

An economic feasibility analysis of urgent projects for solving flood and drought problems in targeted areas of Thailand

Witaya Pintong¹, Rattaphong Sonsuphap²

¹ Dean of Business Administration Faculty, Suvarnabhumi Institute of Technology, Thailand

² College of Social Innovation, Rangsit University, Thailand

² rattsonsuphap@gmail.com

ABSTRACT

This affects agricultural sectors, the quality of life of farmers and overall economic and social conditions of the country. The objective of this research is to analyze the economic suitability and feasibility of the urgent projects development plan for resolving flood and drought problems in the targeted areas of the Office of the National Water Resources (ONWR) during 2018-2022. This seminal research utilizes macroeconomic tools and methods to achieve the results. Economic impact analysis points out that the government should accelerate the projects under the urgent project development plan. If the projects are not implemented, it could damage the overall economy, which can reduce the economic expansion by 2.16 percent from the potential level in the event of flooding and 1.91 percent in the event of a drought. Whereas, if the projects are implemented it can contribute to economic expansion by 0.36 percent from the potential level in the event of flooding and 0.87 in the event of a drought. Therefore, if the projects are not implemented, it will hinder the economy which in turn affects the quality of life, employment and the forward future effects

Keywords

Targeted Areas, Area Base, Gross Domestic Product, Input-Output Table

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

Introduction

Water resource problems, especially floods and droughts, have been a recurring problem in Thailand for a long time. Despite ongoing action by every government, the problems could not be solved efficiently and sustainably. Thailand has a total area of 321.2 million rai, of which agricultural land is 149.2 million rai, but has only 30.22 million rai of irrigated area, or 20 percent of the agricultural area. In addition, about 120 million rai, or more than 80 percent, are non-irrigated areas where rain-based crops are grown, which is at risk of water shortage in the dry season (Office of National Water Resources, 2018). Additionally, there is a risk of flooding problems owing to the variation in weather conditions. With about 27 million rai of recurrent drought-affected areas and about 10 million rai of recurrent flood-prone areas (Office of National Water Resources, 2019), agricultural production will be aggravated because it depends largely on weather conditions, resulting in a poor quality of life of farmers and overall economic and social conditions of the country eventually. It is a problem for the government to find an effective and sustainable solution.

In 2018, the Office of the National Water Resources (ONWR) was established to recommend policies and prepare a strategic plan - a master plan and measures for the management of water resources of the country (ONWR, 2018).

Subsequently, on February 2, 2018, the National Water Resources Committee chaired by the Deputy Prime Minister assigned ONWR as the main organization of integration with relevant agencies to make a master plan for solving spatial problems systematically (2018-2022). The ONWR then created an urgent project development plan to address flood and drought problems in the targeted areas (ONWR, 2019). The urgent project development plan was constructed

by considering projects that can solve problems in the area appropriately, both in terms of budget and action plans integration of various agencies concerned to reduce the overlap of work and the effective use of budget for problem solving. The definition of targeted areas is "Areas with recurring flood/ drought or other problems of water resources needed to be addressed integrally among relevant departments so that the problems can be reduced. This includes special economic areas according to government policies and important tourist areas." (ONWR, 2019). The result of data analysis of ONWR has obtained 66 targeted areas, consisting of 12 Northern areas, 15 Central areas, 16 Northeastern areas, 8 Eastern areas and 15 Southern regions (ONWR, 2019).

Since the projects included in this urgent projects development plan have objectives of solving flood and drought problems in targeted areas of high-priority and require high budget, the government needs to analyze the economic impact of the implementation of such an urgent plan. The worthiness of investment has to be analyzed and presented to the National Water Resources Committee for consideration before submitting it to the Cabinet for finalization.

Objectives of the Study

1. To analyze the economic suitability and feasibility of the projects implementation of the urgent projects development plan for resolving flood and drought problems in the targeted area.
2. To suggest opinions in policy and management so that the implementation of the plan can truly achieve the goals.
3. To provide guidance on funding sources for the project development.

Related Concepts and Theories

In researching the economic feasibility of the project implementation under the urgent projects development plan, related theoretical concepts are used as follows:

Output Evaluation based on the principles of National Accounting: Economic impact analyses for the project implementation will be done in 2 cases. Firstly, if the projects are not implemented, how much damage will it affect the economy? Secondly, if the projects are implemented, how much will it benefit the economy? In analyzing the effect that occurs on the economy, an estimate of the country's output or Gross Domestic Product (GDP) will be estimated, especially of agricultural products, which are considered the main production base of the country. Moreover, the agricultural sector depends on natural conditions and weather, especially water availability. The output of other economic sectors will then be estimated.

In estimating economic output, the most common concepts and methods used by economists are the concept of National Accounting for calculating Gross Domestic Product or National Income in a broad sense. The national accounting system is the most widely used economic accounting system around the world. Its history dates back to about 1660 -1710 when the first national income was estimated in England by Petty, King and Davenant, and in France by Boisguillebert and Vauban (Bos, 2013). The first official national income statistics were published in 1930 by Simon Kuznets (Lequiller & Blades, 2014). National Accounting was established on the basis of consideration of the major economic flows, i.e., the circular flow of money and the circular flow of commodities. The flow patterns are similar in each country because it has taken the template from the United National System of National Accounting (UN SNA) (Fiscal Policy Office, 2003). For Thailand, the Office of the National Economic and Social Development Council (NESDC) started the first national income account in 1950 (National Accounting Office, Office of the National Economic and Social Development Board, n.d.).

The basic concept of National Income is defined as the total income of the people earned from participating in the production of goods and services over a period of time as the owners of the primary inputs or factors of production. In economics, factors of production include labor, land, capital and entrepreneurship. When the owners of the factors of production have already earned income from the compensation of their inputs, they will use their income for consumption. Circulating flows in the economy will then make national income equal to Gross Domestic Product (GDP), which is the total of final goods and services value produced in the economy. The GDP or total supply (Aggregate Supply) is then equal the total expenditure of different units of the economy who purchase those goods and services (Aggregate Demand). By this principle, the National Income is equal to the Gross Domestic Product and equal to total expenditure. Therefore, the calculation of national income can be done using 3 methods, Production Approach, Income Approach, and Expenditure Approach. Hereafter, only the calculation of the Product Approach will be discussed.

Calculation of national income by Production Approach or the calculation of GDP uses the value added generated at each stage of the production of goods and services to avoid recalculation problems in the value of the product. Calculation by using value added can be done by enumerating all steps in producing goods and services and then finding value added in each step of production. The sum of the value added of every step of production, which is equal to the value of the final product or GDP is then calculated. The value added can be obtained from (Pintong, 2013):

Value added = Value of products sold (Output) - Value of products purchased for production (Intermediate Input)

The stages of production in calculating the gross domestic product of Thailand is divided into 16 production sectors: 1) Agriculture, Hunting and Forestry, 2) Fisheries, 3) Mining and Quarry, 4) Manufacturing, 5) Electricity, Gas and Water Supply, 6) Construction, 7) Wholesale and Retail, 8) Hotel and Restaurant, 9) Transportation and Storage, 10) Financial Intermediary, 11) Real Estate Services, 12) Public Administration and Defense, 13) Education, 14) Health and Social Work, 15) Community, Social and Other Personal Services, and 16) Household Workers.

Analysis of the input structure using the Input-Output Table : Input-Output Table (I-O Table) is a table showing the relationship of production and the use of products in the economy. It was invented and developed by Wassily Leontief in 1936. (Leontief, 1936) The production in the economy is divided into sectors of production, where each production sector produces the same product or service depending on the product classification system used. A column of the table shows the structure of production of goods and services. It consists of the use of intermediate inputs and primary inputs, or value added as mentioned earlier, which consists of rent, wages, interest and profit. The column sum equals to the total output of that production sector. A row of the table shows the distribution structure of the output of that production sector for different uses. It consists of the use by other production sectors as an input for production, also known as Intermediate Demand and final use by consumers known as Final Demand. The row sum is also equal to the total output of that production sector. The I-O table, therefore, is a table that shows the inter-connection of production and consumption in the economy together.

Thailand has been building I-O tables for more than 50 years. The first is a 3 x 3 table using economic data of 1951 by Dr.Vichitwong Na Pomphet. It has been continuously developed until Thailand was able to create a systematic I-O table, which is the 1975 edition. It was created by the cooperation of 4 institutes: the Institute of Developing Economics of Japan (IDE), the Office of the National Economic and Social Development Board (NESDB), the National Statistical Office, and Faculty of Economics and Social Research Institute, Chulalongkorn University (Sadjaphan, 2015). Since then, NESDB (later on changed to the Office of the National Economic and Social Development Council) has made I-O tables until now. They are tabulated in 3 sizes: 180, 58 and 16 production sectors (Office of the National Economic and Social Development

council, 2019). The structure of I-O table is shown in Table 1.

I-O tables can be useful in analyzing the relationships of production and consumption of an economy. There are many methods of utilizing I-O methodology such as macroeconomic models, Leontief Multiplier, forward and backward linkage analysis and the analysis of input structure of production sectors. The important assumption is that the Input-Output Coefficient or commonly abbreviated a_{ij} , which is the proportion of the output value of sector i used as the input of sector j , is a constant (Sadjaphan, 2015).

Table 1 Structure of the table of inputs and outputs

		Intermediate Demand			Final Demand (F_i)	Total Output (X_i)
		Agric.	Manu fac.	Servic.		
Intermediate Input	Agric.	X_{11}	X_{12}	X_{13}	F_1	X_1
	Manu fac.	X_{21}	X_{22}	X_{23}	F_2	X_2
	Servic.	X_{31}	X_{32}	X_{33}	F_3	X_3
Value Added	Employees	V_1	V_2	V_3		
	Business Owners & Capital					
	Government					
Total Output (X_i)		X_1	X_2	X_3		

Note. Adaptation from Miller and Blair, 2009.

Research Methods: analysis of economic suitability

Urgent projects to tackle flood and drought problems in targeted areas consist of potential projects to be implemented in targeted areas across the country. The total number of projects is 103 in 16 targeted areas with a total construction budget of 420,035 million baht. These consist of projects and activities as large natural water resources development, large groundwater source development, Kham Ling Reservoirs, irrigation weirs, flood prevention system, improvement of flood gate canals, drainage tunnels, multi-channel drainage canals, water barriers, dams to prevent bank erosion, the irrigation system improvement, and increasing the drainage potential. The summary of the targeted area, number of projects, water capacity, and area size and construction budget are shown in Table 2.

Table 2 Targeted area, number of projects, water capacity, area size and construction budget limit

Potential projects to be implemented by 2022 (103 projects)	Capacity (million m ³ /year)	Area (rai)	Construction limit (million baht)
1. Chiang Mai - Lamphun (N-03), 9 projects	53	35,831	4,023
2. Lower Yom-Nam River Basin (N-10), 14 projects	320	308,051	21,150
3. Tak Special Economic Development Zone (N-12), 5 projects	114	120,994	7,863
4. Lower Chao Phraya covers Tha Chin River Basin and Bangkok. (C-06, C-08, C-09), total 30 projects	1,979	5,533,788	329,510
5. Connection areas in Kan Chanaburi and Suphanburi (C-05) 3 projects.	12	10,500	1,550
6. Phetchaburi-Pranburi (C-14), 1 project	0	157,500	14,800
7. Bang Saphan District, Prachuap Khiri Khan Province (C-15), 2 projects	13	15,832	3,318
8. EEC Eastern Economic Development Zones (E-04, E-05, E-06) 7 projects	277	195,146	14,181
9. Lower Loei River Basin (NE-01), amount 1 project	0	72,555	4,644
10. Upper Chi River Basin (NE-08), 6 projects	143	139,110	9,185
11. Upper Mun River Basin (NE-11), 7 projects	11	28,367	2,302
12. Lower Mun River Basin (NE-13), amount 10 projects	62	87,419	3,839
13. Chumphon-Langsuam (S-01), 4 projects	0	67,588	1,769
14. Koh Samui - Koh Phangan (S-03), 1 project			
15. Nakhon Si Thammarat (S-04), 1 project	0	1,831	350
16. Trang City (S-09), 2 projects	0	3,800	931
Total	2,985	6,759,851	420,035

Note. From Office of National Water Resources, 2019.

The economic feasibility analysis aims to analyze the economic impact on the agricultural sector, which is the most fundamental production sector of the country and linkage impact on the overall production sectors of the country. The analysis will be performed in 2 cases: in case of without project implementation and in case of with project implementation. The analysis results indicate how much the country will lose economically in both agriculture and its overall production if such projects are not implemented. On the contrary, if such projects are implemented, how it will benefit the agricultural sector and the overall economy. The economic impact analysis uses the following information and methods.

Resources :

1) Information on the size of areas and households affected by floods and drought in the 16 river basins in the targeted areas, both in case of without project implementation and with project implementation is from the ONWR as part of the preparation of a master plan for systematically solving spatial problems (2018-2022). Table 3 displays such data from the ONWR. The italic characters in the cells of the table are data variable names used for calculation in 4.2 method of analysis.

Table 3 The data set and variables about size of areas affected by floods and drought in a representative river basins in the targeted area of ONWR

River Basin	Provinces	Without project implementation		With project implementation	
		Flooded Area	Drought Area	Flooded Area	Drought Area
1. Basin 1	Province 1	<i>Number (rai)</i>	<i>Number (rai)</i>	<i>Number (rai)</i>	<i>Number (rai)</i>
	Province 2				
	Province 3				

2) Information related to the important agricultural production of the areas are compiled from the latest 2013 agricultural census, including provinces, important agricultural production of the provinces province (such as rice planting, field crops, growing of perennial plants and fruits, rubber plantation, growing vegetables and herbs, sea salt farming, cattle raising, aquaculture in fresh water areas, etc.), agricultural areas, number of agricultural households, and agricultural products per area. These data are used to estimate the value of important agricultural products based on the production potential of the provinces in the affected area. Table 4 displays such data from 2013 agricultural

census together with average prices from Ministry of Commerce.

Table 4 Data and variables about important agricultural products of provinces from 2013 agricultural census

Province s	The 5 most importa nt agricultu ral producti on	Planted area (rai)	Product ivity per area (kg per rai)	Average price* (baht / kg)
Province 1		<i>total planted area</i>		
	1. Agricu lral Product 1	<i>area</i>	<i>producti vity per area</i>	<i>average price</i>
	2. Agricu lral Product 2			
	3. Agricu lral Product 3			
	4. Agricu lral Product 4			
	5. Agricu lral Product 5			

3) Price information of agricultural products in 2019 is from the Ministry of Commerce.

4) Statistical data on the percentage of damage from drought and flood is from a summary of the situation of drought and flood in 2011-2016 of the Department of Disaster Prevention and Mitigation. The percentage of the average value of the affected agricultural product in the event of flooding is about 58 percent of the potential output to be produce. In the event of drought, agricultural products will be affected by 60 percent of potential output.

5) Value added ratio to the product value of the agricultural sector is from the Input-Output Table the latest version of 2010, of NESDC (Office of the National Economic and Social Development council, 2010).

6) The proportion of agricultural GDP to the GDP of other production sectors is from the 2017 National Accounts of NESDC (Office of the National Economic and Social Development council, 2019).

Method of analysis:

1) In either case, without project or with project implementation, the areas affected by flood and drought of

the provinces in the 16 river basins from the ONWR will be used as a basis for calculating the value of agricultural products affected. Firstly, the affected planted areas for main agricultural production in a province are estimated by applying the proportion of each type of agricultural area to the total provincial agricultural areas from the agricultural census to the provincial affected areas of the ONWR.

2) The next step is to estimate the value of the important agricultural products of the affected province. Starting with the estimation of the amount of each agricultural production, this is done by multiplying respective agricultural area with productivity. The production amount is then converted to value by multiplying agricultural product with product price. Finally, total agricultural value affected of each province in a river basin is calculated by summing up each agricultural value in the province. This procedure is applied for flood and drought of the two cases.

3) To arrive at the effective agricultural value affected by flood and drought, statistical information on the percentage of damage from drought and flood from a summary of the situation of drought and flood in 2011-2016 of the Department of Disaster Prevention and Mitigation is used. The effective agricultural value affected by flood is 58 percent of the value obtained from the second step and that affected by drought is 60 percent of the value.

4) The effective agricultural value from the third step is the output value at market price. It must be converted to value added (Agricultural GDP) according to the Gross Domestic Product calculation principle. It is done by applying the value added proportion to the product value of the agricultural sector, from the I-O table, the latest year 2010, which is about 62.22 percent.

5) Estimate the GDP of other production sectors to determine the overall economic impact (overall GDP), which is the linkage impact from agriculture to other production activities along the supply chain. This is done by using the proportion of agricultural GDP to the GDP of other production sectors from the 2017 National Accounts and analyzing the proportion of GDP affected to the total GDP of the country at the value of 2019.

Conclusions of the Study

1. Adverse effects in the event of without project implementation :

1.1 Adverse effects on the agricultural sector

In the event that the 103 projects are not implemented under the urgent project development plan for solving flood and drought problems in the targeted areas, the damage to the flooded area of 8,854,038 rai will be important agricultural products in the targeted areas, such as rice, rubber, field crops, perennial crops and fruit trees, vegetables and herbs and aquaculture in freshwater livestock. The value in 2019 is approximately 45,169 - 53,692 million baht or an average of 49,431 million baht. Meanwhile, it will cause damage to the dry area of 5,643,028 rai and cause damage to agricultural products of approximately 40,127 - 47,422 million baht or an average of 43,774 million baht, as analyzed in Table 5.

Table 5 Impact on the agricultural sector in case of without project implementation

River Basin	Province	Flood (value: thousand baht)		Drought (value: thousand baht)	
		Damaged area (rai)	Agricultural products	Damaged area (rai)	Agricultural products
1. Alleviate flood and droughts Chiang Mai-Lamphun Area	Chiang Mai, Lamphun	4,106	39,892	31,725	330,219
2. Flood relief Lower Yom-Nan River Basin Area	Kamphaeng Phet, Phichit, Phitsanulok, Sukhothai, Udon Thani	41,656	141,263	266,395	1,601,202
3. Support the Tak Special Economic Development Zone	Tak	735	4,277	115,750	697,153
4. Alleviate droughts Kanchanaburi-Suphanburi junction area	Kanchanaburi, Suphanburi	0	0	10,500	140,167
5. Flood relief Lower Chao Phraya River Basin Area	Chaiwat, Nakhon Pathom, Nakhon Si Thammarat, Ayutthaya, Lopburi, Saraburi, Singburi, Ang Thong, Bangkok, Nonthaburi, Pathum Thani, Samut Prakan	1,112,714	5,598,931	1,697,026	6,116,965
6. Alleviate flood and droughts The Phetchaburi and Prachin Buri River Basin	Prachin Buri, Khin Khan, Phetchaburi	6,796	109,960	0	0
7. Flood relief Bang Si Phan District	Prachin Buri, Khin Khan	15,322	398,242	0	0
8. Support the Eastern Special Development Zone (EEC)	Chachoengsao, Chonburi, Chanthaburi, Rayong	4,981	106,820	190,165	3,233,675
9. Alleviate droughts Lower Loei basin area	Loei	0	0	62,510	6,151,995
10. Alleviate flood and droughts Upper Chi River Basin	Khon Kaen, Chaiyaphum, Nakhon Ratchasima	18,610	194,269	120,500	1,301,271
11. Alleviate flood and droughts Upper Man River Basin	Nakhon Ratchasima	19,413	88,246	8,954	42,107
12. Alleviate flood and droughts Lower Man River Basin	Yasothon, Siakhet, Udon Ratchasima	17,919	65,737	69,500	263,826
13. Flood relief Chumphon-Langkaew area	Chumphon	67,588	1,400,741	0	0
14. Support tourism Koh Samui - Koh Phangan	Surat Thani	0	0	1,200	13,764
15. Flood relief Nakhon Si Thammarat Area	Nakhon Si Thammarat	1,831	17,828	0	0
16. Flood relief Trang city area	Trang	3,300	40,038	0	0
Total		1,315,980	8,215,245	2,574,225	19,912,344

Note: Agricultural product value is valued at 2019 market prices.

1.2 Negative effects on the overall economy

The analysis of the impact to other economic sectors according to the method described in article 5.1 finds that in case of without project implementation, there will be adverse effects to the overall economy (overall GDP) in the event of flooding of approximately 337,648 - 401,355 million baht, or averaging to 369,501 million baht. This is approximately 1.97 - 2.34 percent, or averaging to 2.16 percent of GDP in 2019. In considering each sector effect, the impact on agricultural sector equals to 30,756 million baht, manufacturing sector to 120,663 million baht and service sector to 218,081 million baht.

In the event of drought, the adverse effects on the overall economy are approximately 299,952 - 354,488, or averaging to 327,220 million baht. It is approximately 1.75 - 2.06 percent, or averaging to 1.91 percent of GDP in 2019. In considering each sector effect, the impact on agricultural sector equals to 23,236 million baht, manufacturing sector to 106,856 million baht and service sector to 193,127 million baht, as the analysis results in Table 6.

Table 6 Impact on the overall economy in case of without project implementation

Production Sectors	Adverse effects; without project implementation (Value: thousand baht)	
	Flood	Drought
Agricultural Sector	30,756,116	27,236,766

Manufacturing Sector	120,663,969	106,856,673
Service Sector	218,081,803	193,127,212
Gross Domestic Product (GDP)	369,501,887	327,220,651
GDP 2019	17,133,900,000	17,133,900,000
Proportion to GDP	1.97 - 2.34	1.75 - 2.06
	Average 2.16	Average 1.91

2. Benefits in the event of without project implementation

2.1 Benefits to the agricultural sector

In the event that the 103 projects are implemented for solving flood and drought problems in the targeted areas as proposed, it will benefit in flood prevention of 1,315,980 rai. Consequently, it causes a positive impact on agricultural products that are important in targeted areas such as rice, rubber, upland crops, perennial crops and fruit trees, vegetables and herbs, aquaculture in freshwater areas and livestock approximately 7,507 - 8,923 million baht in 2019, or an average of 8.215 million baht. Meanwhile, it will cause benefit in drought protection of about 5,643,028 rai. Calculating in terms of product value, the benefits to agricultural products are approximately 18,252 - 21,571 million baht or an average of 19,912 million baht, as shown in the analysis in Table 7.

Table 7 Benefits to the agricultural sector in the event of without project implementation

River Basin	Province	Flood (value: thousand baht)		Drought (value: thousand baht)	
		Damaged area (rai)	Agricultural products	Damaged area (rai)	Agricultural products
1. Alleviate flood and drought: Chiang Mai-Lamphun Area	Chiang Mai, Lamphun	4,106	39,892	31,725	330,219
2. Flood relief: Lower Yom-Nan River	Kamphaeng Phet, Phichit, Phitsanulok, Sukhothai	41,656	141,263	266,395	1,601,202

River Basin	Province	Flood (value: thousand baht)		Drought (value: thousand baht)	
		Damaged area (rai)	Agricultural products	Damaged area (rai)	Agricultural products
Basin Area	i, Uttaradit				
3. Support the Tak Special Economic Development Zone	Tak	735	4,277	115,750	697,153
4. Alleviate drought: Kanchanaburi-Suphanburi junction area	Kanchanaburi, Suphanburi	0	0	10,500	140,167
5. Flood relief: Lower Chao Phraya River Basin Area	Chainat, Nakhon Pathom, Nakhon Sawan, Ayutthaya, Lopburi Saraburi, Singburi, Ang Thong, Bangkok, Nonthaburi, Pathum Thani, Samut Prakan	1,112,714	5,598,931	1,697,026	6,116,965
6. Alleviate flood and drought: The Phetchaburi and Pranburi River Basin	Prachuap Khiri Khan, Phetchaburi	6,796	109,960	0	0
7. Flood relief: Bang	Prachuap Khiri Khan	15,832	398,242	0	0

River Basin	Province	Flood (value: thousand baht)		Drought (value: thousand baht)	
		Damaged area (rai)	Agricultural products	Damaged area (rai)	Agricultural products
Saphan District					
8. Support the Eastern Special Development Zone (EEC)	Chachoengsao, Chonburi, Chanthaburi, Rayong	4,981	106,820	190,165	3,253,675
9. Alleviate drought: Lower Loei basin area	Loei	0	0	62,510	6,151,995
10. Alleviate flood and drought: Upper Chi River Basin	Khon Kaen, Chaiyaphum, Nakhon Ratchasima	18,610	194,269	120,500	1,301,271
11. Alleviate flood and drought: Upper Mun River Basin	Nakhon Ratchasima	19,413	88,246	8,954	42,107
12. Alleviate flood and drought: Lower Mun River Basin	Yasothon, Sisaket, Ubon Ratchathani	17,919	65,737	69,500	263,826
13. Flood relief: Chumphon-Langsuan area	Chumphon	67,588	1,400,741	0	0
14. Support tourism: Koh	Surat Thani	0	0	1,200	13,764

River Basin	Province	Flood (value: thousand baht)		Drought (value: thousand baht)	
		Damaged area (rai)	Agricultural products	Damaged area (rai)	Agricultural products
Samui - Koh Phangan					
15. Flood relief: Nakhon Si Thammarat Area	Nakhon Si Thammarat	1,831	17,828	0	0
16. Flood relief: Trang city area	Trang	3,800	49,038	0	0
Total		1,315,980	8,215,245	2,574,225	19,912,344

2.2 Benefits to the overall economy

In analyzing the impact to other economic sectors, it is found that in case of with project implementation for solving flood and drought problems in the targeted areas, the benefit for the overall economy (overall GDP) in the event of solving the flood problems is approximately 56,115 - 66,703 million baht, or an average of 61,409 million baht. This is approximately 0.32 - 0.38 percent, or averaging to 0.36 percent of GDP in 2019. In considering each sector effect, the impact on agricultural sector equals to 5,111 million baht, manufacturing sector to 20,053 million baht and service sector to 36,244 million baht.

In the event of solving the drought problems, the benefit for the overall economy is approximately 136,442 - 161,249 million baht, or an average of 148,846 million baht. This is approximately 0.79 - 0.94 percent or averaging to 0.87 percent of GDP in 2019. In considering each sector effect, the impact on agricultural sector equals to 12,389 million baht, manufacturing sector to 48,606 million baht and service sector to 87,849 million baht, as shown in the analysis results in Table 8.

Table 8 Benefits to the overall economy in case of with project implementation

Production Sectors	Benefit; with project implementation (Value: thousand baht)	
	Flood	Drought
Agricultural Sector	5,111,525	12,389,460
Manufacturing Sector	20,053,798	48,606,964
Service Sector	36,244,195	87,849,708
Gross Domestic Product (GDP)	61,409,518	148,846,133
GDP 2019	17,133,900,000	17,133,900,000
Proportion to GDP	0.32 - 0.38	0.79 - 0.94

	Average 0.36	Average 0.87
--	---------------------	---------------------

Conclusion and Recommendations:

Summary

Solving water problems to achieve the goals of the 20-Year Water Resources Management Master Plan (2018-2037) entails a number of goals and indicators especially important to prevent and solve the huge economic damage that has occurred from flood and drought. It is necessary to increase water retention to increase production potential and make it sufficient for consumption, expand irrigated areas to increase quality of life and reduce farmer's inequality. These goals are in line with the objectives of the National Strategy and the 12th National Economic and Social Development Plan. It is therefore essential to accelerate the action as soon as possible, especially for large-scale projects and projects that have a strong impact on solving water problems.

This investment project proposal utilizes the area based principle to identify areas to cover flood and drought problems that are more vulnerable and severe than other areas. By using modern data and using geographic information (Geographic Information System: GIS) as an analytical tool, areas with all aspects and high priority factors will be selected as the target area. In selecting projects to include in the urgent project development plan, the criteria must be developed in addition to the projects being in the targeted areas, including engineering readiness, operation readiness within 1-2 years, avoid the public objection problem, and worth more than 100 million baht. The projects meeting such criteria and ready to operate during the year 2019 to 2022 then were selected to include in the urgent projects development plan totaling 103 projects in 16 target areas with construction budget of 420,035 million baht.

Economic impact analysis can be summarized in Table 9 pointing that the government should accelerate the projects under the urgent project development plan. This is because if the projects are not implemented, it will damage the overall economy, which is to reduce the economic expansion by 2.16 percent from the level of potential that should be in the event of flooding and 1.91 percent in the event of drought. Whereas if the projects are implemented, it will help the economy expand more by 0.36 percent from the level of potential that should be in the event of flooding and 0.87 in the event of drought. Therefore if the projects are not implemented, it will hinder the economy which affects the quality of life, employment and the continuing effects to the future.

Table 9 Summary of economic analysis results

Items	In case of without project implementation (Losses)		In case of with project implementation (Benefits)	
	Flood	Drought	Flood	Drought
Agricultural sector (million baht)	49,431	43,774	8,215	19,912
Overall	369,501	327,220	61,409	148,846

economy (million baht)				
Percentage of GDP	1.97 – 2.34 average 2.16	1.75 – 2.06 average 1.91	0.32 – 0.38 average 0.36	0.79 – 0.94 average 0.87

Recommendations

1. Accelerate all 103 projects to solve water problems in 16 targeted areas with construction limit of 420,035 million baht by the loan method to reduce the limitations of the national budget. These projects have qualifications in line with the guidelines for applying for loans in accordance with the regulations of the Public Debt Management Policy and Regulation Committee. Regarding the Public Debt Management Regulations 2018, there are rules for a government agency that wants to borrow money for use in a development project stating that it must be consistent with the National Strategy, National Reform Plan and the National Economic and Social Development Plan. Moreover, there must be reports of technical, economic, social, financial and operational suitability. The economic impact study of the urgent project development plan indicates the economic suitability as already discussed.

2. Direct agencies involved in all 103 projects in the urgent project development plan must prepare to expedite what needs to be done at the same time so that the project can be implemented as soon as money has been allocated, such as detailed design, environmental impact study, etc..

3. To achieve objectives and the goals of the 20-year Master Plan for Water Resources Management (2018-2037), truly and completely, relevant government agencies need to accelerate the implementation of other projects in accordance with the missions of the agencies in line with the water resource management master plan concurrently to produce real results that are consistent and support these large-scale projects.

Acknowledgement

The researcher would like to offer our heart-felt thanks to the Executive of the Office of the National Economic and Social Development Council, Office of National Water Resources, governors of various provinces, local government organizations of the 16 provinces, as well as government and private network partners who helped make this research report successful

References

- [1] Office of National Water Resources. (2018). 20-Year Master Plan on Water Resources Management (2018-2037). Retrieved from <http://hydrology.rid.go.th/strategy/2561/24.pdf>
- [2] Office of National Water Resources. (2019). Work Plan to Drive the Sustainable Spatial Water Relief Project. Bangkok.
- [3] Bos, F. (2013). Meaning and measurement of national account statistics. Conference on the Political Economy of Economic Metrics. Lindenlaan, Netherlands: Eagle Economics &
- [4] Statistics. Retrieved from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2231937.
- [5] Lequiller, F., & Blades, D. (2014). Understanding National Accounts (2nd ed.). OECD Publishing, from <http://dx.doi.org/10.1787/9789264214637-en>.
- [6] Fiscal Policy Office. (2003). Economics to know. Retrieved from <http://www2.fpo.go.th/S-I/Source/ECO/ECO1.htm>.
- [7] National Accounting Office, The Office of the National Economic and Social Development council. (n.d.). Manual for processing national accounts statistics. Bangkok.
- [8] Pintong, W. (2013). Management Economics. Documents for teaching the Master of Business Administration Program. Sripatum University. Bangkok.
- [9] Sadjaphan, J., (2015). The Impact of the Automotive Industry to the Thailand Economy, An Independent Study, Faculty of Economics, Thammasat University. Retrieved from http://ethesisarchive.library.tu.ac.th/thesis/2015/TU_2015_5704010767_4859_3348.pdf
- [10] Office of the National Economic and Social Development Council. (2010). Input - Output Table of Thailand 2010 (16 Sectors). Retrieved from https://www.nesdc.go.th/main.php?filename=io_page
- [11] Office of the National Economic and Social Development council. (2019). National Income of Thailand 2019.

- [12] Leontief, W. W. (1936). Quantitative Input and Output Relations in the Economic Systems of the United States. *The Review of Economics and Statistics*, 18(3), 105-125.
- [13] Miller, R. E., & Blair, P. D. (2009). *Input–Output Analysis: Foundation and Extensions*. (2nd ed.). Cambridge, UK: Cambridge University Press.