



Strategic Environmental Assessment: A Case Study of Mueang Lopburi District, Lopburi Province, Thailand

Pitchakorn Wongthongdeepeekaew^{*}, Allan Sriratana Tabucanon
and Sukanya Sreenonchai

Environmental Management Technology Course, Faculty of Environment and Resources,
Mahidol University, Nakhon Pathom 73170, Thailand

^{*}E-mail : ko7tam@outlook.co.th

Abstract

The objectives of this research were 1) to study and analyze gaps in strategic plans under the Mueang Lopburi District Development Plan (Development Plan) and 2) to evaluate and recommend suitable strategic alternatives for the Development Plan. Alternative 1 defines following the Development Plan (B.E. 2015 - 2017). Alternative 2 applies the strategies set for the Development Plan (B.E. 2018 - 2022). Alternative 3 adopts the results of the strategic environmental assessment or environmental assessment at the strategic development level for Mueang Lopburi District to develop the area. The study found that Alternative 3 was recommended to use for decision-making in the preparation of the next development plan of the Mueang Lopburi District. Interviewing the stakeholders in Mueang Lopburi District was conducted to prioritize the issues to be formulated as strategic issues, which were summarized into five strategic issues environmental quality development, social development, quality of life and equality, economic and tourism development, water resource management, and agricultural development. The assessment of the impact of the implementation of Alternative 3 was as follows: It should focus on measures to promote solid waste segregation at source to reduce the amount of solid waste being discarded to the solid waste disposal process. Furthermore, measures should be established to monitor the quality of effluent at the source. Moreover, soil characteristics and land use should be studied following scientific principles. Finally, a forest fire management plan should be in place to mitigate a forest fire. Air pollution control equipment and air quality monitoring should be installed in the local workplace.

Keywords : Strategic Environmental Assessment (SEA); Strategic Alternatives;
Mueang Lopburi District

Introduction

According to the Lopburi Provincial Development Plan, Mueang Lopburi District has the potential for tourism promotion due to its ease of access to various historical assets and resources, including art and archaeological sites, royal palaces as well as diplomatic sites from the early Ayutthaya era. Therefore, harmonizing with its remarkable assets, the Mueang Lopburi District Development Plan 2018 – 2022 [1] highlights key developmental strategies, including promoting tourism, eco-tourism, and attractive historical sites. Such implementation success relies heavily on improving people's

health and infrastructure, strictly prohibiting illegal drug use, citizen and property safety, and good quality education systems and environment. Furthermore, the enhancement of agricultural productivity is another important issue for the socioeconomic development of the area. However, Mueang Lopburi District has not yet achieved its goals arising from a lack of comprehensive integration of economy, society, and environment into the development planning process. Hence, this study applied the Strategic Environmental Assessment (SEA) tool to ensure consideration of those three sustainable pillars in the process for long-term sustainability [2].

Materials and Methods

This qualitative research applied SEA to evaluate the impact of strategic alternatives for sustainable development of Mueang Lopburi District, Lopburi province [3]. The step-by-step description is shown below.

Step 1 Identify the strategic issues involved in the study area regarding the 20-year National Strategy (2018 – 2037), the 12th National Economic and Social Development Plan (2017 – 2021), the Regional Development Plan (2018 – 2021) including Chainat, Lopburi, Singburi, Anghong provinces, 4-year [4], Lopburi province Development Plan and 5-year Mueang Lopburi District Development Plan (2018 – 2022) [5]. The latest plan consists of six strategies, improvement of life quality and infrastructure, strict prohibition of illegal drug use, safety in daily life and property, tourism promotion, eco-tourism, and attractive historical sites as learning resources, good quality educational systems and environment, and enhancement of agricultural productivity.

Step 2 Consider and consult with key stakeholders in the study area to determine the strategic issues to be considered in this study by using questionnaire techniques, in-depth interviews, and data collection. The main target stakeholders will be divided into three groups as follows:

1. Representatives of government agencies such as the Lopburi Provincial Office, the Lopburi Provincial Tourism Office, private organizations in tourism management in Lopburi, Mueang Lopburi District, the Office of the Environment Region 7 (Saraburi), the Office of Natural Resources and Environment, the Office of Public Works and Town & Country Planning, and the Water Supply and Maintenance Department at 1 Lopburi Irrigation Project. In this study, a total of 11 people were interviewed.

2. Representatives of local government organizations in Mueang Lopburi District and representatives from higher education institutions by selecting one representative from each agency, totaling 24 persons, to provide information on policies and plans for area development, including development measures, impacts and concerns from the development of Mueang Lopburi District.

3. Representatives of communities in Mueang Lopburi District by selecting one representative from each community. A total of 22 people were selected to provide information on their potential and trends in the area.

Strategic issues of Muang Lopburi District were set up in three dimensions: economic (tourism, agriculture, industry, transportation, and fisheries), social (quality of life and equality, electricity, and urban development), and environmental dimension (climate change, water resources, environmental quality, and biodiversity) [6]. These dimensions and issues are consistent with the work of the Office of the National Economic and Social Development Council, the Asian Development Bank, and the International Center for Environmental Management (2019) under the "SEA of the Rayong Provincial Development Plan" project [7].

Step 3 Prioritize strategic issues by the judgment of 11 representative government agencies and subsequently define sub-topics and indicators under each strategic issue to be further investigated in this study.

Step 4 Utilize the derived data to analyze, synthesize, review, compile, and describe the study and discussion results. Then develop and evaluate strategic options through a public hearing with key target participants to develop and assess the proposed strategic options. Covering measures for preventing or mitigating potential impacts of implementing the strategic alternatives and recommendations on the implementation by the various agencies involved in the Mueang Lopburi district obtained from the study.

Results

1. Development of issues and indicators for the environmental impact assessment at the strategic level and the development of strategic alternatives to be used in the assessment

1.1 Development of issues and indicators for the environmental impact assessment at the strategic level was performed. Issues and indicators used in the strategic impact assessment were based on scoping at the issue level according to the Sustainable Development principle. That is a development creating balance in three aspects: economic, social, and environmental. Up to 12

strategic issues related to the development of Mueang Lopburi District covering all three dimensions were defined. These issues were consistent with the Office of the National Economic and Social Development Council, the Asian Development Bank, and the International Center for Environmental Management (2019). In this regard, this research studied the gaps in the development of Mueang Lopburi District from the implementation of the Mueang Lopburi District Development Plan (2018 – 2022). In the past, some issues had not yet been addressed with respect to the goals of the development plan. The results of the gap analysis are shown in Table 1.

The Mueang Lopburi Development Plan (2018 – 2016) was presented to experts in Mueang Lopburi District and 11 experts. The aim was to prioritize strategic issues by allowing the experts to assess each strategic issue regarding the size of the problem, the difficulty of solving the problem, the severity of the problem, and public interest. The scoring was from 1(least) to 9 (most). The top four results are shown in Table 2.

The results of prioritizing the strategic issues by the expert judgment found that the experts highly impacted four strategic issues: environmental quality, social, quality of life, equality, economy, and tourism and water resources, respectively. It was found that agriculturalists in the area were managing the water and the gap analysis results of the plan. There were still gaps in agriculture gap analysis, including the vision of Mueang Lopburi District. It also highlighted the importance of food security. Therefore, adding another strategic issue, namely, agriculture, was appropriate. The researcher presented five strategic issues to the stakeholders. The stakeholders were comprised of local government organizations and higher education institutions in Mueang Lopburi District representatives, totaling 24, and 22 Mueang Lopburi District community representatives selected by using an interview form to present sub-issues under the strategic issues, indicators, and goals of all five strategic issues, shown in Diagram 1.

Table 1 The results of the gap analysis in the development plan of Mueang Lopburi District (2018-2022)

Strategies	The gaps in the Mueang Lopburi District development plan
Strategy 2 Solving the illegal drug problem and providing people with daily life and property safety.	Lack of cooperation at the local level, such as no power of attorney or village headman not being involved in solving illegal drug problems.
Strategy 3 Promoting and developing prominent tourist attractions, eco-tourism, and history as learning resources.	Promotion of tourism without considering the potential supporting tourists causes the following problems: 1. The amount of waste increases more than the capacity of the waste bins provided by Mueang Lopburi District, generating excess rubbish around the bin area. 2. The ancient site was destroyed due to more tourists than the staff could monitor. Therefore, the supervising was not strict enough to ensure adequate care. 3. Monkeys in Mueang Lopburi District change their eating behaviors because tourists feed them. Moreover, the tourists threaten the monkey's habitat, so the monkeys invade local people's properties, causing conflict between the locals and the monkeys.
Strategy 5 Developing and increasing agricultural productivity to be safe and the development of local products.	Lack of promoting the body of knowledge in the development of new agricultural products and lack of support for innovation in organic farming or non-toxic agriculture.

Table 2 Results of prioritization of strategic issues

No.	Strategic											Diversity Biological.
	Economy and Tourism.	Society quality of life and equality.	Electricity and energy.	Climate change.	Water resources.	Agriculture	Industry	Urban development	Transportation	Fishery and Livestock	Quality of environment.	
01	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
02	5 5 5	7 6 5 4	4 3 5 4	6 5 4 4	4 5 5 3	3 5 4 3	3 3 3 3	3 3 3 3	3 3 3 3	4 5 5 5	5 6 6 5	1 1 2 5
03	4 4 4 5	6 5 2 2	3 3 5 3	5 4 4 4	4 4 4 4	3 6 4 3	4 4 4 5	4 3 3 3	3 3 4 3	4 4 4 4	4 3 3 4	1 1 4 3
04	2 2 7 3	2 4 7 4	1 1 7 5	4 4 4 2	5 6 4 7	5 4 4 7	2 1 7 4	2 5 4 7	3 4 6 4	3 2 6 4	3 2 3 6	4 2 6 1
05	2 2 4 6	4 6 4 3	1 2 4 4	3 4 4 4	4 5 3 6	3 3 4 5	2 2 5 5	4 3 3 4	1 2 3 4	1 1 2 1	7 7 7 4	1 1 1 1
06	4 4 5 7	5 5 5 3	2 2 5 3	4 4 5 6	3 4 4 6	2 3 4 2	2 2 2 2	2 3 3 3	1 2 1 1	1 3 5 6	7 4 6 2	2 2 3 1
07	4 4 4 4	4 4 5 4	5 5 6 5	4 5 6 3	5 4 6 5	3 3 5 3	2 2 2 2	3 2 2 2	1 1 3 1	5 2 4 4	4 6 5 7	3 3 6 6
08	5 4 4 3	5 5 5 3	4 5 5 3	4 2 4 4	4 4 3 3	2 3 4 3	4 3 4 5	6 1 2 3	2 2 2 2	2 3 2 3	2 5 6 7	3 3 2 2
09	6 6 6 6	6 6 7 6	3 4 4 3	4 5 6 2	2 3 4 4	3 4 5 4	2 2 2 2	2 2 2 2	2 2 2 2	2 3 2 3	2 4 4 4	1 2 2 2
10	5 4 5 6	6 6 6 4	3 2 5 6	3 4 3 4	3 3 4 3	2 1 2 3	4 2 3 2	2 3 4 2	3 2 3 2	2 4 3 3	6 5 6 3	3 3 2 2
11	2 2 4 6	4 6 4 3	1 2 4 4	4 3 4 4	4 5 3 6	3 3 4 5	2 2 5 5	4 3 3 4	1 2 3 4	1 1 2 1	7 7 7 4	1 1 1 1
Sum	44 42 53 56	55 59	31 49 45 52	44 44 44 44	45 47 45 52	32 33 46 45	29 28 41 39	29 32 33 35	22 26 33 29	29 33 39	36 55 60 57	21 19 31 29
Mean (Sum/11)	4 4 5 5	5 5 5 4	3 3 4 4	4 4 4 4	4 4 4 4	3 3 4 4	2.5 3.5 2.6 2.9	3 3.2 2.4 3	2.6 2.4 3	2.6 3 3.5	5.2 5.2 5.2 5.2	1.9 2 3 2.6
Positive	18	19	14	16	17	14	11.6	11.7	10	12.4	20.4	9.5
Multiply	400	500	144	256	320	144	6825	7238	3744	9555	676	2964
No.	3	2	6	5	4	7	10	9	11	8	1	12

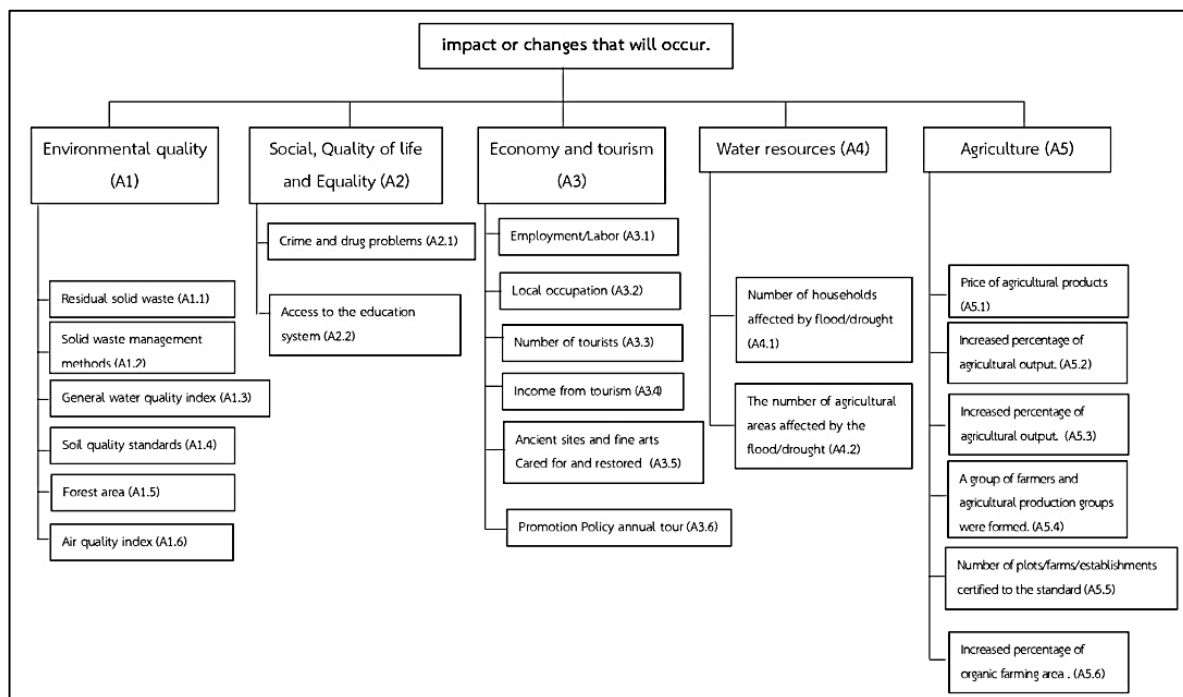


Diagram 1 Effects or changes that may occur as a result of the operation

Eleven experts compared the importance of each strategic issue, then prioritized the issues and indicators by comparing correlations individually. Then compiled the assessments in a matrix table, starting from the top layer of the chart with strategic issues, and the lower level of the chart was the indicator level. It uses the level of importance of all problems with numbers -3 to +3. The results were considered important by the experts. The results are shown in Table 3.

1.2 Determination of strategic alternatives for environmental assessment at the strategic level of Mueang Lopburi District.

The Environmental Impact Assessment at a Strategic Level that may occur from implementing the Mueang Lopburi District Development Plan affects the economy, society, and environment. Mueang Lopburi District has considered the role and vision of Mueang Lopburi District as "*The district is livable, has stability, promotes tourism development, people have knowledge and food safety.*" The main activities were improving the quality of life for

people's health and infrastructure education system development for a solution to the illegal drug problem, developing a safe agriculture system, and promoting and developing historical and eco-tourism sites [8].

Strategic issues according to the development plan of Mueang Lopburi District, Lopburi province (2018 - 2022) [9] from the area's potential and the social component of Mueang Lopburi District based on background data, on-site interviews with the stakeholders, and on-site observations. Therefore, there were three important alternatives to be considered in assessing the impact level, namely:

1) Adopting a strategy for the development of Mueang Lopburi District, Lopburi province (2014 - 2017) to undertake development in the area and assess the impact of the operation (Containing, Strategy 1 Creating Value by increasing food safety. Strategy 2 Create added value in tourism and tourism products. Strategy 3 to improve people's quality of life to have good health).

Table 3 Results of priority consideration from experts

No.	A1	Value*						A2	Value*			A3	Value*						A4	Value*			A5	Value*					
		A1.1	A1.2	A1.3	A1.4	A1.5	A1.6		A2.1	A2.2	A3.1		A3.2	A3.3	A3.4	A3.5	A3.6	A4.1		A4.2	A5.1	A5.2		A5.3	A5.4	A5.5	A5.6		
1	0.65	0.15	0.05	0.28	0.25	0.11	0.16	0.46	0.53	0.47	23.0	0.09	0.16	0.11	0.41	0.13	0.1	0.26	0.66	0.34	0.25	0.14	0.13	0.38	0.15	0.04	0.16		
2	0.25	1.10	15.0	0.29	0.09	0.13	0.23	0.24	0.49	0.51	0.29	0.17	0.06	0.17	0.42	0.08	0.1	0.34	0.69	0.31	0.36	0.14	0.09	0.45	0.12	0.14	0.06		
3	0.33	24.0	23.0	0.16	0.06	0.1	0.21	0.27	0.29	0.71	0.95	0.16	0.03	0.13	0.17	0.25	0.26	0.21	0.36	0.64	0.42	0.03	0.17	0.47	0.04	0.26	0.03		
4	0.42	19.0	0.17	0.13	0.26	0.14	0.11	0.85	0.31	0.69	0.74	0.14	0.14	0.14	0.11	0.33	0.14	0.23	0.26	0.74	0.12	0.06	0.16	0.15	0.16	0.33	0.14		
5	0.26	1.10	0.19	0.14	0.14	0.14	0.28	0.54	0.11	0.89	0.35	0.14	0.14	0.08	0.24	0.28	0.12	0.32	0.65	0.35	0.23	0.12	0.13	0.16	0.14	0.31	0.14		
6	0.51	33.0	0.24	0.14	0.07	0.14	0.08	0.26	0.6	0.4	0.38	0.24	0.14	0.16	0.12	0.2	0.14	0.38	0.54	0.46	0.25	0.04	0.08	0.35	0.18	0.21	0.14		
7	0.52	17.0	0.26	0.09	0.09	0.14	0.25	0.35	0.2	0.8	0.27	0.18	0.14	0.24	0.05	0.24	0.15	0.44	0.14	0.86	0.64	0.05	0.32	0.23	0.04	0.01	0.35		
8	0.26	45.0	19.0	0.03	0.01	0.12	0.2	0.24	0.21	0.79	0.25	0.09	0.14	0.1	0.48	0.07	0.12	0.43	0.3	0.7	0.52	0.03	0.08	0.32	0.14	0.25	0.18		
9	0.54	0.60	33.0	0.05	0.31	0.08	0.17	0.69	0.33	0.67	0.24	0.04	0.18	0.25	0.13	0.24	0.16	0.25	0.65	0.35	0.34	0.21	0.17	0.18	0.17	0.15	0.12		
10	0.62	0.90	22.0	0.04	0.24	0.12	0.29	0.25	0.79	0.21	0.29	0.16	0.12	0.21	0.21	0.26	0.04	0.32	0.33	0.67	0.23	0.09	0.14	0.07	0.19	0.37	0.14		
11	0.37	35.0	15.0	0.14	0.04	0.13	0.19	0.39	0.24	0.76	0.32	0.14	0.14	0.11	0.36	0.16	0.09	0.45	0.05	0.95	0.25	0.14	0.14	0.13	0.17	0.15	0.27		
Mean	0.43	0.10	0.15	0.26	0.14	0.20	0.16	0.41	0.37	0.63	0.39	0.14	0.13	0.15	0.25	0.20	0.13	0.34	0.42	0.58	0.33	0.10	0.15	0.26	0.14	0.20	0.16		

*Remark:

A1 Environmental Quality	
A1.1	The amount of residual solid waste
A1.2	Solid waste management methods
A1.3	General water quality index
A1.4	Soil Quality Standards
A1.5	Forest area
A1.6	Air Quality Index

A2 Social Quality of Life and Equality	
A2.1	Crime and illegal drug problems
A2.2	Access to the education system

A3 Economic and Travel	
A3.1	Employment/Labor
A3.2	Local Occupation
A3.3	Number of tourists
A3.4	Income generated from tourism
A3.5	Historic Sites and Arts
A3.6	Tourism Promotion Policy

A4 Water Resources	
A4.1	Number of households affected by flood-drought
A4.2	Number of agricultural areas damaged by flood or drought

A5 Agriculture	
A5.1	Prices of agricultural products
A5.2	Percentage increase in agricultural production
A5.3	Percentage of developed farmers
A5.4	Farmers gatherings
A5.5	Number of plots farms that have received the standard
A5.6	Percentage increase in organic farming

2) Implement a strategy for the development of Mueang Lopburi District, Lopburi province (2018 – 2022) to undertake development in the area and assess the impact of the operation (Consisting of Strategy 1 Improving the quality of life for people's health and infrastructure. Strategy 2 Solving the illegal drug problem and providing people with safety in life and for property. Strategy 3 Promote and develop important tourist attractions, eco-tourism, and history as learning resources. Strategy 4 Promote quality education systems and learning resources to

develop people's education. Strategy 5 To develop and increase agricultural productivity to be safe and develop products.

3) Bring the environmental assessment results at the strategic level of the Mueang Lopburi District development plan, Lopburi province (2018 – 2022), to be used in the decision-making of the next development plan for Mueang Lopburi District. By these, the strategic data is separated according to the specified alternatives into three alternatives [10]. The chart data is shown in Diagram 2.

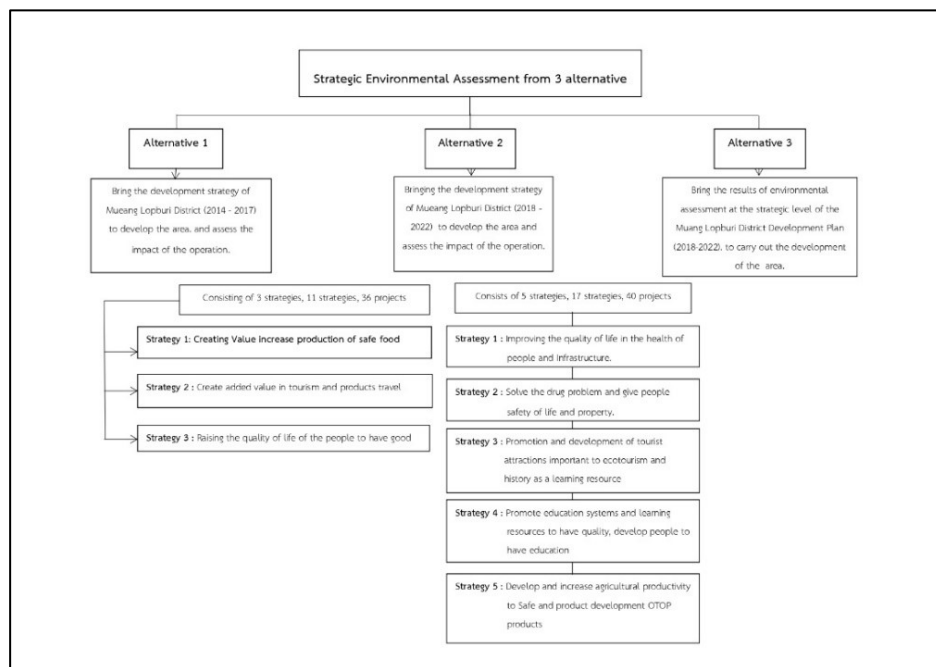


Diagram 2 Strategic Environmental Assessment from 3 alternatives

All three alternatives, according to the Lopburi Provincial Development Plan, the Lopburi District Development Plan, and other related plans, plus field visits to collect data from stakeholders in the area. The results showed that Alternative 3, an alternative proposed to use the results of environmental assessment studies at the strategic level of the development of Mueang Lopburi District, should be used in the decision-making in the preparation of the next Mueang Lopburi District development plan was the alternative with the highest rating score (3.47). Followed by the second option, to adopt the Mueang

Lopburi District development strategy, Lopburi province (2018 – 2022) (2.54).

1.3 A study of the stakeholders' opinions on the development of Mueang Lopburi District.

In this part of the study, the stakeholders' opinions were surveyed by using an electronic media system (Video Conference) to assess their opinions on the development of the area according to the development strategy of Mueang Lopburi District. If there was an action to develop Mueang Lopburi District according to the third option, which was the result of the environmental assessment study at

the strategic level, the development of Mueang Lopburi District to be used in decision-making in the preparation of the next development plan for Mueang Lopburi District implementing all 5 strategies [11] by 31 commentators, consisting of

1. Representatives of provincial-level agencies 6 persons
2. Representatives of Mueang Lopburi District 2 persons
3. Representatives of local government organizations in Mueang Lopburi District 8 persons
4. Community leader 15 persons

The results of the opinion study revealed that despite implementing the Mueang Lopburi District development plan (2018 – 2022) in the past, Mueang Lopburi District still faces problems in all dimensions, whether in terms of economy, society, and environment. In terms of economy, as the main income of Lopburi province is from tourism since the Covid-19 epidemic at the beginning of 2020, Mueang Lopburi District has been unable to drive the tourism promotion policy to achieve its full potential. The epidemic situation for the business sector has also slowed down investment and business operations. The

forementioned development plan for Mueang Lopburi District does not specify an action plan for epidemic situations in the social aspect of developing the quality of life in Mueang Lopburi District. The development of quality of life is carried out overall under the government's quality of life improvement policy, focusing on vulnerable groups such as the elderly and the disabled. The welfare state has not yet been promoted to cover all age groups, genders, and the environment. The primary problem is solid waste, and the local government organizations do not have the ability to suitably and entirely dispose of solid waste. Some local government organizations also dispose of solid waste by tipping it outdoors (Open Dump), which is not sanitary. In the study, participants were asked to give their opinions on the issue of the impact that will occur from the development of Mueang Lopburi District. These opinions were separated into positive impacts or expected benefits and negative impacts or issues that stakeholders were worried about if there is a future development of Mueang Lopburi District; the results of comments in the form of positive and negative impacts as shown in Chart 1.

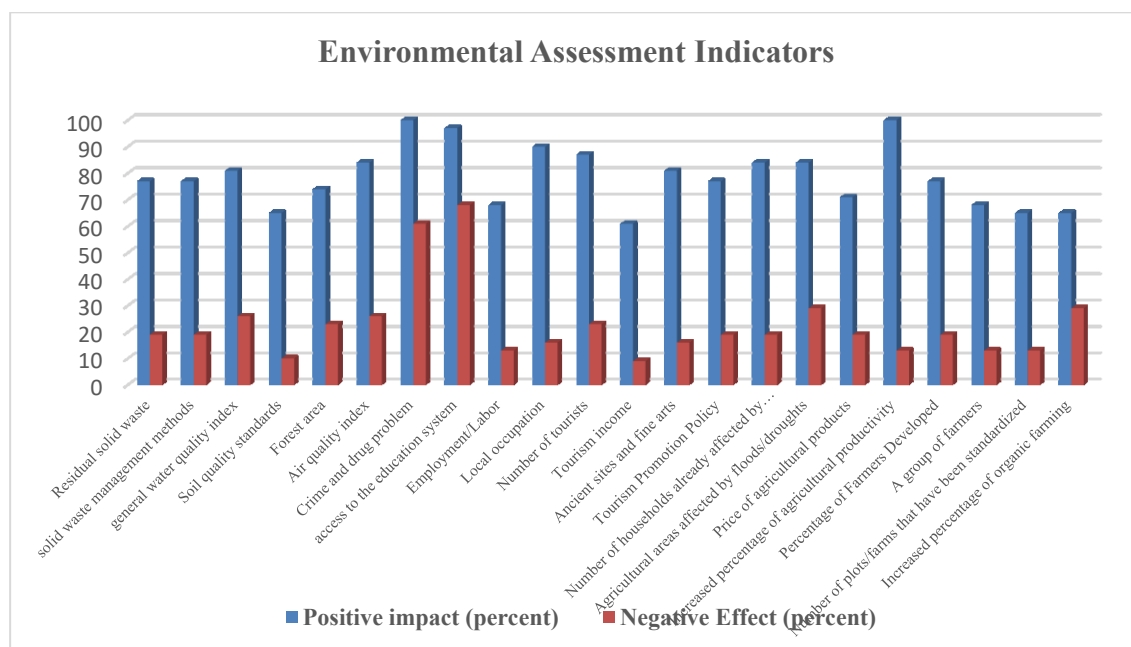


Chart 1 Environmental Assessment Indicators

Strategic Environmental Assessment for Mueang Lopburi District Development, Lopburi Province

The strategic environmental assessment in this study provided a description of the potential impacts in detail on each strategic issue, along with the weight of the score for the assessment to clearly see the impact by dividing the scoring criteria into 7 levels, namely Max Benefit +3 Medium Benefit +2 Minor Benefit +1 No benefits or effects 0 Low Impact -1 Medium impact -2 and Severe Impact -3

First, the impact levels, both strategic issues and indicators of each alternative, were calculated by weighting the priority values of

the strategic issues and indicators considered by experts. The experts were representatives of provincial agencies, district agencies, local authorities, and local people, a total of 31. The details of the Strategic Evaluation of the three options for the development of the Mueang Lopburi District were as follows:

1. The Strategic Environmental Assessment for Mueang Lop Buri District Development Lopburi Province According to Option 1, the development strategy of Mueang Lopburi District Lopburi Province (2014 - 2017), three strategies to be implemented in the area of Mueang Lopburi District Lopburi Province as shown in Table 4, 5 and 6.

Table 4 The results of the environmental assessment at the level of strategic development of Mueang Lopburi District, Lopburi Province according to alternative 1

Strategic Issues	Indicators	Impact		
		Score	weight value from experts	weighted score
1. Environmental quality	1. 1The amount of residual solid waste	1	0.10	0.10
	1. 2Solid waste management methods	1	0.15	0.15
	1. 3General water quality index	-1	0.26	-0.26
	1. 4Soil Quality Standards	1	0.14	0.14
	1. 5Forest area	1	0.20	0.2
	1. 6Air Quality Index	2	0.16	0.32
	Total	5	1.00	0.65
2. Social quality of life and equality	2. 1Crime and drug problems	1	0.37	0.37
	2. 2Access to the education system	-2	0.63	-1.26
	Total	-1	1.00	-0.89
3. Economic and travel	3. 1Employment/Labor	1	0.14	0.14
	3. 2Local Occupation	1	0.13	0.13
	3. 3Number of tourists	1	0.15	0.15
	3. 4Income generated from tourism	1	0.25	0.25
	3. 5Historic Sites and Arts	0	0.20	0.00
	3. 6Tourism Promotion	0	0.13	0.00
	Total	4	1.00	0.67
4. Water resources	4. 1Number of households affected by flood/drought	1	0.42	0.42
	4. 2Number of agricultural areas damaged by flood/drought	1	0.58	0.58
	Total	2	1.00	1.00

5. Agriculture	5. 1Prices of agricultural	1	0. 10	0.10
	5. 2Percentage increase in agricultural production	0	0. 15	0.00
	5. 3Percentage of developed farmers	1	0.26	0.26
	5. 4Farmers gathering	1	0. 14	0.14
	5. 5Number of plots/farms that have received the standard	1	0. 20	0.20
	5. 6Percentage increase in organic farming	1	0. 16	0.16
Total		5	1.00	0.86
Impact on environmental quality		0.65	0.43	0.28
Impact on society, quality of life and equality		-0.89	0.41	-0.36
Impact on the economy and tourism		0.67	0.39	0.26
Impact on water resources		1.00	0.34	0.34
Impact on Agriculture		0.86	0.33	0.28
Total		2.29	1.9	0.80
Include the strategic environmental assessment results from alternative 1				0.80

Table 5 The results of the environmental assessment at the level of strategic development of Mueang Lopburi District, Lopburi Province according to alternative 2

Strategic Issues	Indicators	Impact		
		Score	weight value from experts	weighted score
.1Environmental quality	1.1The amount of residual solid waste	2	0. 10	0.2
	2.1Solid waste management methods	1	0. 15	0.15
	3.1General water quality index	1	0.26	0.26
	4.1Soil Quality Standards	1	0.14	0.14
	5.1Forest area	1	0.20	0.2
	6.1Air Quality Index	2	0. 16	0.32
Total		8	1.00	1.27
.2Social quality of life and equality	1.2Crime and drug problems	1	0.37	0.37
	2.2Access to the education system	2	0.63	1.26
Total		3	1.00	1.63
.3Economic and travel	1.3Employment/Labor	2	0. 14	0.28
	2.3Local Occupation	1	0. 13	0.13
	3.3Number of tourists	2	0. 15	0.3
	4.3Income generated from tourism	2	0. 25	0.5
	5.3Historic Sites and Arts	1	0. 20	0.2
	6.3Tourism Promotion	2	0. 13	0.26
Total		10	1.00	1.67
.4Water resources	1.4Number of households affected by flood/drought	1	0.42	0.42
	2.4Number of agricultural areas damaged by flood/drought	1	0.58	0.58
Total		2	1.00	1

.5Agriculture	5.1 Prices of agricultural	1	0. 10	0.1
	5.2 Percentage increase in agricultural production	1	0. 15	0.15
	5.3 Percentage of developed farmers	1	0.26	0.26
	5.4 Farmers gathering	1	0. 14	0.14
	5.5 Number of plots/farms that have received the standard	1	0. 20	0.2
	5.6 Percentage increase in organic farming	1	0. 16	0.16
Total		6	1.00	1.01
Impact on environmental quality		1.27	0.43	0.55
Impact on society, quality of life and equality		1.63	0.41	0.67
Impact on the economy and tourism		1.67	0.39	0.65
Impact on water resources		1.00	0.34	0.34
Impact on Agriculture		1.01	0.33	0.33
Total		6.58	1.9	2.54
Include the strategic environmental assessment results from alternative 2				2.54

Table 6 The results of the environmental assessment at the level of strategic development of Mueang Lopburi District, Lopburi Province according to alternative 3

Strategic Issues	Indicators	Impact		
		Score	weight value from experts	weighted score
.1Environmental quality	1.1The amount of residual solid waste	3	0. 10	0.3
	2.1Solid waste management methods	2	0. 15	0.3
	3.1General water quality index	2	0.26	0.52
	4.1Soil Quality Standards	2	0.14	0.28
	5.1Forest area	1	0.20	0.2
	6.1Air Quality Index	2	0. 16	0.32
Total		12	1.00	1.92
.2Social quality of life and equality	1.2Crime and drug problems	2	0.37	0.74
	2.2Access to the education system	2	0.63	1.26
	Total	4	1.00	2
.3Economic and travel	1.3Employment/Labor	2	0. 14	0.28
	2.3Local Occupation	2	0. 13	0.26
	3.3Number of tourists	2	0. 15	0.3
	4.3Income generated from tourism	2	0. 25	0.5
	5.3Historic Sites and Arts	2	0. 20	0.4
	6.3Tourism Promotion	2	0. 13	0.26
Total		12	1.00	2
.4Water resources	1.4Number of households affected by flood/drought	2	0.42	0.84
	2.4Number of agricultural areas damaged by flood/drought	2	0.58	1.16
Total		4	1.00	2

.5Agriculture	1.5Prices of agricultural	2	0.10	0.2
	2.5Percentage increase in agricultural production	1	0.15	0.15
	3.5Percentage of developed farmers	1	0.26	0.26
	4.5Farmers gathering	1	0.14	0.14
	5.5Number of plots/farms that have received the standard	1	0.20	0.2
	6.5Percentage increase in organic farming	1	0.16	0.16
Total		7	1.00	1.11
Impact on environmental quality		1.92	0.43	0.83
Impact on society, quality of life and equality		2.00	0.41	0.82
Impact on the economy and tourism		2.00	0.39	0.78
Impact on water resources		2.00	0.34	0.68
Impact on Agriculture		1.11	0.33	0.37
Total		9.03	1.9	3.47
Include the strategic environmental assessment results from alternative 3				3.47

According to the environmental assessment at the development strategy level of Mueang Lopburi District, all three alternatives from the information study according to the Mueang Lopburi District Development Plan, other related plans, and field visits to obtain information from stakeholders in the area. It was found that Alternative 3 was proposed to bring the results of the environmental assessment study to the Strategic Development Level of Mueang Lopburi District. To be used for decision-making formatting the next version of the Mueang Lopburi District Development Plan, the option with the highest evaluation score was at the highest level (3.47), followed by the second option to adopt the Mueang Lopburi District Development Strategy. Lopburi Province (2018 - 2022) with strategies to be implemented in the area of Mueang Lopburi District Lopburi Province (2.54).

Discussion

1. Assessment of strategic alternatives for the development of Mueang Lopburi District

According to the assessment of Strategic Alternatives for Development of Mueang Lopburi District, there were 31 stakeholders, consisting of 6 representatives of provincial

government agencies, 2 representatives of Mueang Lopburi District, 8 representatives of local government organizations, and 15 representatives of the people. The alternatives were weighted and scored based on the opinions of the stakeholders with a scale to assess the impact weighted to clarify the impact score criteria divided into 7 levels (-3 to 3). The evaluation results for each option were as follows:

1) Alternative 1. Adopting all strategies set out in the Mueang Lopburi District development plan, Lopburi province (2014 - 2017) with three strategies to operate in Mueang Lopburi District scored equal to 0.80.

2) Alternative 2. Adopting all strategies set out in the Mueang Lopburi District development plan, Lopburi province (2018 - 2022) with five strategies to operate in the area of Mueang Lopburi District scored equal to 2.54.

3) Alternative 3. The results of the environmental assessment study at the strategic level of Mueang Lopburi District development to be used in the decision-making in the preparation of the next development plan of Mueang Lopburi District got a score of 3.47.

It was concluded that Alternative 3, an alternative proposed to bring the results of environmental assessment studies at the strategic level of the development of Mueang

Lopburi District, be used in decision-making in preparing the next development plan of Mueang Lopburi District, was preferred. It was the choice with the highest evaluation scores, followed by Alternative 2, implementing all the strategies set out in the Mueang Lopburi District development plan, Lopburi province (2018 - 2022) with five strategies to operate in the area of Mueang Lopburi District. Last was Alternative 1, adopting all strategies set out in the Mueang Lopburi District development plan, Lopburi province (2014 - 2017), with 3 strategies to operate in the area of Mueang Lopburi District.

2. Measures for promoting positive impacts and preventing negative impacts from developing Mueang Lopburi District

1) Measures for promoting and preventing impacts on environmental quality.

Residual solid waste should emphasize the measures to promote solid waste separation at the source to reduce the amount of solid waste that enters the disposal process. Also, to stress the importance of a well-maintenance landfill site for solid waste according to the Pollution Control Department of the Ministry of Natural Resources and Environment measures. It must ensure that it is ready for use and appropriately manage waste landfill sites for the actual amount of solid waste to prevent it from overflowing.

General water quality index measures should be put in place to monitor the quality of effluent, and the source should be established. Additionally, a collective wastewater treatment system in Mueang Lopburi District should also be constructed.

Soil quality standards should consider soil characteristics and land use in the area according to scientific principles, including preparing land use maps that give data on soil fertility and soil type to be used as information in land planning and soil use.

Air quality index air treatment equipment should be installed in an establishment in the area. Also, air quality monitoring should be carried out by installing air quality monitoring stations in Mueang Lopburi districts and nearby at-risk areas, i.e., heavy traffic and air quality displays, along

with recommendations, should be made available to residents [12].

2) Measures for promoting and preventing social impacts, quality of life, and equality.

Crime and illegal drug problems in Mueang Lopburi District should resolve by integrating the work of the police and local government officials to take action to prevent potential crime. These crimes may be due to domestic violence, quarrel, mayhem, or snatching. For the problem of illegal drug trafficking in the area, access to the education system and focus on preventing the problem at the grassroots level. To address the lack of educational opportunities for school-age children in Mueang Lopburi District, authorities should work with educational institutions to create a plan to solve the problems of families with a shortage of funds or lack of access to education. This plan shall encompass everyone; all genders of school age should have a good education, equal to those in large cities. Additionally, develop a plan to construct a body of knowledge, especially developing academic knowledge, technology, and innovations.

3) Measures for promoting and preventing impacts on the economy and tourism.

It is important to focus on preventing problems of non-national workers or workers from outside the area. Firstly, supervise and control outside workers and take measures to promote and develop occupations for people in the area. Plus, having an income should be promoted by conserving local occupations or traditional occupations, which represent the identity and background of Mueang Lopburi District or that area. Mueang Lopburi District should be promoted as important tourist attractions, ancient sites, and historical places. Allow the public to easily access open space for organizing activities to attract tourists who want to travel in the area. The tourism income of Mueang Lopburi District should be managed, and the budget should be used for tourism development. It may be hiring tour guides, hiring workers, cleaning tourist attractions, or developing new attractions according to social trends. These investments will generate more tourism revenue for government agencies, including the private

sector. Civil society conservationists join together in the care and maintenance of ancient and art sites to keep them in good condition and take measures to prevent the destruction of ancient sites. It should drive tourism promotion policies according to the development plan and quickly adjust to keep up with social trends, observing what tourists are currently interested in. The relevant agencies should organize activities to fulfill the needs of tourists.

4) Measures to promote and prevent impacts on water resources

By focusing on quantitative water resource management, it should provide water reservoirs to prevent flooding during the rainy season and drought during the dry season. To prevent damage to life and property, buildings, and houses, the District should, as an urgent case, provide water reservoirs to prevent flooding during the rainy season and provide irrigation water during a drought in the dry season because floods or droughts will directly affect the agricultural areas. Mueang Lopburi District should work with relevant agencies on joint ventures related to the issue of dredging canals. To ensure the canals are not clogged or shallow, procure water storage resources, and prescribe measures to financially compensate farmers affected by such disasters to alleviate their suffering. Reference from Department of Environmental Quality Promotion. 2020. Environmental standards [13].

5) Measures for promoting and preventing agricultural impacts

Agricultural production prices should be controlled through economic mechanisms by organizing a forum to exchange farmers' knowledge. And to allow farmers to access new farming information and promote the integration of farmers to strengthen the administration and stability in agricultural operations. Also, to create more bargaining power in the market, encouraging farmers to be aware of and have a shared awareness in using resources in an agricultural occupation. Incentivize farmers to develop their farm plots and farms to meet the standards set by the government referring to the agricultural management guidelines from the Agricultural and Cooperative Development Plan of Lopburi Province (2018 - 2022)

Conclusion

Study on the formulation of the Mueang District development plan with SEA, a Case Study of Mueang Lopburi District had three strategic alternatives identified as follows :

Alternative 1. Implementing all strategies set out in the Mueang Lopburi District development plan, Lopburi province (2014 - 2017) with the strategies to operate in Mueang Lopburi District.

Alternative 2. Adopting all strategies set out in the Mueang Lopburi District development plan, Lopburi province (2018 - 2022) with five strategies to operate in the area of Mueang Lopburi District.

Alternative 3. To bring the results of an environmental assessment study at the strategic level of the development of Mueang Lopburi District.

They were used for decision-making in preparing the development plan for Mueang Lopburi District by using strategic environmental assessment principles, field visits, interviews with stakeholders, and observations in the area. The results of the study can be concluded as follows:

1. Mueang Lopburi District is located in the central region of Thailand. It has an area of approximately 565 square kilometers. It is about 153 kilometers from Bangkok, considered a district not far from the capital. The advantage of Mueang Lopburi District is that there are various transportation routes, whether car via many routes, a railway station, public bus routes (vans), and a service station. Therefore traveling to Mueang Lopburi District is quite convenient. The southern area of the District is a lowland area suitable for farming, and the northern and eastern areas of the District are upland scrubland.

2. Strategic issues and appropriate indicators for the development of Mueang Lopburi District cover all aspects based on the principle of sustainable development. Balanced development of three dimensions: Economic dimension (strategic issues in the economy were tourism and agriculture), Social dimension (strategic issues on social was quality of life), and Environmental dimension (environmental quality strategic issues were

water resources). Based on the priorities of the strategic issues study, Environmental quality strategic issues were the most important in the area's development. This was followed by strategic issues in social, quality of life, the environment, economic, and tourism, strategic issues on water resources, and strategic issues in agriculture. Environmental quality strategic issues were the issues that may be affected first by the area's development. For example, soil resources must be developed by accumulating data and mapping the land use according to the fertility of each soil type to plan for appropriate land use during the construction of roads, buildings, or various development projects. If the soil is used to fill an area, it will be necessary to study the soil data and sources for use in the ecosystem boundaries of the development area. These boundaries should be clearly defined to comply with strict measures to prevent encroachment.

Establish a unit to supervise and regularly monitor solid waste. The potential of local administrative organizations should be developed to effectively manage the waste problem campaign for waste sorting to reduce the amount of waste, providing a reserved area to dispose of solid waste.

Air quality monitoring stations should be installed to cover the area of Mueang Lopburi District. Daily results report instructions on the right actions and measures to reduce activities that may cause air pollution, such as announcing no-burning zones. Control the industrial sector to strictly comply with the pollution prevention measures of the Department of Industrial Works.

3. Environmental Assessment at the strategic level of Mueang Lopburi District development according to Alternative 3 brings the results of an environmental assessment study at the strategic level of Mueang Lopburi District development to be used for decision-making in the preparation of the next development plan of Mueang Lopburi District from the implementation of the aforementioned alternatives. There may be impacts from the implementation of the Muang District Development Plan. However, such impacts are in the executives' plans in every District, and governance is managed following mitigation

principles by using the cooperation of the people in the area of Mueang Lopburi District to prevent such negative effects from occurring as little as possible.

4. Based on the stakeholders' opinion of Mueang Lopburi District according to the development strategy of Mueang Lopburi District, the development would be beneficial to the quality of life of the people, mostly from career development opportunities, well-being quality, and access to a sound education system, the standardized public health system, social services, and the welfare state. In addition, they expressed concern about the change in environmental quality. Such development might directly affect the soil, water, and air quality of the ecosystem. Resulting in the development affecting the lifestyles and culture of the people of Mueang Lopburi District. Moreover, the non-registered populations and non-nationals might cause changes to the culture and traditions unique to the Mueang Lopburi District and the safety of people's lives and properties.

5. Development of Mueang Lopburi District could have both positive and negative impacts; it would make Mueang Lopburi District grow and become more competitive but, at the same time, cause negative impacts on various issues such as economic development, and tourism affects the environmental quality and the well-being of society. Therefore, the appropriate development has to be developed on the sustainable development principle.

References

- [1] Mueang Lopburi District Office. 2020. 5-Year Development Plan for Mueang Lop Buri District (2018-2022). Available from : <http://www.lopburi.go.th/amphoe/Mueang.htm>. [Accessed 2020 Apr 12].
- [2] Chamlong Phoboon. 2013. Environmental Assessment (Environmental Assessment). Bangkok: Bangkok Blog : 112-118.
- [3] Office of the National Economic and Social Development Council. 2020. Strategic Environmental Assessment Guidelines. Available from : <https://>

- www.nesdc.go.th. [Accessed 2020 May 20].
- [4] Office of Strategic Administration of Upper Central Region Provinces 2. 2018. Four-year provincial group development plan (2018-2021); Upper Central Province Group 2 (Chainat, Lopburi, Singburi, Angthong). Retrieved April 17, 2020. 68-96.
- [5] Lopburi Provincial Office. 2020. Lopburi Provincial Development Plan 2018-2022. Available from : <http://website2021.lopburi.go.th> [Accessed 2020 Feb 14] lopburi-province-development-plan.
- [6] Institute of Water Resources and Agriculture (Public Organization). 2012. Data Collection and Data Analysis Operations Project for the development of data warehouse system 25 river basins and flood and drought modeling in the Pa Sak River Basin. Available from : <https://tiwrm.hii.or.th>. [Accessed 2020 Jan 16].
- [7] Office of the National Economic and Social Development Council, Asian Development Bank and International Centre for Environmental Management. 2019. SEA of the Rayong Provincial Development Plan. Available from : <http://sea.nesdc.go.th/report7> [Accessed 2023 Mar 20].
- [8] Office of the Council of State. 2563. Ministerial Regulations enforcing the City Planning of Lopburi Province B.E. 2560. Available from : https://www.chonnoi.go.th/project_detail.php. [Accessed 2020 Mar 12].
- [9] Department of Environmental Quality Promotion. 2020. Environmental standards. Available from https://www.deqp.go.th/?page_id=3073 [Accessed 2020 July 12].
- [10] Office of Natural Resources and Environment, Lopburi Province. 2020. Action Plan for Environmental Quality Management in Lopburi Province Fiscal Year 2022. Available from : <http://www.mnre.go.th/lopburi/th/information/more/69> [Accessed 2020 June 5].
- [11] Lopburi Provincial Statistical Office. 2020. Development plan for area statistics in Lopburi province. Available from : https://osthailand.nic.go.th/masterplan_area/userfiles/file%20Download/Plan [Accessed 2020 Aug 7].
- [12] Office of Natural Resources and Environmental Policy and Planning. 2017. Annual Report 2020 Environment Fund Administration Division. First Edition, Bangkok : Tex and Journal Publication Company Limited. 212-125.
- [13] Agriculture Office, Lopburi Province. 2019. Agricultural and Cooperative Development Plan of Lopburi Province (2018 - 2022). Available from <https://www.opsmoac.go.th/lopburi-dwl-preview-421891791842>. [Accessed 2020 June 20].