PSYCHOLOGY AND EDUCATION (2021) 58(4): 2040-2045
Article Received: 08th October, 2020; Article Revised: 15th February, 2021; Article Accepted: 20th March, 2021

Factors influencing the sustainable flood prevention in Bangkok, Thailand

Thawatchai Piyanonthaya[1], Duangsamorn Rungsawanpho[2], Piyada Wongwiwat[3]
Ph.D. Program in Development Administration, Suan Sunandha Rajabhat University, Thailand
s58484916082@ssru.ac.th

ABSTRACT

This objective of this research is to study 1) Level of flood management policy, flood problem management, readiness of agencies, cooperation among government sector, private sector, community, and sustainable flood prevention in Bangkok, 2) Influence of flood management policy, flood problem management, readiness of agencies, cooperation among government sector, private sector, community, and sustainable flood prevention in Bangkok, and 3) Sustainable flood prevention approaches in Bangkok. This research used the mixed methods of quantitative and qualitative research. Regarding the quantitative research, the sample group consisted of a total of 320 people living in the Bangkok Metropolitan Area affected by the flood disaster in the year 2011. The data was collected using questionnaires and was analyzed by a structural equation model. For qualitative research, the in-depth interviews were conducted on 21 key informants. The research results revealed that 1) The flood management policy, flood problem management, readiness of agencies, cooperation among government sector, private sector, community, and sustainable flood prevention in Bangkok were at the high level. 2) The flood management policy had the most overall influence on the sustainable flood prevention in Bangkok followed by the cooperation among government sector, private sector, community, readiness of agencies, and flood management, respectively. 3) The approaches for sustainable flood prevention in Bangkok are (3.1) To improve relevant regulations to facilitate the operations, (3.2) To decentralize the management power to local agencies, (3.3) To integrate the cooperation among various units to be in the same direction and, (3.4) To improve the city plan in accordance with the current drainage guidelines

Keywords
Flood in Bangkok / management policy / readiness of agencies

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Background and Significance of Problem

Flood is natural disaster that often occurs over and over again across all regions of the world that are located along rivers. According to the nature of the river, the water level that overflows the banks often occurs during heavy rains. Whether the flood level is more or less high partly depends on the rainfall rate. The other part is caused by the nature of drainage of the area into the river. Bangkok is the city located in the Chao Phraya River Basin, about 40 kilometers north of the river having the Chao Phraya River passing in the middle. Therefore, Bangkok regularly encounters the flood problem. The damage condition is more severe following the land use condition that has become communities and the important economic sources of the country. Thus, the Bangkok area has always been naturally risky for flooding (Kasetsart University, 2011).

Bangkok is an area prone to suffer from annual flooding. Experiencing the flood problem each time inevitably brings loss in life and properties of people who live in Bangkok severly. Throughout the years, the measures for the prevention and mitigation of flood problems were used in the reactive approach cycle. It is the disaster response operation of various agencies by helping to alleviate the flood and restore only when the flood has already occurred.

After the big flood in 2011, the government agencies realized the importance of flood problem management. The flood problem was raised as national problem that must be solved urgently. The flood prevention and mitigation policies were used as the proactive approach cycle focusing on the measures aiming at reducing the risk of flooding and subsequent losses. There are both structural measures and non-structural measures such as natural flood management, required structural engineering, mapping to avoid the risk of flooding, flood warning, preparation plan, education and emergency response plan. The disaster management often involves the activities and operations. There are four main activities; Step 1: Pre-disaster prevention, Step 2: Pre-disaster preparation, Step 3: Post-disaster response, and Step 4: Post-disaster recovery. These measures are classified as "sustainable flood management" (Debnath, 2012).

Research's objectives

To study 1) Level of flood management policy, flood problem management, readiness of agencies, cooperation among government sector, private sector, community, and sustainable flood prevention in Bangkok, 2) Influence of flood management policy, flood problem management, readiness of agencies, cooperation among government sector, private sector, community, and sustainable flood prevention in Bangkok, and 3) Sustainable flood prevention approaches in Bangkok.

Literature review

Concepts and theories of flood prevention

From the flood incident in Bangkok, His Majesty the King had always been very concerned. He studied, researched, and found the solutions to problems as well as allowing responsible agencies to attend from time to time in a reasonable opportunity to jointly consider a solution to the problem effectively (Kasetsart University, 2011); 1. Accelerate drainage to the sea through the canal on the east side of the Bangkok community area, 2. Provide the Green

Belt which can be transformed into a drainage way, 3. Build the flood prevention system in the Bangkok community area, 4. Build the stations at various points in Bangkok area for water storage to help in flood prevention projects, 5. Expand the waterways or open the waterways in the point that passes through highways or railways.

From the big principles as mentioned above, the responsible agencies had jointly formulated an implementation plan according to the royal initiative since 1980 onwards. Until 1983, the flood prevention project had not been completed and it appeared that another great flood occurred. But it was the flood of only some points that were weak and the water could not flow into the sewer only. This is the proof of accuracy of the royal initiative in diagnosing problems. In conclusion, sustainable flood prevention in Bangkok refers to processes, procedures, or guidelines for implementing measures to prevent and mitigate floods in 13 Bangkok areas. This is the process operated before, during, and after the occurrence of flood situation in order to return to normal as soon as possible. It also prevents repeated damage incidents consisting of measures on surveillance and warning, sewerage, reduction of loss in life and properties, quick and thorough aid.

Concepts and theories of flood management

The sustainable flood management is the process to assess the flood risks. The obtained information will be taken to implement appropriate management measures. These measures could be the construction of flood protection structures, provision of flood warning system, wetland system, or development on policies to reduce the increase of regularly flooded areas (Debnath, 2012; Department of Water Resources, 2012).

The Sustainable Flood Management (SFM) refers to planning at the catchment level and considering various measures to reduce flood risks. The natural land use management approaches such as floodplain management and wetland restoration are essential components of Sustainable Flood Management. The Sustainable Flood Management consists of various measures aiming at reducing flood risks and reducing consequentially economic, social and environmental costs. Such measures consist of structural measures and non-structural measures such as natural flood management, required structural engineering, mapping to avoid the risk of flooding, flood warning, preparation plan, education and emergency response plan. The risk management often involves the activities and operations in four main activities; Step 1: Pre-disaster prevention, Step 2: Pre-disaster preparation, Step 3: Post-disaster response, and Step 4: Post-disaster recovery.

The elements of Sustainable Flood Management (SFM) are natural flood management (NFM) which can be achieved through the implementation of activities to manage flood risks. Bangkok flood management means the management to solve problems and prevent flood of Bangkok efficiently and sustainably. The elements that are important factors in management are management structure, participation, and coordination between agencies involved in sustainable flood prevention in Bangkok.

Concepts and theories on the cooperation among the public sector, private sector, and communities

Vangen & Huxham (2010) developed the theory of cooperation by collecting documents since 1989. It could be concluded that the cooperation arose from the support of the organization to achieve its objectives. The decision to cooperate was made by the leaders of such organization. It was the development of activities / projects that were created. Mostly, the cooperation in the nature of Collaboration is the cooperation between the government and non-profit organization or the government sector and state enterprise. It also includes the cooperation between public and private sectors. When the cooperation between organizations occurs, the business benefits will follow.

Understanding the three levels of cooperation above results in the study on the components leading to the cooperation that is important for building cooperation between organizations. In addition, Umaphorn Boonphet (2012) has given the meaning of cooperation that cooperation means working until they can achieve goals, accept each other, and are ready to walk together. People who come to cooperate all have the same purpose that they feel satisfied with. It is a good and positive feeling that we have for people, work, and society. With the cooperation, we will achieve whatever we do and work. Any society that can make people cooperate and work altogether to achieve their goals will be definitely strong. With the strength of society, in doing anything in group to be successful, it requires cooperation. The cooperation means the cooperation among Bangkok, the private sector and the community to work altogether and help one another in the prevention and mitigation of flood problems in Bangkok.

Research methodology

This research uses the mixed methods of quantitative research and qualitative research.

For the quantitative research, the sample group consists of people living in the Bangkok area who are affected by the 2011 flood disaster for a total of 320 persons. The sample size was determined using the criteria of 20 times of the observed variables. The multiple sampling method was used. The data was collected with questionnaires through the content validity test having IOC values from 0.60-1.00. For the reliability, it was found that the reliability coefficient (Cronbach's Alpha value) of the observable variables used in this study was between 0.834 and 0.959. The entire was 0.975 and it was analyzed with structural equation model.

For the qualitative research, the in-depth interview was conducted with the key informants including (1) Director of the Office of National Water and Flood Management Policy, (2) Director of the Bureau of Water Resources Policy and Planning, (3) Director of the Office of Water Management, (4)) Director of the National Disaster Warning Center (5) Director of the Water Resources Information Center, (6) Director of the Water Crisis Prevention Center, (7) Director of the Bangkok Disaster Prevention and Mitigation Office, (8) Director of the Department of Drainage and Sewerage,

(9) Director of the Bangkok Metropolitan Administration for 13 districts totaling 21 persons.

Research results

1. Flood management policy (mean = 3.60), flood problem management (mean = 3.59), readiness of agencies (mean = 3.58), cooperation among the public sector, private sector, and communities (mean = 3.57) and sustainable flood prevention in Bangkok (mean = 3.54) were all at high level.
2. For the results of the model analysis entirely considered, it was found that the indicators can be consistent with every data and pass the criteria of the admission rate with the information determined by the academicians (Diamantopoulos & Siguaw, 2000) who developed all of these criteria. It means that the empirical data and the model are good fit as shown in Table 1.

Table 1: Index of good consistency with the data

Indicators	Criteria of good consistency with the data	Before improving the model	After improving the model
Chi-square/df	Less than 2.00	2.70	1.99
RMSEA	0.05-0.08	0.073	0.056
Standardized RMR	Less than 0.05	0.021	0.018
GFI	From 0.90 and over	0.91	0.93
AGFI	From 0.90 and over	0.87	0.90
CFI	From 0.90 and over	0.99	1.00
PGFI	From 0.50 and over	0.63	0.62
CN	Not less than 200	155.03	211.75

The researcher presented the results of the model analysis in the t-value as shown in Figure 1.

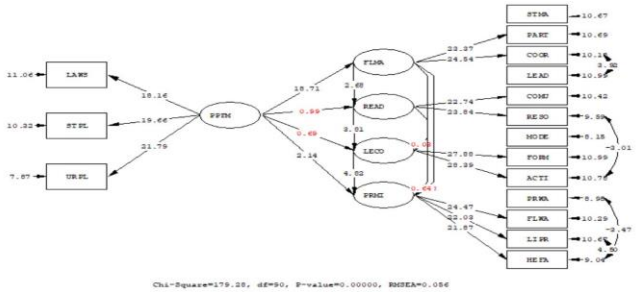

Figure 1: Results of the model analysis in the t-value

Direct and indirect influences among variables for sustainable flood prevention in Bangkok

The results from the model analysis in t-value (Figure 4.10) show the direct and indirect influence of latent variables on sustainable flood prevention in Bangkok. The researchers then used the analysis of structural equations to present the direct and indirect influence including the total influence of all latent variables in order to show the influence of factors on sustainable flood prevention in Bangkok as shown in Table 4.15.

Table 2: Direct and indirect influence including the total influence of the studied factors

Influence of variables	*Cause-effect relationship*		
	Direct	**Indirect**	**Total**
Flood problem management policy	0.41	0.46	0.87
การ Flood problem management	-	0.36	0.36
Readiness of agencies	-	0.71	0.71
Cooperation among the public, private and community sectors	0.84	-	0.84

From Table 2, it was found that the flood problem management policy had the most overall influence on the sustainable flood prevention in Bangkok, followed by cooperation among the public, private and community sectors, the readiness of agencies, and the flood problem management, respectively. However, when considering only the factors directly influencing the sustainable flood prevention in Bangkok, it was found that cooperation among the government, private and community sectors had the most direct influence on the sustainable flood prevention in Bangkok, followed by the flood problem management policy.

3. Approaches for sustainable flood prevention in Bangkok

1) Improve relevant regulations to facilitate implementation and support sustainable flood readiness and prevention such as adjusting land readjustment regulations, city planning only in areas with high flood risk, regulate the rules and regulations facilitating the use of technology in surveillance, preparation, and prevention.
2) Bangkok should decentralize in terms of budgets, personnel, and management power for agencies in the area more such as the district office.
3) The cooperation and knowledge transfer should be integrated among various agencies to be in the same direction.
4) The city plan must be improved in accordance with the current drainage approaches by focusing on promoting participation processes in solving problems from all sectors.
5) Bangkok Metropolitan Administration should develop and construct a drainage infrastructure to cover the entire Bangkok area.
6) Enhance knowledge and understanding for people to participate in being responsible for the maintenance and prevention of flooding such as arranging a campaign to prevent littering into rivers and canals.
7) Strict law enforcement on people who dump their sewage into sewer ditches, canals, and drainages.
8) Apply the knowledge and technology in management such as preparing a water plan in Bangkok and surrounding areas, drainage system planning, installation of telemetry in the major canals.
9) Plan to prevent flood concretely both in the short term, medium term and long term with the plan consistent with the national plan and plans of other relevant agencies.

10) Provide public relation to enable surveillance and monitoring by making it in a manner easy to communicate, understand, and disseminate through social media that is easily accessible to everyone.
11) The participation from all sectors can support sustainable flood operations and use low operating budgets. The participation process must be carried out from the collection and storage of information until the monitoring and evaluation
12) The civil society, people, and communities with continual participation in the operations should be glorified and supported in various measures such as the adoption of operating support expenditures for tax deduction, reduction of import tariffs on surveillance-related machines, flood prevention, and remediation.

Research discussion

1) Flood problem management policy: There are both direct and indirect influences and they are the most important variables for sustainable flood prevention in Bangkok. The management of flood or various disasters in all matters must start at the policy level by tracking solutions to problems, finding new measures, setting the project plans and budgets to support local assistance having the Prime Minister as the chairman at the top level or at the policy level. In Bangkok, the Governor of Bangkok is the chairman of the action at the lower level or in the area. The findings are consistent with the research of Walker & Westley (2011) studying resilience in terms of ecological recovery and community recovery. It was noted that the disaster management always focused on specific measures designed for each type of disaster. It created the potential to accommodate specific problems such as creating a water-bottom flap, acquiring boats for the rescue in time of flooding. These measures are often short-term measures focusing on solving problems immediately. For the community to pass through the disaster and to become stronger as it was or even more was not resulted from thematic and immediate measures. Therefore, the emphasis should be placed on building recovery capacity that is general potential, not specific to flood.
This is as same as city planning because the city planning is from the city development policies and plans which determines the direction of urban growth. It affects flood prevention planning and possible damage from flood. The urban growth according to city planning possibly causes some areas to have greater risk of flooding problems. There are several approaches for the concept of urban water resource planning and management. The focus is on the recreation or approaches emphasizing the engineering complete management. The important idea is the concept of water sensitive urban design (Fletcher & Deletic, 2005).
2) Cooperation among the public, private and community sectors: This has the most direct influence on sustainable flood prevention in Bangkok because the public sector, the private sector and the community are aware of the damage that will occur. That is why the government, the private sector and the community have taken part in the management to prevent damage. The good cooperation has been received from the private sector and the community. The cooperation among the public, private and community sectors is essential for flood prevention. In some countries, legal requirements have been modified to involve all relevant groups. The community involvement is in many forms depending on the project implementation steps, ability to perceive the news of the community, and objectives of each arrangement including (1) Dissemination of information through various media, (2) Establishment of information center, (3) Public consultation, (4) Organization of public meeting, and (5) Establishment of a community liaison committee.
This is consistent with Sari, Susilo & Susilo (2013) studying the Role of Stakeholders in Flood Management: Study at Ponorogo, Indonesia. The research's results reveal that the stakeholders (government agencies, private sector entities (NGOs, academicians, and communities) will coordinate in each stage of flood management both before and after the flood. This includes the flood warning system, flood mitigation, and dealing with disasters in an emergency case. The stakeholders will work altogether and coordinate with the regional disaster management office to inform the warning of disaster and declare the area as the area affected by flood.
3) **Readiness of agencies:** It has indirect influence to prevent flooding in Bangkok most sustainably. For the best flood prevention approach, the accurate weather forecast is required to provide an effective and rapid alarm. In addition, there will be a systematic and appropriate preparation for disaster mitigation in both the government and the people sectors. This will help reducing the losses of the public, private and people sectors from the disaster better. The public and private sectors must prepare resources in terms of finance, budgets, personnel, tools, and equipment in order to recover as soon as possible. Besides, the government should provide disaster prevention and mitigation agencies with modern information technology and satellite technology to apply in disaster prevention and mitigation operations. This is for the achievement of efficiency in the integration of helping flood victims with accuracy, comprehensiveness, no duplication and fairness. The government sector must allocate sufficient budget to relevant agencies for the implementation of the set work plan. For example, the main warning agency, the Meteorological Department, needs to be ready in both power rates and modern equipment. This is because the information must be used as accurately and precisely as possible to prevent potential natural disasters and the potential for significant losses.
All types of agencies or organizations desiring to achieve their goals and objectives are required to study the readiness of agencies in various factors including leadership. The leaders play a role in the cooperation or in the decision making to cooperate with other relevant agencies. The importance of leadership is part of the factors that directly affect cooperation (Mattessich, Murray-Close, & Monsey, 2001). The top management of all agencies who cooperates has to be responsible and enthusiastic about working and participate in all occurring projects (Keraminiyage, 2009). This is consistent with Koontz & Weihrich (1990) describing the leadership as an art in the use of influence or the process of exerting influence on other people to make

them willing and enthusiastic to perform the task until reaching the success of the group's goals.

The most important resource for cooperation in flood management and prevention is that the organization has sufficient budget or capital for the management, namely having sufficient personnel and ready to work together. The sufficient materials are necessary to be shared with one another. The management resources are generally related to personnel, budget, and necessary materials. This also includes information technology (Mattessich, et al., 2001). Therefore, the resource availability is the amount of budget received on expenditures for activities or projects that occur including materials used with such activity or project. That the agency is ready to use technology into practice and that the personnel are responsible for the project activities are adequate (Sumittra Jermphan, 2009).

4) Management of flood problems: This influences the sustainable flood prevention in Bangkok because the flood management is a process for assessing the risks of flooding and taking the obtained information to formulate appropriate management measures. The executives can use the organizational or administrative structure design as a medium for communication and implementation following the guidelines into the same direction and goals. The explanations can be created for people in the organization to understand at the same level regarding the shared values and behaviors. It includes the creation of psychological commitments between people in the organization and the organization or agency that must be consistent with the strategic plan, corporate policy, and corporate culture (Chatchawalit Sorawari, 2007).

In addition, public participation is important because people in the area are aware of the problems better than government officials or politicians. Thus, the plans to resolve the flood problems should be approved and judged by the people of the area. At the same time, people or stakeholders should have the opportunity to express their views and exchange information and opinions in order to seek alternatives and decisions related to suitable project mutually acceptable. All involved parties are advisable to participate in this process from the very beginning until the monitoring and evaluation in order to achieve understanding and perception, learning, and cohort modification to benefit all parties (Orathai Kokphol, 2005).

The coordination is another component of flood management. The community is now more aware of natural disasters by taking flood prevention, preparation and surveillance as important and proactive approach cycle than waiting for disasters to occur, rescue, and restore later (Department of Disaster Prevention and Mitigation, 2003). This is in accordance with the research of Uthai Laohawichien and Suwannee Saengmahachai (2017) for the management on the prevention and solving of flood problems in Bangkok. The study found that stakeholders, coordination, communication, control of political factors, and community participation positively correlated with the effectiveness of flood prevention and mitigation in Bangkok. The agrees with the work of Hathaikan Thawithong (2014) which studies the coordination of flood prevention and mitigation in Bangkok by studying the natures of coordination, problem of coordination, and solutions of coordination problems in flood prevention and mitigation in Bangkok. The study found that there is the coordination for flood prevention and mitigation in Bangkok of the Drainage Bureau

References

[1] Department of Water Resources. (2012). Water resources database. Searched from http://www.waterbase.dwr.go.th/Water/WaterLogin.aspx

[2] Department of Disaster Prevention and Mitigation. (2003). Damage and Hazard Assessment. Pathumthani: Disaster Prevention and Mitigation Training Institute.

[3] Chatchawalit Sorawari. (2007). Managing organizational people. Bangkok: Chulalongkorn University Press.

[4] Sumittra Jermphan. (2009). Success in implementing energy saving policy in government sector. Doctor of Philosophy Thesis, Ramkhamhaeng University.

[5] Hathaikan Thawithong. (2557). Coordination for flood prevention and mitigation in Bangkok. Doctor of Philosophy Thesis, Ramkhamhaeng University.

[6] Orathai Kokphol. (2005). People's Participation with Local Public Policy Development. Bangkok: Charansanitwong Publication.

[7] Uthai Laohawichien and Suwannee Saengmahachai. (2017). Management of flood prevention and mitigation in Bangkok. Kasem Bundit Journal, 18.

[8] Umaporn Boonphet. (2012). Relationship between the administrative behavior of the school administrators and the cooperation of the personnel in the educational institution. Nong Chok District Office Under Bangkok. Chandrakasem Rajabhat Institute.

[9] Debnath, R. (2012). Sustainable flood management. Retrieved from kmcenter.rid.go.th/kmc13/km/send/km04-04-02-56.pdf

[10] Diamantopoulos, A. & Siguaw, J. A., (2000). Introduction to LISREL: A guide for the uninitiated. London: SAGE Publications.

[11] Fletcher, T. & Deletic, A. (2005). Water sensitive urban design engineering procedures: Stormwater. Melbourne: CSIRO PUBLISHING.

[12] Keraminiyage, K. (2009). Achieving success in collaborative research: The role of virtual research environments. Electronic Journal of Information Technology in Construction,14.

[13] Koontz, H. & Weihrich, H. (1990). Essentials of management. New York: McGraw-Hill.

[14] Mattessich, P. W., Murray-Close, M., & Monsey, B. (2001). Collaboration: What make it work (2nd ed.). Amherst: H. Wilder Foundation Publication.

[15] Sari, A. N., Susilo, A., & Susilo, E. (2013). The role of stakeholders in flood management: Study at Ponorogo, Indonesia. The International Journal of Engineering and Science (IJES), 2(10), 1-10.

[16] Vangen, S., & Huxham, G. (2010). Managing to collaborate. New York: Routledge.

[17] Walker, B., & Westley, F. (2011). Perspectives on resilience to disasters across sectors and cultures. Ecology and Society, 16(2), 4