

DEVELOPMENT OF A SET OF INDICATORS EVALUATING THE MODEL OF COMMUNITY - BASED MANAGEMENT OF DOMESTIC WATER SUPPLY IN ADAPTING TO CLIMATE CHANGE IN CA MAU PROVINCE

Pham Ngoc Anh⁽¹⁾, Huynh Thi Lan Huong⁽²⁾

⁽¹⁾Office of Ministry of Natural Resources and Environment

⁽²⁾Viet Nam Institute of Meteorology, Hydrology and Climate change

Received: 14 August 2020; Accepted: 31 August 2020

Abstract: *In the context of climate change, Ca Mau province is facing to unstable water resources. So, it is requested to adjust and change the method of water resource management in order to adapt to climate change based on the community. Besides, strengthening socialization and governing towards the business model are important solutions to reduce water loss and waste and optimizing the State's resources.*

This work therefore, proposes a set of indicators to help assessing the appropriateness of community-based water resource management models in the context of climate change. In addition, the research proposes and recommends activities and solutions to improve, develop models as well as enhance community capacity in water resource adapt to climate change based on the community management.

Keywords: *Indicators, water resource management, climate change adaptation, community-based management.*

1. Introduction

In the context climate change, the Mekong River Delta in general and Ca Mau province in particular are facing to unstable water resource. Therefore, it is requested to change the method of water resource management (WRM) to adapt to such instabilities. In which, relying on the community for locality-adaptation and strengthening socialization will contribute to achieve the goal of water resource management.

Water resource is considered as the first component/factor transferring climate change impacts on society and environment; it is an intermediary for climate change to affect people, ecosystem and economy [2], [3]. Climatic stresses (including increase of temperature; droughts; changes in rainfall; storms; sea level rise) are considered in relation to non-climatic stresses (including domestic water supply services, poor irrigation,

poor and backward infrastructure; unfairness of infrastructure investment support; lack of waste water treatment system; information inequality, especially, information related to water resource; poor management; high population and high population growth rate; high increase of poverty and unemployment, etc.). Therefore, water security becomes a global security challenge [1], [9].

In the world, community participation in the process of water resource management is considered as an inevitable rule. In 1977, at World Conference on Water in Argentina for the Decade International Program on freshwater supply and sanitation, the role of community was first mentioned; thereafter, the idea of community-based water management continued to be tested, strengthened and spread out, especially after the Global Fresh Water Consultation Conference held in New Delhi (1990) and the Dublin Declaration on water and sustainable development (1992); the summit on Earth in Rio De Janeiro (1992); International Conference on Freshwater in

Corresponding author: Pham Ngoc Anh
E-mail: phamngocanhntmt@gmail.com

Germany (2001), etc.

According to Molle (2005), Community-based Water Resource Management is a participatory process, in which community is a center of an effective water management system. Such community participation can be viewed as a tool (for better governance) or as a process (for community empowerment) [4]. Community participation can be established under the form of consumer associations, community action groups in urban areas, water user groups and irrigation cooperatives in rural areas [2].

In Viet Nam, according to Nguyen Viet Dung (2006), the community participation in water resource management has a long history. Thanks to the community's participation many km of dykes, dams, artificial reservoirs, canals and village wells have been built. However, the participation of community in the water resource management is different depending on the condition of each locality and region in different stages of development of the country [5].

Regarding to the legal basis for community-based water resource management, according to the National Strategy on Water Resources up to 2020, community participation has been recognized as a key measure ensuring the sustainable water resource management and use. The Law of water resources (2012) continues to mention the role of community in the management, protection, exploitation and use of water resources. Besides, it unifies view of integrated management of water resources and water resource management in the river basin.

For the Mekong Delta, "Research on community model of sustainable water resource management in Mekong River Delta - Case study for 2 provinces including Ca Mau and Hau Giang" has reviewed the community models of sustainable water resource management in Viet Nam and the Mekong River Delta for the field of water use, including domestic and agricultural water supply. The research shows that most of the community models of water resource management are considered to be relatively sustainable, or less sustainable [7].

In fact, there are many models of community-

based water resource management which being applied in the Mekong River Delta. However, their sustainability is not high or requiring a lot of state financial support [7]. Such models need to be managed according to the business model to reduce loss, waste and optimize the State's support resources. Therefore, the study approaches the organization's strategic governance system through the use of Balanced Scorecard to measure the implementation of 4 important aspects in an organization that have causality including *Finance, Customer, Internal Operation and Development* [8]. On that basis, a set of assessment indicators was established for the model of community-based management of domestic water supply in adapting to climate change in Ca Mau province.

2. Development of a set indicator to assess the model of community-based management of domestic water supply in adapting to climate change in Ca Mau province

2.1. Establishment of evaluation indicators

2.1.1. Method of developing a set of indicators evaluating the model of community-based management of domestic water supply in adapting to climate change

In order to evaluate the model of community-based management of domestic water supply in adapting to climate change in Ca Mau province with considering climate change to be a risk factor and affecting to water resource management in the region at present and in the future, four indicators at level I were established to assess four important aspects in the organization including: *Finance, Customer, Internal Operation and Development*. On that basis, the sub-indicators (indicators at level II) are proposed as follows:

*) The Financial indicators include 5 sub-indicators including: A1. How is the rate of the model of the WRM socialized in financial investment? A2. How is the rate of the WRM model with costs paid by community itself? A3. How is the rate of the WRM model having financial summary? A4. How is the rate of the WRM model having financial interest? A5. How is rate of affordability of water users?

*) The assessment indicators relating to Customers (water users) include 10 sub-indicators including: B1. How much proportion of households accessing to a water supply is? B2. How is the rate of the model of the WRM model having monitoring and evaluation activities on the quality of supplied water? B3. How does the rate of the WRM model meet the quality of domestic water supply according to the regular and standard? B4. What is the rate of people being consulted during the period of building works? B5. What is the rate of people who vote for management team for the water resource management model? B6. How is the rate of the WRM model being monitored by the community? B7. How is the proportion of people who want to continue operating the the WRM model? B8. How is the satisfaction rate of the people/community on the service price? B9. How is the rate of satisfaction of the people/community on the ability to meet sufficient quantity and quality? 10. What is the rate of satisfaction of people/community on handling complains/feedback?

*) The assessment indicators on Internal operation include 6 sub-indicators including: C1. How is the rate of the WRM model operated by the community itself? C2. How is the rate of the WRM model periodically checked, maintained by the community itself? C3. How is the rate of the WRM model having operation plan/schedule? C4. What is the time to stop water supply from the WRM model? C5. How is the proportion of the WRM model having water reserve to supply water in the dry season? C6. How is the proportion of time of water supply from the reservoir in the dry season?

*) The assessment indicators on Model development guarantee include 5 sub-indicators including: D1. How is the proportion of the WRM model formed from community aspiration? D2. What is the rate of the WRM model established or recognized by local authorities? D3. What is the rate of the WRM model, which is registered as an enterprise model, established by the community? D4. How is the rate of the WRM model with community participation having Organization and Operation

Chapter? (including Participation Mechanism; Coordination Mechanism; Election Rules and Regulations. etc.). D5. What is the rate of the model managers and operators participating in training on operational techniques and management?

2.1.2. Delphi method

Delphi method is applied in the research for selecting component indicators (level II indicator). In order to conduct the Delphi, a team of 10 experts with extensive knowledge and interests in the fields of water resource, climate change and other related fields were selected. In the Delphi process, expert opinions are consulted through two rounds (Round 1: assessing the suitability of the proposed indicators; Round 2: selecting additional indicators related to capacity building for the community-based water resource management in adapting to climate change in the Mekong River Delta and two provinces including Ca Mau and Hau Giang). Based on the opinion of experts, the research synthesized, analyzed, evaluated and completed the set of indicators to evaluate the model of community - based management of domestic water supply in adapting to climate change for selected areas.

2.2. Data collection and statistics

The WRM model with community participatory in Ca Mau province has: 220 works are built by Center for Water Supply and Rural Environmental Sanitation and are handed over to the Commune People's Committee for management; up to now, only 59 works are operating effectively, 105 works moderately operate, 73 works (accounting for 30% of the works) are ineffective, stopped working, serious deterioration, waiting for liquidation and dismantlement; 2 works supply water according to the socialization method of investor Phan Van Hien in Thanh Phu Commune, Cai Nuoc district [6].

Based on the aforementioned set of indicator and the actual survey of 20 fresh water supply works with 75 votes for the local people, 25 votes for local authorities and management unit of domestic water supply works, it is

recognized that: state-invested works are seriously degraded; the funded works are ineffective (the number of water-use households is limited); the drilled wells that are not managed by household, are contaminated with alum, cannot be used, or if they can be used, they must be drilled in deep layers with a high cost; while the work, which is socialized investment by Pham Van Hien, is constantly reinvested, scaled up and improved quality to meet the demand for water use of people. Specifically: From the end of 2014, with the encouragement and support of the local government, Mr. P.V. Hien decided to borrow 200 million VND from a bank to invest in, upgrade and repair a water supply work which was funded by UNICEF and has been degraded (the People's Committee of Thach Phu commune supported the work with 40 million VND). By 2017, he continued investing in works including water stations, well and network pipes with a total capital of nearly 400 million VND; supplying water for more than 300 households within 3 km of hamlets including Tan Hoa, Phan Thach and So Tai. By May 2020, the investment has been upgraded and expanded with a total capital of nearly 2 billion VND; His works can supply water for more than 1,000 households. Water quality is regularly verified people therefore, can use it with peace of mind. Turnover is over 50 million per month.

2.3. Indicator assessment and calculation

The analysis of the achieved value of each sub-indicator (level II Indicator) and level I Indicator play important roles in proposing recommendations and solutions to develop the model in the fact. For level I Indicator, the equivalent weight for each indicator is 1/4, indicating equal importance of the sub-indicators. For level II indicator of each level I Indicator, the equivalent weight for each indicator is equal and is calculated by average of the sub-indicators (in which, Finance is 1/5; Client is 1/10; Internal operation is 1/6; Mode development is 1/5). The model of community-based management of domestic water supply in adapting to climate change in Ca Mau province will be evaluated as appropriate in the context of climate change, if

targets are met (as shown in the Sub-indicators) and the total score is met the average level of the selected scale (the scale is 1). Therefore, the model is appropriate if the total scale is above 0.5.

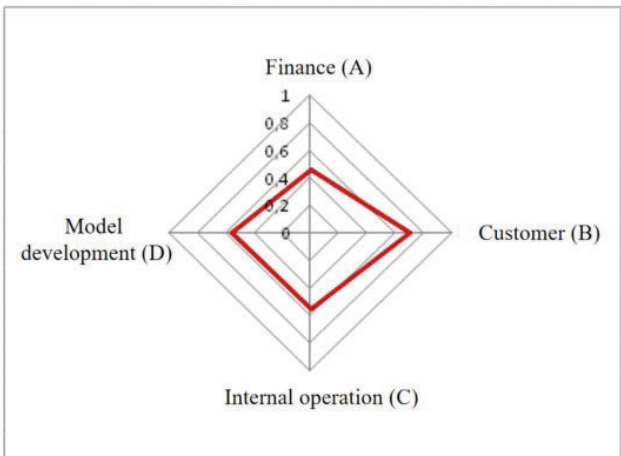
3. The result of evaluating the model of community - based management of domestic water supply in adapting to climate change in Ca Mau province

The evaluation results of the model achieved an average level of 0.56 and was assessed as a suitable model under local climate change conditions. Four basic level I indicators are calculated with fairly balanced values (in the range of around 0.5). However, in order to ensure sustainable and adaptive models to climate change in the future and consider the order of priority, it is necessary to focus first on investment in enhancing Financial indicator; following is Internal operation and Model development indicator; and Customer indicator (as shown in the Table 1).

The Financial indicator has low value with only 0.46 point: The socialization of water supply under the management and support of the State has brought a significant efficiency. This method receives high consensus from local people. However, up to now, there are very few individuals and businesses investing in rural fresh water supply works (the main unit is the Center for Water Supply and Rural Environmental Sanitation). Therefore, it is necessary to propose local preferential policies such as land assistance; concessional loans, etc.

The Customer indicator has high value of 0.7. Base on the local survey, it shows that network access and water supply services has been improved (over 90%). However, it still remains some problem such as capital recovery, solvency and financial sustainability planning. The promotion of non-state WRM model (including equitization, privatization and community-based) raises the need to improve the governance capacity towards customers, especially in the context of climate change. This means that ensuring Customer satisfaction is an important output criterion that must be addressed in order to maintain the evaluation results of this indicator.

Table 1. The evaluation results of the model of community - based management of domestic water supply in adapting to climate change in Ca Mau province

| Level I indicator | Value of level I indicator |  <p>Evaluation results: 0.56</p> |
|------------------------|----------------------------|---|
| Finance (A) | 0.46 | |
| Customer (B) | 0.71 | |
| Internal operation (C) | 0.55 | |
| Model development (D) | 0.56 | |

The Internal operation indicator is assessed to average (0.55). There are a lot of pressure making it difficult to achieve high point. The main reason is that water quality is declining (due to pollution and effect of climate change) in many areas of the province, the water source therefore, will be in difficulty and will be supplied from other water source, or will be treated with more expensive treatment processes. These increase the cost of water production and transportation. Therefore, consideration should be given to ensure that the model has a reserve reservoir to supply water during the dry season.

The Model indicator which shows the development trend of the model in the present and in the future, is rated at above 0.5. Ensuring water supply models are recognized by local authorities; promoting the development of WRM model established under the enterprise model; ensuring the organization's chapter with the community's participation will support to improve this indicator.

4. Conclusion

From the aforementioned analysis and application results of the set of evaluation indicators, it shows that there are important roles in the management of the model of

community-based management of domestic water supply in adapting to climate change.

Firstly, the set of indicators can be considered as a tool to assist in assessing the capacity of the availables. If the indicators are met, the model will develop sustainably; from there, the State plays the role of an investor to help the models develop more (in terms of capital investment, technology and management, etc.); the models have not met the indicators, the State needs advice for them to achieve according principles of ensuring the "balance" of aforementioned Finance, Customers, Internal operations and Model development. Secondly, the orientation of the models that are not yet open or formulated should meet the criteria set out in the set of indicators.

In order to effectively implement such models, firstly, it is necessary to clearly define the role of community in the water resource management at appropriate scales; secondly, the model of community-based management of domestic water supply should be oriented to develop according to the enterprise model, market mechanism (having financially profitable; financial statements, etc.), through gradual satisfaction of the aforementioned indicators; Thirdly, promoting socialization

of water supply under the management and support of the State will bring significant effect.

This method receives the high consensus from the local people.

References

1. Asia-Pacific Water Forum, (2012), *Framework Document on Water and Climate Change Adaptation: For Leaders and Policy-makers in the Asia-Pacific Region*.
2. Cap-Net, (2014), *IWRM as a Tool for Adaptation to Climate Change*.
3. EPA, (2015), *Community-base adaptation to a changing climate*, EPA-230-F-15-001.
4. Molle. F., (2005), *Irrigation and water policies in the Mekong region: Current discourses and practices*. Colombo, Sri Lanka: IWMI. 43p. (Research report 95).
5. Nguyen Viet Dung et al. (2006), *Community-based water resource management in Viet Nam: A review of experiences and success models*.
6. People's Committee of Ca Mau province, (2020), *Report of providing information for the supervision team of the Provincial People's Council, May 2020*.
7. Pham Ngoc Anh et al. (2018), *Study on models of sustainable community water resources management in Mekong River Delta (case study for two provinces including Ca Mau and Ha Giang)*, Code: 2015.05.13. The final report of scientific research project at the Ministry of Natural Resources and Environment.
8. Robert S. Kaplan and David P. Norton, (1986), *Strategy map*.
9. WaterAid, (2012), *Water security framework*. WaterAid, London.