

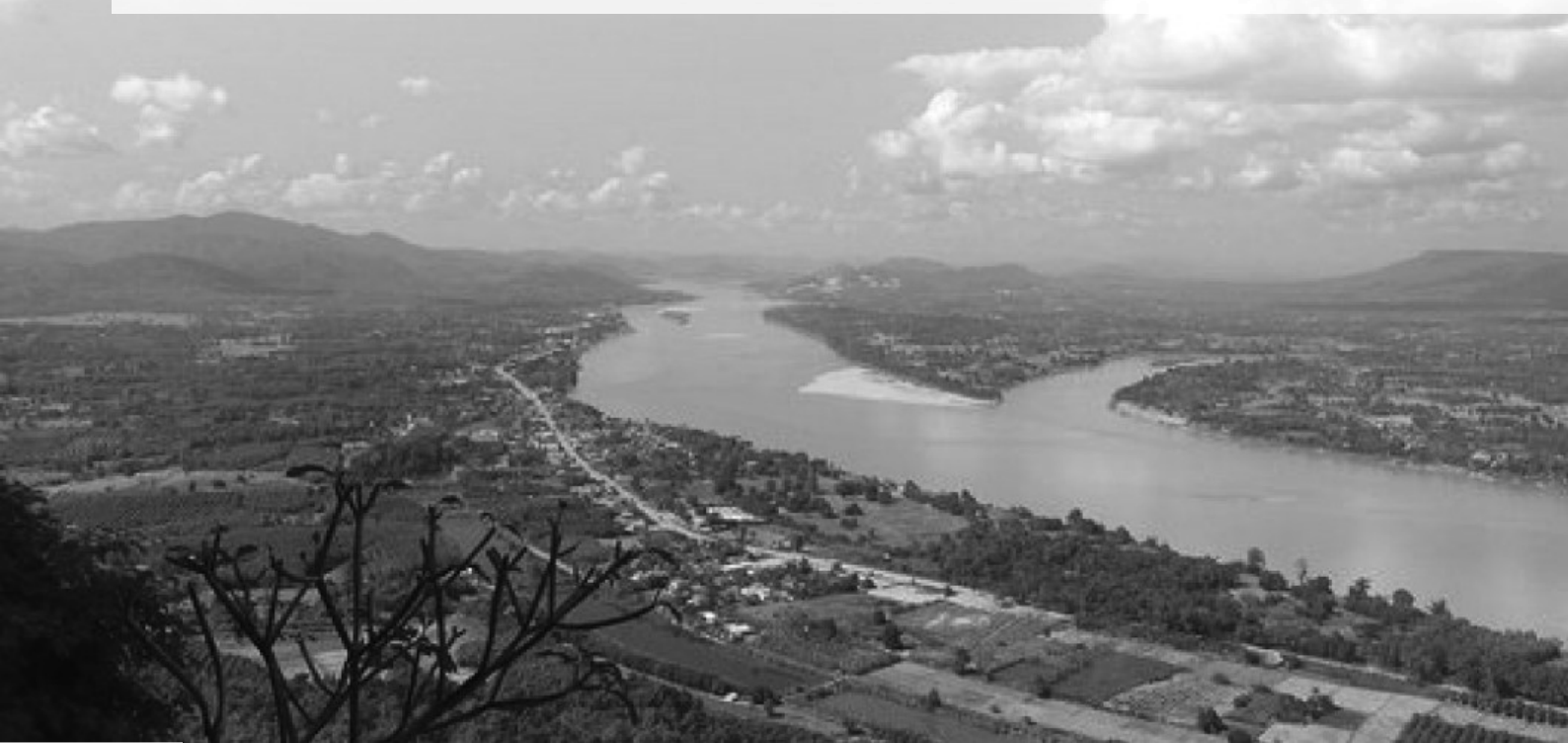
# Study on criteria for prioritization of investment in climate change adaptation in the water resources sector for sustainable agriculture in Mekong delta

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● **Abstract:** Based on practical need to improve the efficiency of investment in climate change adaptation projects in the irrigation sector in the Mekong Delta, this study has been implemented to develop criteria to help managers applying in the process of determining investment priority. The study has synthesized and summarized international experience and analyzed relevant legal documents. Based on direct consultation with local managers in project proposal activities in the past period, the study has pointed out the lessons and the need to develop criteria for prioritizing investment as well as proposals on step-by-step procedure of determining priority with specific criteria. From the research results, the paper proposes solutions and conditions to apply as well as recommendation on technical guidelines in determining investment priority in water resources sector in practice in Mekong Delta to the ministries/governmental-agencies at the central and local provinces. Finally, the article raises issues to be studied in order to continue to improve and apply technical guidelines for the whole country and other regions.



## 1. Introduction

The Mekong Delta has been identified as a key economic region of the country with many advantages in exporting agricultural and fishery production, food industry, tourism, and renewable energy. It is also an agricultural production center of Vietnam, providing 50% of rice production, 65% of aquatic products and 70% of fruit production, 95% of rice production and 65% of aquatic products of The Mekong Delta is for export.

In the face of complicated fluctuations of climate change (rising temperature, salinity coming early and lasting, water shortage causes drought, flood, waterlogging ...), upstream development (depletion of water sources, lowering of water level, loss balancing alluvium, sedimentation, erosion ... and socio-economic development (sand mining, agricultural restructuring, mangrove deforestation ...) have caused many problems in the Mekong Delta. Facing the increasing and complex impacts of climate change, in recent years, the Government and localities in the Mekong Delta have been proposing and implementing many investment projects to develop irrigation systems to response climate change and sea level rise, protecting people's livelihood and sustainable agricultural production for this key economic region. However, in the past, the investment in projects in the field of irrigation in service of agricultural production has not applied priority but often dealt with in a coping manner, not taking into account the impacts of climate change. Notably, the Government's Resolution No. 120 of November 17, 2017 on climate change adaptation for sustainable development in the Mekong Delta emphasized the integration of climate change into programs and projects, including: socio-economic development and infrastructure.

In this article, the author will discuss the results of evaluation research based on an overview of international experience and practical construction, application of legal documents in the approval of investment projects in the water resources sector for sustainable agricultural development taking into account climate change of Vietnam in general and in the Mekong Delta in particular.

By various research methods such as document analysis, policy analysis, stakeholder consultation with ministries, branches, research institutes and especially relevant departments and branches of 13 provinces/cities. In the city of the Mekong Delta, the research has developed criteria to determine priority investment in climate change adaptation in the irrigation sub-sector for the Mekong Delta. These criteria are used to screen and prioritize climate change adaptation activities/projects based on the assumption that they comply with and fully meet regulations and requirements. Currently, the project construction, the management of capital construction investment and in accordance with the socio-economic development planning as well as the planning of agriculture and irrigation.

## 2. Overview of international knowledge and practices of prioritizing investment in adaptation to climate change in the water resources sector in the Mekong Delta.

### *2.1. Overview of international knowledge of determining prioritization of investment in climate change adaptation in the water resources sector.*

Vietnam has received a lot of supports from major donors and international organizations such as ADB, WB, IFAD, CARE, JICA ... in many different fields including irrigation infrastructure, water resources management, climate change adaptation, agriculture development... These organizations, when deciding to sponsor or support, all have researched and provided criteria to determine the priority of investment to formulate projects.

- The Asian Development Bank (ADB, 2016) has set up the criteria and evaluation steps to select a priority project for climate change adaptation. Adaptive assessment results in the priority list for implementation are selected from a number of possibilities that may occur. Priority can be based on the technical feasibility, benefits and costs, social acceptability and opportunities that the project can provide for coordination with other national priorities.

- The World Bank (WB, 2013) has pointed out the steps to assess climate change relevance of projects, including: Step 1: It is necessary to ensure (i) that all projects related to adaptation are considered with climate change; and (ii) all expenditures considered for annual planning and budgeting are related to climate change. Step 2: Categorize expenditures into pillar/ category/task groups according to Expenditure Classification Methods. Step 3: Determine whether the activity's climate change objectives are to adapt or mitigate climate change risks.

- Intergovernmental Panel on Climate Change (IPCC, 2010): proposed priority criteria to identify the project including: (1) The ability to store and utilize rain to supply water for agriculture; (2) Development of irrigation information systems/ water resources to cope with weather/climate; (3) Reuse waste water against drought and (4) Water supply efficiency of irrigation systems.

- Japan International Cooperation Agency (JICA, 2011a): Using the approach of priority criteria associated with solutions to adapt to climate change of sectors and sub-sectors. For example, with the transport system, the priority criteria of the projects are to overcome, adapt and cope with the impacts that climate change has on the industry. The steps that JICA takes consists of 02 stages: (1) Selecting priority projects for short lists (fully meeting criteria associated with climate change and criteria related to project planning and goals ...) and (2) Select project priorities for a long list (fully proposed projects are approved).

On the other hand, the priorities for climate change adaptation investment are given by organizations based on various evaluation criteria. Although the contents and the selection steps are not exactly the same, they are all based on common evaluation criteria such as:

- (1) Content of the project proposal (necessity, usefulness, feasibility, sustainability);
- (2) Emergency of project activities with climate change adaptation;
- (3) Economic efficiency;
- (4) Technical feasibility.

The application of the criteria prioritized help for the countries can evaluate and select priority projects for adaptation to climate change that are consistent with the strategy q cost convention, as well as to ensure the use appropriate technological techniques, financial, socio-economic and environmental assurance; improve resilience to climate change.

## ***2.2. Legalbasis and practice in investment to adapt to climate change in the field of irrigation in Vietnam***

### ***2.2.1. Legal documents on determination of investment projects***

The proposed project plan investment today must comply with the provisions of the Law on Investment, the Law on State Budget, Construction Law, the Decree of the Government guiding the implementation of the Law on Investment and the Law on Budget State, Resolution No. 26/2016/QH14 dated November 10, 2016 of the National Assembly on medium-term public investment plan for the period 2016-2020. Under the aforementioned documents, there are a number of guiding documents serving as a basis for determining investment projects.

### ***2.2.2. Policies on investment in climate change adaptation in the field of irrigation***

Regarding water resources sector, MARD has issued the documents involved include the strategy, planning, plans, programs, projects and development schemes , proposals to restructure the agricultural sector every year, including integration and plans for adaptation to climate change as Decision 543/QD-BNN-KHCN dated 23/3/2011 of the Minister of Agriculture and Rural Development on the b an action plan into coping with climate change and rural development sector PTNT period 2011-2015 and vision to 2050; Decision No. 66/QD-BNN-KHCN dated January 11, 2013 of the Minister of Agriculture and Rural Development on promulgating the Action Plan of the Ministry of Agriculture and Rural Development to implement the national climate change action plan for the period of 2012-2020; An action plan to respond to climate change in agriculture and rural development

in the period 2016 - 2020, with a vision to 2050 Issued together under Decision No. 819/QĐ-BNN - KHCHN dated 14 January 03 2016 of the Minister of Agriculture and Rural Development.

However, the above documents all indicate priority programs / projects but do not specify criteria to define or not specify technical guidelines, standards, regulations and norms on climate change impact assessment methods, methods to identify priority activities, monitoring and evaluation indicators on climate change response.

### *2.2.3. Practical experience on determining investment priorities for climate change adaptation in the Mekong Delta*

The selection of priority investment in climate change adaptation is a matter of great concern to the government, ministries, localities and donors, especially in the context of limited resources and high demand. Only 02 documents have been issued at national level regarding guidance on identifying/selecting investment priorities related to climate change in Vietnam.

(1) Decision No. 1719/QĐ-TTg 2011 Approving Criteria for Evaluation of Priority Projects under the Support Program to Respond to Climate Change (SP-RCC)

This set of criteria is aimed at: (1) Orientations for ministries, branches and localities to have grounds to propose priority tasks and projects in order to effectively respond to the impacts of climate change, especially water. rising sea; (2) Ensuring systematic, synchronous, multi-objective, focus, key, both urgent and long-term tasks of the National Target Program to cope with climate change; (3) Basis for assessing and selecting projects to cope with climate change in accordance with the policy framework committed with donors and investment capacity and resources under the Support Program to cope with climate change (SP-RCC).

(2) Decision 1485/QĐ-BKHDT 2013 promulgating the guiding framework for prioritizing climate change adaptation in socio-economic development planning

The purpose of this Priority Selection Framework is to support and strengthen the capacity of climate change adaptation and planning staff in ministries, sectors and localities. The process of prioritizing investment in climate change adaptation consists of 4 steps: Step 1- Defining priority objectives ; Step 2 - Screening activities and projects according to priority objectives and urgency ; Step 3 - Scoring activities, projects screened by many criteria ; and Step 4 - Prioritize ranking by high to low scores as a basis for decision making.

This Framework introduces criteria determining project climate change adaptation priorities included in the socio-economic development plan and plans to respond to climate change of ministries, branches and localities but in the scope of many industries, different sectors, while the irrigation sector itself has a lot of projects at the scope, scale and division by different types.

### *2.2.5. Situation of investment in climate change adaptation in Vietnam and the Mekong Delta*

According to a report of the Ministry of Planning and Investment (2015), research projects on climate change response (58%) were little or very little related to climate change response, with most of the activities showing contribute indirectly benefit adaptation or mitigation, but is not reflected in the objectives, outputs or results of the project .

For the Mekong Delta region, the fact shows that, over the past time, Vietnam has made a strong commitment in the fight against climate change and has received effective support from international donors, e.g. projects implemented in cooperation with Japan, Denmark, Sweden, France, Germany, etc. toward the goal of climate change adaptation.

In the development planning of central and local CTU, provinces in the Mekong Delta also mention investment projects related to climate change adaptation. Currently the number of works is too large compared to the funding provided. However, the priority criteria in climate change adaptation have not been clearly defined. Notably, the Government's Resolution No. 120 of November 17, 2017 on climate change adaptation

for sustainable development in the Mekong Delta emphasized the integration of climate change into programs and projects on socio-economic and infrastructure development. It is necessary to have evaluation criteria and priority ranking to help donors, investors, local authorities, experts and officials at the planning agencies at central and local levels in selecting appropriate projects to submit to competent authorities and stakeholders for approval of investment projects.

### **3. Climate change impacts on agriculture and water resources infrastructure in the Mekong Delta and investment priorities to adapt to climate change**

#### **3.1. Climate change impacts on agriculture and water resources infrastructure in the Mekong Delta**

There are several types of climate change in the Mekong Delta as well as the impact to the operation of agricultural production include:

(1) Sea level rise resulting in losing arable land, which will greatly affect the food security of the country and the livelihoods of millions of people in the Mekong Delta will be affected. Besides, the Mekong Delta is suffering from subsidence several millimeters per year. Currently, the Mekong Delta is only 1-2m above sea level, which means an increase in the risk of saltwater intrusion, flooding and coastal erosion.

(2) Drought and salinity intrusion is increasingly exacerbated by climate change and the development of the countries along the Mekong River in the upper part of which Vietnam cannot control. Recently, due to the impact of climate change, the decrease of rainfall compared to the annual average rainfall has caused droughts to occur more and more frequently with the affected area increasing. In addition, drought also leads

to saline intrusion, making many lowland areas unable to get or enough irrigation water from tidal-affected rivers.

(3) Flooding leads to reduce agricultural land (loss of land due to erosion, waterlogging no arable land to be acid by prolonged flooding ...). On the other hand, the phenomenon of flood frequency has decreased recently and the sediment content is seriously depleted due to retention in upstream hydropower projects (up to 50% at present and may increase) up to 90% when the hydroelectric dam in Laos and Cambodia completed) causing subsidence and erosion become serious. The depleted sediment load also has a significant impact on the fertility of the delta, leading to a decrease in rice productivity.

(4) Landslide causing damage or threat to human life and property, also losses in agriculture (soil loss or threatened loss of land); affect transportation of agricultural products and materials, indirectly affects agriculture production. Recently, this phenomenon is becoming much more complex in many areas such as Ca Mau seaside, the shore of the River Hau, Tien.

The main impacts of climate change on water resources sector for agricultural production:

(5) Sea level rise and saltwater intrusion causes the irrigation infrastructure in lowland areas will be flooded. Irrigation systems including irrigation canal, drainage, water supply, river dyke, embankments, and sluice gates are all subject to high risks and vulnerability while their adaptability is low. The sea level rise requires the height of sea dykes, river dykes and structures on the route to be raised.

(6) Floods will cause erosion, damage to irrigation infrastructure (dykes, embankments, canal banks) and overload the irrigation system (pumpings, irrigation canals, etc.) when not timely regulated.

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<sup>3</sup> With scenario of sea level rise of the Ministry of Natural Resources and Environment: In case the sea level rise increases by 0.5m, the Mekong River Delta will be inundated 177,800 ha (4.48%). In case the sea level rises by 1.0 m, this area will be flooded with 1.5 million ha (38.9%).

<sup>4</sup> Journal of Natural Resources and Environment / 2017, No. 13, p.46-47

(7) Drought and salinization have not much impact on the irrigation infrastructure which mainly affects the availability of water resources on the irrigation infrastructure. When a drought occurs, water source is not enough to ensure irrigation, increasing the cost of pumping water to save farmers' crops. Severe drought will greatly affect the productivity and crop yields, reducing the quality of agricultural products, making people's income less. Many buildings located inland not designed for saline intrusion will affect the quality and efficiency of the operation of irrigation infrastructure.

(8) Landslide damages irrigation infrastructure, breaks the canal bank, cause flooded crops, and endangers the urban areas, residential areas, loss of productive land. Besides, landslides cause sedimentation in the canal bed which reduces the water transfer capacity of the system, obstructing navigation.

### ***3.2. Climate change adaptation investment priorities in the water resources sector for sustainable agricultural development in the Mekong Delta***

When determining investment priorities for climate change adaptation irrigation projects by sub-region or the whole region, the following indicators need to be considered:

(1) Works with urgency to protect the lives and property of citizens, protection for large areas, important. For this type of works/projects, it is required to perform immediately, in the shortest time.

(2) As part of a regional plan that has been approved by the government. This indicator needs to be prioritized because it ensures the overall planning, serves the long-term development of the industry and is in the general plan of the government both in planning and financially.

(3) Under the direction of the Central Government in order to resolve specific and urgent priority issues associated with the implementation of local socio-economic development guidelines and strategies.

(4) Having solutions to deal with and respond to climate change. This is a necessary indicator in the screening phase of project proposals to ensure the project is in the climate change adaptation program.

(5) Works with inter-regional properties. This index aims to prioritize projects with great efficiency, large influence scope and ensure the development in the direction of synchronous and sustainable planning for a long period of time.

(6) Investment projects which are synchronous and self-contained. This indicator helps determine the additional features complete the investment in existing buildings, improving the efficiency of the service production works are operating.

When the above indicators are met but there are many projects that need to be considered at the same time to prioritize, some other sub-indicators need to be used and compared such as benefited area, the number of people to be protected, benefits of local economic development, multiple goals, financing capacity, support for poor areas, disadvantaged areas (poor people, ethnic minorities, vulnerable groups ...), readiness in terms of project procedures and rate of return of the investment project according to preliminary estimates.

## **4. Proposing assessment process of prioritizing climate change adaptation investment in the Mekong Delta**

### ***4.1. Method of multiple criteria analysis to determine investment priorities***

Multiple criteria analysis (MCA) is an effective tool to solve complex selection problems including many criteria and choices, especially for qualitative variables. Qualitative standards often have ambiguous characteristics, difficult to delineate correctly, making it difficult to synthesize assessment results according to criteria and decision-making. The MCA method will quantify these criteria, including quantitative and qualitative criteria, calculate the total score of the weighted objects of each criterion and help decision makers

get a chance. The department is more certain and accurate. The evaluation method in this guide is referenced from the document "Assessing and prioritizing climate change adaptation technologies" by Danish Technical University (Trup, SLM, & Bakkegaard, RK, 2015).

Besides, the main benefit of multi-criteria evaluation is the ability to integrate the priorities of stakeholders in the assessment process. Users can flexibly use the criteria, without limiting the number of criteria, without setting up a scoring scale for each criterion; only adjust the weights for each criterion to match the policy, investment orientation. This is also the advantage of the method compared to the criteria framework of the two previous guiding documents (the scale has been fixed, difficult to apply for a specific area or according to the scale and scope of different projects). Therefore, this method is often used in projects on natural

disasters and climate change and has been applied in the evaluation of investment priorities to adapt to climate change in many countries around the world.

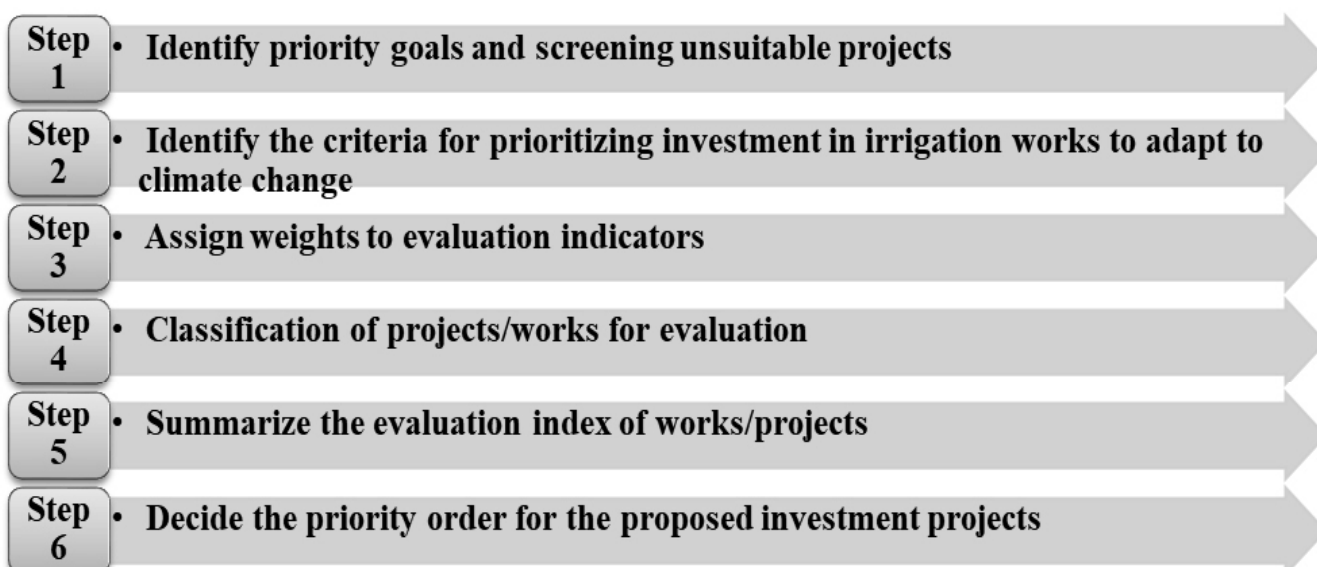
The multi-criteria assessment method uses

priority sequencing techniques by converting input index into a range of data from 1 to 100. The calculation of the index will determine 2 points as the extreme value Primary (Min) and maximum value (Max). Then, calculate the distance of the other index to the two fixed points and convert them into a scale of 1 to 100. The conversion will help the reader of the data will easily visualize and compare the index of one project with other projects, while allowing the combination of indexes with weights and summarizing many index to produce a common index. This is a strong and commonly used ranking method.

This method satisfies all the criteria for selecting assessment tools: (i) Satisfy the objectives of assessing the impact of climate change; (ii) Give results with the required accuracy and (iii) Consistent with the capacity and time allowed by the evaluator.

#### ***4.2. Steps to assess investment priority in climate change adaptation in the Mekong Delta***

The following steps are introduced to assess investment priority in climate change adaptation in the Mekong Delta.



**Step 1: Identify priority goals and screening unsuitable projects**

This evaluation process is to consider investment activities/projects with priority objectives to adapt to climate change so that unsuitable projects will be eliminated at this step.

First, the assessment agency should identify the objectives that will be applied to prioritize projects based on climate change adaptation strategies and plans set out by management levels (central or provincial level).

**Step 2: Identify the criteria for prioritizing investment in irrigation works to adapt to climate change**

The determination of ranking criteria must be based on a clear and transparent process. Participants in the multi-criteria analysis process need to understand the meaning of the criteria. Criteria will show differences between projects

and they will not be used if their values do not differ between projects. The proposed criteria and indicators for adapting to climate change are based on the inheritance of issued documents, guidelines, international experience, and indicators issued by relevant secondary agencies. The proposal is based on practical experience in assessing the priority for investment in climate change adaptation in recent years by the Directorate of Irrigation, Disaster Management Agency, the Irrigation Management Board No. 10 at Mekong Delta, and MPI, as well as from the practical experience of the Mekong Delta provinces/localities.

Accordingly, the proposed evaluation indicators are determined for the priority level of investment at the central level. Therefore, when provincial/local authorities apply it, it is necessary to flexibly consider adding or subtracting indicators to suit the local situation due to the variety of bio-physical conditions, socio-economic context and climate change impacts type.





**Table 1: The criteria for prioritization of investment in irrigation works to adapt to climate change**

	Objective		Criteria		Indicator
1	Ensuring food security and water security.	1.1	Irrigation works promote capacity to ensure water security, contribute to ensuring food security	1.1.1	Benefited area
2	Actively respond to climate-related natural disasters, reduce natural disaster risk factors	2.1	Emergency - The works are proposed to deal with the risk of death and/or socio-economic damage caused by climate change that may occur in the near future.	2.1.1	Emergency level
		2.2	Local has fund ready to implement the project	2.2.1	Proportion of local fund
		2.3	Irrigation works promote the ability to minimize disaster risk factors for people	2.3.1	Number of beneficiaries
		2.4	Irrigation works have been strengthened to manage natural disasters and climate hazards	2.4.1	Types of climate change adaptation
		2.5	Irrigation works promote the capacity to reduce natural disaster risk factors for highly populated and vulnerable areas.	2.5.1	Population density
3	Strengthening management capacity and improving mechanisms and policies on climate change	3.1	Capacity of exploitation and management is enhanced through the system of synchronous irrigation works, in compliance with planning	3.1.1	Synchronous works, in compliance with planning
4	Protecting groups and regions vulnerable to climate risks	4.1	Vulnerable people are supported to protect against climate risks	4.1.1	Number of vulnerable beneficiaries
				4.1.2	Poverty rate
5	Raising awareness and developing human resources to cope with climate change	5.1	The propaganda system for people is strengthened	5.1.1	Number of people to be enhanced awareness
6	Science and technology development ensures the goal of "synchronous" and "sustainable" response to climate change	6.1	New technologies to respond to natural disasters and climate change help reduce investment costs or improve coping capacity faster than previously used methods.	6.1.1	New technologies

**Step 3: Assign weights to evaluation indicators**

When all projects have been graded according to criteria, scores can still be compared because the priority of one criterion is not necessarily equal to that of another. Therefore, each criterion should be assigned a weight to reflect the importance

that stakeholders assign to each specific criterion. Once the criteria have been considered, scores against all criteria can be compared.

Each indicator is assigned a corresponding weight to reflect the importance of the indicator assigned by the assessor to each specific indicator.

The determination of weights may be fixed by various statistical techniques or by measurements, or based on the experience and subjective knowledge of the weight decision maker.

Weight can be determined as follows. First, arrange the final list of criteria in descending order of relative importance. Then specify the weights from 0 to 1 for each criterion, ensuring that the sum of all weights total is 1. The consulted weights are determined from the study of the current guiding documents, the overall planning of the Mekong Delta irrigation, the Decisions, Decrees and Circulars mentioned in the Part 3 of this report, the economic development orientation of the Mekong Delta has been decided by the government, the results of consultations with provinces and the practical experience of the Consultant on the level

of priority concern of the current types of climate change and proposed as in the table below.

**Table 2: Weights for climate change types**

No.	Climate change type	Weight	Weighted value range
1	Landslide	0.26	0.2 - 0.3
2	Salinization	0.22	0.15 - 0.25
3	Drought	0.2	0.15 - 0.25
4	Sea level rise	0.17	0.15 - 0.25
5	Flood	0.15	0.1 - 0.2

The weights are determined for the indicators that prioritize investment at the central level. However, when the provincial authorities apply, it is necessary to reconsider, can increase or decrease the weights to suit the local situation.

	Criteria	Weight	Weighted value range
1.1.1	Benefited area	0.07	0.05 - 0.1
2.1.1	Emergency level	0.32	0.25 - 0.35
2.2.1	Proportion of local fund	0.02	0 - 0.05
2.3.1	Number of beneficiaries	0.06	0.05 - 0.1
2.4.1	Types of climate change adaptation	0.21	0.15 - 0.25
2.5.1	Population density	0.03	0 - 0.05
3.1.1	Synchronous works, in compliance with planning	0.18	0 - 0.05
4.1.1	Number of vulnerable beneficiaries	0.03	0 - 0.05
4.1.2	Poverty rate	0.02	0 - 0.05
5.1.1	Number of people to be enhanced awareness	0.03	0 - 0.05
6.1.1	New technologies	0.03	0 - 0.05
	<b>Total</b>	1	

**Step 4:** Classification of projects/works for evaluation.

Due to the different nature of the features, the structure of the building, the way of operation and the level of impact of climate change, when evaluating and prioritizing irrigation projects in the Mekong Delta, it should be divided by type construction. That is, when prioritizing, compare projects belonging to the same group of works to ensure the equivalence and convenience for investment decision-making levels.

Based on the actual types of works, it can be divided into the following groups of works:

- 1) River and coast protection works (including planting of irrigation plants)
- 2) Works for agriculture (cultivation and animal husbandry)
- 3) Works in service of fisheries
- 4) Works for economic life
- 5) Other works
- 6) Integrated irrigation project

Other irrigation works, not listed here, will be grouped into an "Other" category. In addition, projects that include more than one type of irrigation work will be grouped into "Integrated Irrigation System".

The result of this step is the list of project/work names in different categories in the same index spreadsheet. This arrangement will enable future assessors to make a priority list for each type of project/work, or it can be applied to all different types of projects in the same worksheet in the same way. Data processing and calculation are the same.

**Step 5:** Summarize the evaluation index of works/projects

Enter initial values for index of each proposed work/project

In this step, the information provided by the project is entered into a summary table for each index, to be the input for grading according to the index proposed in Step 3 and aggregated in one Spreadsheet as below.

Convert the values in each index column to a scale of 1 to 100

After the values of the index are entered into the spreadsheet for all projects, these values will be converted to the value scale from 1 to 100 in each index column by resetting the linear scale as follows:

$$X_i = 1 + 99 * (Z_i - Z_{min}) / (Z_{max} - Z_{min})$$

Where:

X<sub>i</sub>: index value converted by the i<sup>th</sup> project (minimum X value is 1, maximum is 100)

Z<sub>i</sub>: initial index value of i<sup>th</sup> project

Z<sub>min</sub>: the minimum value in an index column

Z<sub>max</sub>: the maximum value in an index column

Calculate the total weighted points of each project

The total score for assessing the priority of a proposed project is calculated by summing (on a corresponding row of that project in the spreadsheet) the converted values multiplied by the weight of the index of the project by the following formula:

$$S = \sum_{i=1}^n (W_i X_i) = W_1 * X_1 + W_2 * X_2 + \dots + W_n * X_n$$

Where:

S: Total weighted points of the project (minimum S value is 1, maximum is 100)

W<sub>i</sub>: weight of i<sup>th</sup> index

X<sub>i</sub>: converted value of i<sup>th</sup> index

**Step 6:** Decide the priority order for the proposed investment projects

The priority of the investment projects in irrigation in the Mekong Delta will be determined by the competent authorities in accordance with the law, but can prioritize according to:

- Using the scoring method of the indicators in this study on a scale from the selected indicators as presented above from high to low.

- The priority can be adjusted depending on the orientation of the state management agency in the field of irrigation. For example, at present, the agriculture in the Mekong Delta will apply priority investment in turn to fisheries > growing fruit trees for export > rice.

- Exception priority criteria are not considered in this guide but will be applied as directed by the central government. For example, the guidelines of the Party and state leaders for projects / projects that are considered to be urgent should not be used first to guide the prioritization.

**Table 4: Result of project priority order**

Project code	Total score	Criteria	1.1	2.1	2.2	2.3	2.4	2.5	3.1	4.1	5.1	6.1	
		Index	1.1.1	2.1.1	2.2.1	2.3.1	2.4.1	2.5.1	3.1.1	4.1.1	4.1.2	5.1.1	6.1.1
			Benefit area	Emergency level	Local capital ratio	Number of beneficiaries	Ability to cope with climate change	Population density	Synchronous and planned projects	Number of vulnerable beneficiaries	Poverty rate	Number of people with increased awareness	Number of new technologies applied
		Weight	0.04	0.4	0.02	0.04	0.2	0.02	0.2	0.02	0.02	0.02	0.02
Project code	Total score	Priority class											
TH4	72	1	36	67	1	100	100	12	100	1	38	100	1
NN2	67	2	100	67	1	43	52	100	100	45	15	1	1
NN4	58	3	5	100	51	8	1	35	100	1	5	1	1
TH1	56	4	94	34	1	86	40	20	100	100	38	1	100
NN3	51	5	50	67	100	65	1	27	100	1	9	1	1
NN1	51	6	30	67	1	40	1	4	100	71	80	1	1
BV1	50	7	12	34	51	34	58	37	100	1	36	1	1
TH3	49	8	1	67	100	1	1	61	100	1	1	1	1
TS1	48	9	6	100	51	12	31	5	1	18	100	1	1
TH2	41	10	9	1	1	17	61	1	100	71	83	1	1

### 4.3. Completion of criteria after testing

The trial started with the introduction of this "Climate Change Adaptation Investment Evaluation Process in the Mekong Delta" for managers at the Department of Planning and Investment, Department of Agriculture and Rural Development, and Provincial Project Management Boards. The team has used 10 irrigation projects sufficient information as required in the 21 tables of project information by the local providers to calculate, test criteria and toolkits priority ranking.

The results of testing the set of criteria on the basis of comparison with the calculation and prioritization of documents including Decision 1719/QD-TTg in 2011 and Decision 1485/QD-BKHDT in 2013, showing superiority and usefulness of indicators suggested by the study.

In comparison with other guidelines, the calculation with the criteria that this study suggests recommendations quickly and easily than in the evaluation and grading of indicators. For example, the previous guidelines gave confusing and complex criteria, or the range was too wide (common for all types of construction and non-construction projects), and the criteria were not assigned points and weighting, or lack of flexibility according to regional, regional priorities,

etc. It can be generally assumed that previous guidance documents did not specify the use of the criteria definition methodology. Some criteria in the guiding framework are qualitative, difficult to quantify in the grading process and determine the input data / information. The application of the multi-criteria analysis methodology in this study will overcome these limitations. This is also the advantage of the method compared to the criteria framework of the previous two guiding documents (the scale has been fixed, difficult to apply to a specific area or according to the size and scope of the project).

Through the testing of priority arrangement with 10 irrigation projects of the Mekong Delta together with the results of consultation with ministries, sectors and localities, the research team finalized the final set of criteria and guidelines.

## 5. Conclusion

Firstly, by studying experiences of international organizations and institutions, it is necessary to define priority criteria to adapt to climate change to help the government and localities to plan and plan on resources to identify appropriate projects. The criteria differ according to the context of the countries and each project but are consistent in

the points that can be applied to Vietnam in terms of processes and approaches.

Secondly, in the context of climate change evolutions in the Mekong Delta, which is increasingly complicated, affecting the development of agricultural production poses investment requirements for the irrigation sector. Results of consultation and review of documents show that the Mekong Delta is currently facing various types of climate change such as saline intrusion, sea level rise, landslides (associated with natural disasters), droughts, floods. In addition, the Mekong Delta in the strategy of sustainable agricultural development also identifies sectors and sectors with advantages such as aquaculture, fruits and rice in different regions, localities have different natural conditions.

Thirdly, the process of consulting local authorities and reviewing documents on investment in irrigation sector associated with climate change adaptation in the Mekong Delta shows that there are no specific guidelines in the field of irrigation screening and evaluating which priority projects. Localities propose investment priority projects to comply with the provisions of the Law on Public Investment, Construction Law and other guiding documents for implementing the Law. In addition, local projects are being integrated with other priority objectives of socio-economic

development such as new rural construction, infrastructure development, and dealing with urgent issues. Restriction on investment capital is also an obstacle in arranging the list of prioritized investment projects due to prioritizing some other criteria such as solve urgent, urgent issues, perfect socio-economic development targets ... leading to projects to take into account long-term climate change impacts on investment policy decisions.

Fourth, the development of criteria is necessary to help localities and agencies identify priority projects to ensure objectivity and relevance to the objectives of climate change adaptation of investment proposals. Appropriate criteria help international and domestic donors support investment capital sources for climate change adaptation in the Mekong Delta.

Fifthly, the determination of criteria for prioritizing investment in the irrigation sector follows 02 steps: (1) Legal bases and (2) Specific criteria to determine the level of adaptation, suitable to climate change sustainable agricultural production of irrigation projects. A detailed technical guideline on the proposed criteria and methods to help localities in the Mekong Delta and the ministry, sectors refer to apply in determining the list of projects prioritized for investment in the field of adaptive climate change for sustainable agricultural development.

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