract. Res.* 17.31-44, 2002.

- [24]. Théritel, R., Partidario, M. The future of SEA. In perspectives on Strategic Environmental Assessment, Partidario, M. and Clark, R. (Eds), Boca Raton: CRC Press, 271-280, 2000.
- [25]. Fischer, T. Theory and Practice of Strategic Environmental Assessment: Toward a More Systematic Approach. Earthscan, 2007.
- [26]. Fischer, T., & Seaton, K. (2002). Strategic environmental assessment: Effective planning instrument or lost concept. *Plann. Pract. Res.*, 17, 31-44. <https://doi.org/10.1080/02697450220125069>
- [27]. Joao, E. (2005). Key principle of SEA. In: Schmidt, M. Joao, E., Albrecht, E. (Eds.), *Implementing Strategic Environmental Assessment*. Springer, Berlin, 2005.
- [28]. Runhaar, H. Driessen, P. What makes strategic environmental assessment successful environmental assessment? The role of context in the contribution of SEA to decision making. *Impact Assess. Proj. Apprais.* 25 (1), 2-14, 2007.