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# A study on the Policy Instrument for Regional Innovation System Construction in the Mekong Delta Region

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**Abstract** This study investigated the policy instruments pertinent to the establishment of a regional innovation system in the Mekong Delta that facilitates the development of a countermeasure towards various issues of industrial and technological nature. First, we conducted the research with regard to the status and environment of the region. Second, a field visiting survey was implemented to analyze the results of international efforts and regional capacity to solve the problems attendant upon introducing technologies related to the Fourth Industrial Revolution. Third, we derived the key policy issues and challenges from the results of the field visiting survey and experts' conference with a deep focus on technological transfer and international cooperation to enhance the capability in the science and technology field. Fourth, we conducted the opinion survey of the experts from Korea and Vietnam to converge local opinions from both countries and analyzed the results. The range of research subjects is responding to climate change, managing water resources, coordinating energy and industrial structure, making a resilient Mekong regional ecosystem, smartification of local cities, and improving the life quality of citizens, and so on. The results of this study are expected to be the beginning of fundamental research in the mid to long-term view of the Mekong Delta region innovation system of Korea and Vietnam and to evaluate the master plan.

**Keywords** Mekong Delta region, Regional Innovation System, STI, R&D, policy instrument, AHP

## I. Introduction

Given the geopolitical importance of Vietnam, numerous world powers, such as the US, France, China, and Japan, as well as organizations, such as the UN(United Nations), OECD(Organization for Economic Cooperation and

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Development), the World Bank, FAO (Food and Agriculture Organization of the United Nations), and WHO (World Health Organization) have researched solutions and provided funding to solve the various issues that affect the Mekong Delta. Collaborative fronts include agriculture and fishing sectors, which encompasses Vietnam's largest export rice, climate change response, water resource management, healthcare, and urban development as well as future-oriented projects such as bioeconomy. In particular, the World Bank has expressed consistent interest with regards to the economy, industry, society and living conditions in Vietnam. The World Bank has played a central role in facilitating cooperation between reputable research centers, universities, and corporations and their local counterparts by continually investing resources in the region.

In recent years, Green Climate Fund launched a project titled 'Transforming the Mekong Delta GCF Program for Vietnam' in order to enable the residents and farmers to autonomously adapt to climate change and floods (The World Bank,2018). The Mekong Delta is the cornerstone of Vietnam's agriculture industry. Comprising 12% of the country's landmass and 27% of its farmland, the Mekong Delta alone generates more than 60% of Vietnam's agricultural exports. (Due to bordering Cambodia, Laos, Myanmar, and Thailand, the Mekong Delta is also the focal point of Southeast Asian politics.) In recent years, climate change induced floods have raised the sea level, which in turn has deleteriously affected the livelihoods of local farmers and fishers (OECD/FAO, 2017). In response, the Vietnamese government has worked with the UN, OECD, and the World Bank to develop effective countermeasures to the various issues affecting the Mekong Delta. However, the majority of these commissioned investigations are focused on predicting climate change or sustaining the agricultural and fishing industry. While these types of studies are necessary, the lack of a centralized strategy limits the application of these works. Thus, a detailed schedule that prioritizes such findings is imperative to effectively engage the multi-faceted nature that affects the Mekong Delta.

The primary objective of the present study is to generate a roadmap that can facilitate the implementation of such policies. The most notable development in Korean-Vietnamese cooperation regarding science and technology is the establishment of VKIST (Viet Nam - Korea Institute of Science and Technology). In 2012, Vietnam requested the establishment of a research center that can induce growth of the economy. Under the provisions agreed upon by KOICA(Korea International Cooperation Agency) and KIST (Korea Institute of Science and Technology) in 2014, $35 million USD in funding was granted over 2014 through 2020 for the construction of VKIST and operation costs.

Direct investment from foreign entities forms the basis of industrial innovation and is expected to encompass production facilities, investments into communications technology, investments in R&D pertaining to science and

technology, and investments into training programs. In addition, the 4th industrial revolution-based state-of-the-art technologies have gained recognition from the Vietnamese government as a promising project. The advancement of industrial innovation capacity is imperative to addressing deficiencies in human resources. Since 1986, Vietnam has experienced rapid economic growth after implementing the Doi Moi policy, as evidenced by the increase in GDP per capita. These changes have resulted in positive societal impacts, and the poverty population had decreased from 58% in 1990 to 13.5% in 2014. Vietnam is now transitioning its effort to sustain its booming economy to overcome challenges associated with the middle class. The poor labor market and low productivity are interconnected phenomena that remain problematic. These issues are largely propagated by the lack of opportunities for workers to learn new skills and pass onto other workers (World Bank, 2013).

In addition, under the agreement between Korea and Vietnam in 1955, Universities and research centers have collaborated on multiple levels: ODA, science and technology committee, and government projects. The present work investigated the possible fronts of the Mekong Delta that may benefit from R&D support. In particular, challenges pertaining to environmental analysis, STI, and implementation of 4th industrial revolution associated technologies were analyzed. The region of Mekong Delta is a place where various countries provide various national support projects and ODA. But looking into the project, there was a lack of accurate solutions to the local situation and practical solutions.

In order to find out the issues for the implementation of research projects that put science and technology elements in order to supplement them, core issues were discovered based on KIST and VKIT, field trips with experts in science and technology R & D, expert interviews, and FGI.

## II. Research Backgrounds

### 1. Regional Innovation systems

Regional innovation systems (RIS) are a useful framework for studying economic and innovative performance; It is a functional tool to improve the innovation process of the enterprise. This is achieved by aligning knowledge flows with the systems they depend on and building trust and trust; and above all, they do it by generating certain kinds of collective complaints about institutional self-knowledge and phenomena. RIS comprises a set of institutions, both public and private, which produce pervasive and systemic effects that encourage firms in the region to adopt common norms, expectations, values, attitudes and practices, where a culture of innovation is nurtured and knowledge-

transfer processes are enhanced. A national system of innovation (NIS) cannot do this sufficiently for specific purposes or needs. Time economies, as well as distance and collapse effects, influence through cognitive ability (Phil Cooke, 2006).

Metcalfe (1997) defines the NIS as a "system of interconnected institutions that create, store, and transfer knowledge, technology, and art that define new technologies." This is much broader on an institutional scale, thus far from a specific mix of local industries, and narrower due to the emphasis on "new technologies" than the definition of RIS: "Regional innovation systems are made up global, national and other-linked interactive knowledge generation and exploitation sub-systems. A local system for the commercialization of new knowledge." (Cooke, 2004).

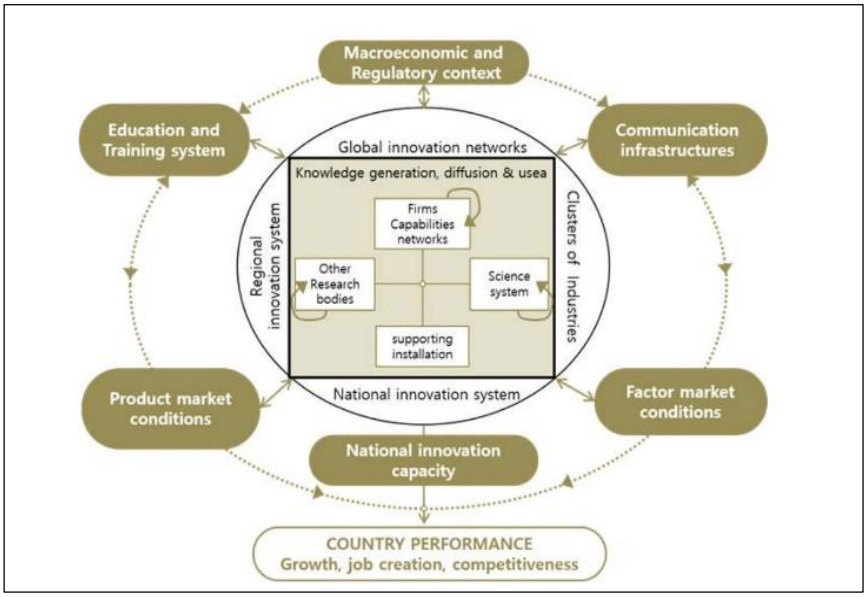



**Figure 1[1] Actors and connections in the innovation system**

Source: OECD 1999: 23.

[1] Figure 1 is an early example of the OECD conceptualization The photo's message is definite: All elements contribute to economic growth in one way or another, raise job opportunities and competitiveness. This is generated by the interaction of supporting institutions and research institutes, where networks, national and regional innovation systems, clusters and market conditions all appear to be dimensionally considered in the analysis. In addition, we consider statistically surveyed differences between countries as a way of measuring relative differences and comparisons among OECD member states in several aspects, such as population, knowledge base, and industrial specialization(OECD 1999).

Thus, the conceptualization of the World Bank is a clear example of how scientific policy has been extended to innovative policy concepts. For example, in a recent report directed to policy makers in "developing countries," the bank states that innovation policy "tends to integrate in a different way than science and technology policies. It also happens as part of the overall trend towards knowledge-based economic strategies. Innovation policies require action in a variety of policy areas, including education, trade, investment, finance and decentralization, and creating a productive innovation environment is the right combination of interventions in these diverse areas." (World Bank 2010: 9; ZEF Working Paper Series 2014). In the concept of a regional innovation system (RIS), which is used as a systematic analytical approach to investigate the innovation process within regions, there is no 'one-size-fits-all' regional innovation policy, as RISs differ widely regarding prior innovation capabilities, industrial base, and institutional contexts (Tödtling & Trippl, 2005).

Regions are important bases of economic coordination at the meso-level, although the level of regional administration can differ quite a lot across various countries. In varying degrees, regional governance is expressed in both private representative organizations, such as branches of industry associations and chambers of commerce, and public organizations, such as regional agencies with powers devolved from the national (or, within the European Union, supra-national) level to promote enterprise and innovation support (Asheim et al., 2003a; Cooke et al., 2000; B.T. Asheim, L. Coenen.,2005). The concept of RIS is an analytical approach that emphasizes the importance of the geographical scale in understanding knowledge production and differences in regional innovation outcomes. RISs differ significantly among countries and within countries, making the region the most interesting innovation system unit to investigate (Braczyk, Cooke, & Heidenreich, 1998).

A recent study has shown that innovation output is higher in regions where both a sizable population of small firms and large firms are present (Ajay Agrawal, 2014). The OECD focuses on the regional innovation system as part of The Regional Development Policy Committee (RDPC) activities. It fosters best practices exchanges on this and regularly publishes reports on related issues (for example, included in the Territorial Reviews) (Regional Development Policy – OECD).

"Peer reviews provide analytic assessment and policy advice for regions, reviews examine the strength of the regional innovation system, the appropriateness of the policy mix for the region's needs, and the strategic use of the region's resources given global, national, regional and local factor. For countries, reviews assess the extent to which policies from different policy streams (e.g., regional development, science and technology, enterprise policy and higher education policy) are effective in building regional innovation

systems and clusters for the range of region types in the country." (Regional Innovation - OECD). Regional innovation agencies have been created in many regions around the world to support the innovation process in their RIS (Arnault Morisson & Mathieu Doussineau, 2019). Enhancing collaboration and networking within the firm's region is important to economic development and sustainable competitive advantages (Cooke et al., 2004; Kajikawa et al., 2012).

Many regions have difficulties in designing and implementing place-based policies due to the quality of their governments (Charron et al., 2014). Existing RIS frameworks have identified a number of RIS elements (Todtlin and Trippl, 2005; Chen and Guan, 2011; Buesa et al., 2010). For example, Cooke and Piccaluga (2004) suggest that RIS includes universities, businesses, local innovation assets, regional culture and governance sub-systems. Todtlin and Trippl (2005) propose that RIS includes regional policy, vertical and horizontal networking with industrial companies, and knowledge generation and diffusion agents. Policy actors in RIS can play a powerful role in shaping regional innovation processes if there is sufficient regional autonomy to formulate and implement innovation policies (Cooke et al.,2000; Vavakova, 2006).

Asheim and Coenen (2005) admit that through the regionalization of innovation policy, more accurate consideration can be paid to the region's specific context and circumstances in terms of the industrial structure, institutional set-up and knowledge base. The potential for innovation policy to be more focused by providing support that is needed given the demands generated by industrial specificities. In this, the distinction between analytical and synthetic knowledge and its important consequences for innovation policy is an example of such a sharper focus that can be catered for at the regional level.

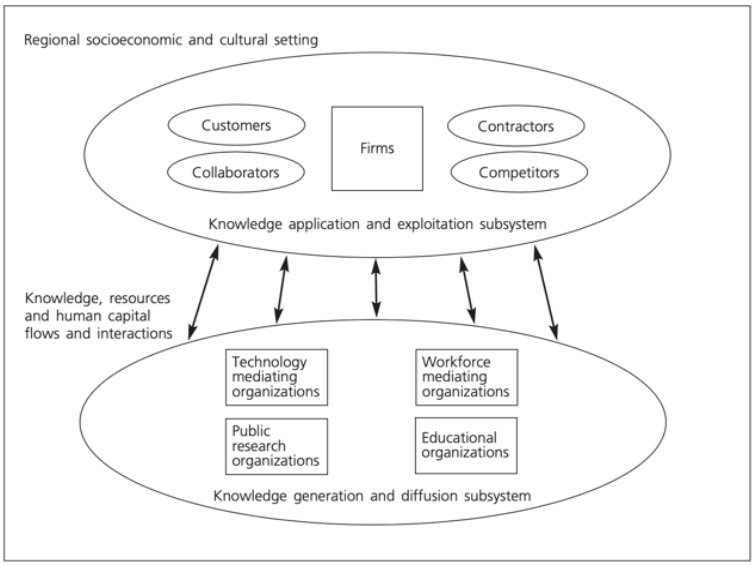



**Figure 2 The regional innovation system: a schematic illustration**

## 2. Analytic Hierarchy Process

Saaty(1994) suggested that analytical decision making should be of tremendous value but simple, accessible to the end-user and have the highest order of scientific justification. The first is a morphological method of thoroughly modeling the decision, inducing people to reveal their implicit knowledge. This leads people to organize and reconcile their different emotions and interests. The agreed structure provides the basis for full multilateral discussion. Second, especially in the framework of hierarchy and feedback systems, this process allows decision makers to use judgment and observation to guess the relationship's relationships and strengths in the flow of interaction forces moving from general to specific and predict the most likely outcome. Third, people can integrate and trade value and influence with an accuracy of understanding more accurately than using language alone. Fourth, people can include judgments arising from intuition and emotion and judgments arising from logic. Reasoning takes a long time to learn, and it's not a common skill for everyone. By numericalizing the strength of the judgment and agreeing on the value, decision groups do not need to engage in long-term debate. Finally, the formal approach allows people to make gradual and more thorough corrections and combine conclusions from others who study the same problem in different places.

The AHP avoids this kind of formulation and compares the importance, preference, or likelihood (probability) of element pairs in terms of common attributes or criteria expressed in the decision hierarchy. Policy makers at all levels of decision making in organizations use multiple criteria to analyze their complex problems. At every decision-making level in the organization, policymakers use a number of criteria to analyze complex issues. Multi-criteria thinking is formally used to facilitate their decision making. Trade-offs clarify the advantages and disadvantages of policy options in situations of risk and uncertainty (Saaty, 1994). Decision making involves many criteria and subcriteria used to rank alternatives to decisions. In addition to alternatives to the criteria or sub-criteria to be evaluated, the alternatives themselves should be prioritized if they are dependent on higher target criteria or alternatives (Saaty, 2008).

Some key and basic steps involved in this methodology are: 1) State the problem; 2) Broaden the objectives of the problem or consider all actors, objectives, and its outcome; 3) Identify the criteria that influence the behavior; 4) Structure the problem in a hierarchy of different levels constituting goal, criteria, sub-criteria, and alternatives; 5) Compare each element in the corresponding level and calibrate them on the numerical scale. Compare each element in the corresponding level and calibrate them on the numerical scale. This requires n(n-1)/2 comparisons, where n is the number of elements with the considerations that diagonal elements are equal or 1 and the other elements will simply be the reciprocals of the earlier comparisons; and 6) Perform calculations to find the maximum Eigenvalue, consistency index CI, consistency ratio CR, and normalized values for each criteria/alternative. AHP helps to incorporate a group consensus. Generally, this consists of a questionnaire for comparison of each element and geometric mean to arrive at a final solution. The hierarchy method used in AHP has various advantages advantages (satty.1980; O.S. Vaidya, S. Kumar. 2006).

Saaty(1994) defines to decisions require a variety of knowledge, information, and technical data. These concerns describe in detail the problem, the person or actor involved in the decision, the purpose and policy, the impact on the outcome, the time horizon, the scenario, and the constraints. Like AHP, in both cost and profit models, we compared baseline and sub-criteria based on their relative importance to the upper elements of adjacent upper levels. And Saaty (2008) defines that in order to make decisions in an organizational way to generate priorities, decisions need to be subdivided into the next level. 1) Define the problem and determine the type of knowledge you want. 2) For decision-making purposes, we construct the decision hierarchy from top to bottom (alternative set) through the middle level (based on which subsequent elements depend) from a broad perspective.3) We generate an interactive comparison matrix. Each element at a higher level is used to compare elements at a lower level. 4)

Priorities of the following grades are measured using priorities obtained from comparison. Do this for all elements. You then add weights to each element at the level below and obtain full or global priority. We continue this weighting and additional process until the final priority of the lowest-level alternatives is obtained.

## III. Methodology

Previous publications and case studies on the Mekong Delta, particularly those published by the UN, OECD, and the World Bank, were reviewed. Local Vietnamese experts were also consulted when reviewing works conducted by the Vietnamese government and other Vietnamese institutions. In addition, an advisory committee, comprised of experts in science and technology policy and research & development as well as research personnel from KIST, was formed to assess the current status of the Mekong Delta and identify key issues and corresponding solutions. In order to facilitate communication between the Vietnamese personnel, members of the advisory committee visited the Mekong Delta in person to evaluate the laboratory as well as other related state and federal government institutions (Minister of Science and Technology).

After identifying current relevant projects and proposed policies, the advisory committee was consulted to generate possible solutions. Subsequently, Vietnamese and Korean personnel with the relevant expertise were interviewed on policy instrument issues, ongoing policies, and proposed solutions regarding the Mekong Delta. Based on the collected response, the advisory committee created current issues that outline the implementation of a technological innovation systems framework in the Mekong Delta. This study investigated the policy instruments pertinent to the establishment of a regional innovation system in the Mekong Delta that facilitates the development of a countermeasure towards various issues of industrial and technological nature. First, we conducted the research with regard to the status and environment of the region. Second, a field visiting survey was implemented to analyze the results of international efforts and regional capacity to solve the problems attendant upon introducing technologies related to the Fourth Industrial Revolution. Third, we derived the key policy issues and challenges from the results of the field visiting survey and experts' conference with a deep focus on technological transfer and international cooperation to enhance the capability in the science and technology field. Fourth, we conducted the opinion survey of the experts from Korea and Vietnam, to converge local opinions from both countries and analyzed the results.

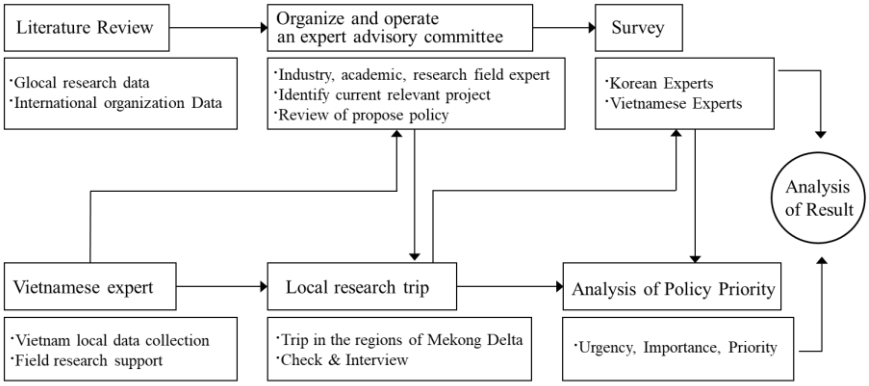



**Figure 3 Process and Analysis Method of Research**

This work derives a hierarchy of criteria that considers the system's policy tools, systems, and content through FGI. Survey on ranking the importance of current issues and their corresponding policies. In order to prioritize the current issues affecting the Mekong Delta, participants were surveyed to rank the key issues and proposed solutions affecting the Mekong Delta. The survey was written in both Korean and Vietnamese to accommodate date participants. Participants were selected based on their expertise in Korean and Vietnamese policies on science and technology. Participants were surveyed between October 31, 2019, and November 20, 2019. A total of 36 Korean experts and 10 Vietnamese experts were surveyed. The demographic information and field of expertise are listed in the table below.

**Table 1 The demographic information and field of expertise**

| Category | | Korean Respondents (n=36) | Vietnamese Respondents (n=10) |
|---|---|---|---|
| Sex | Male | 24 | 9 |
| | Female | 12 | 1 |
| Residence | Republic of Korea | 33 | 0 |
| | Vietnam | 3 | 10 |
| Field of Expertise | STEM | 19 | 9 |
| | Humanities | 17 | 1 |
| Prior experience with ODA | Experienced | 20 | 2 |
| | Unexperienced | 16 | 8 |

Given that the Mekong Delta spans numerous countries, the scope of our research was confined to the implementation of science and technology based solutions in the regions of the Mekong Delta enclosed within Vietnam. Some of

the categories of key issues included the response to climate change, water resource management, energy and industrial structure management, restoration of the Mekong Delta ecosystem, smartification of cities to improve the quality of life for residents. Monitoring progress and improvement in these areas, the private sector was excluded. The results of the Expert Focused Group Interview (FGI) were compiled to list the key issues within the Mekong Delta as shown in the table below.

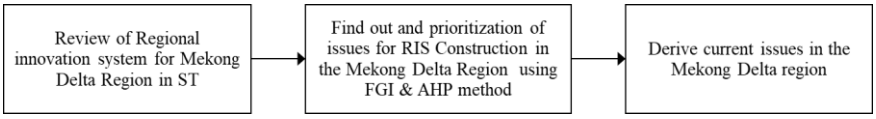



**Figure 4 Procedure of FGI and AHP**

This work derives a hierarchy of criteria that considers the system's policy tools, systems, and content through FGI. The establishment standards and policy issues were derived through the AHP survey through a meeting of experts on the types of reduced policy means, support policies, priority setting standards, and screening standards. Through the literature review and organize and operate an expert advisory committee, and expert interviews with FGI, the issues in the Mekong Delta region were derived, and the feasibility of application of questionnaire performance, procedures, applications, and AHP methods has been designed.

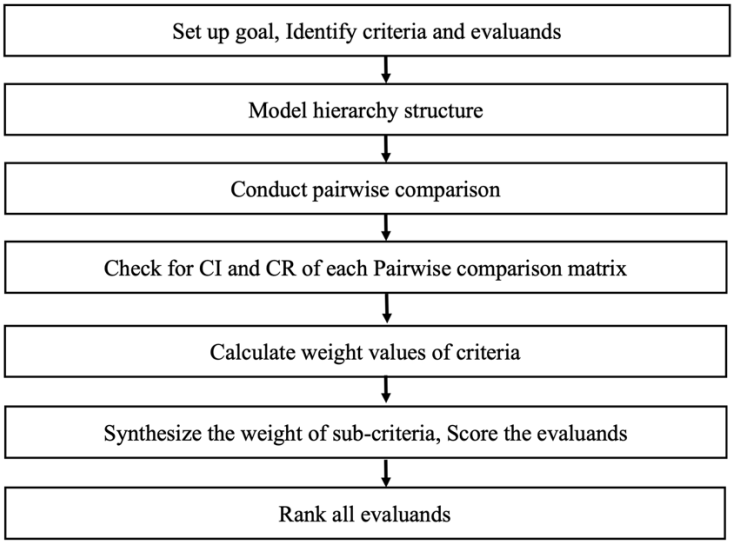



**Figure 5 Procedure for AHP**

Firstly, the requirements of the problem were clarified by defining the research topic and the key issues within the Mekong Delta. Secondly, the hierarchy was constructed using all the criteria related to the problem, from the highest objective to the lowest level alternative, through selection and evaluation. Third, the comparative matrix established the relative importance of the sub-evaluation criteria for the parent item by conducting an interim-based assessment item. Fourth, the consistency of the responses is reviewed after allocating the estimated relative weights from each evaluation item in the comparison matrix of the previous step. In the event that inconsistency is determined to be inconsistent, the comparison results are re-examined using the Consistency Ratio (CR) for a measure of corresponding consistency. Although it may depend on hierarchy, generally, consistency problems have been re-examined when more than 20%, and it was determined that there is no problem if CR is less than 10%.

**Table 2 The key issues within the Mekong Delta**

| Category | Current issues |
|---|---|
| Responding to climate change | 1. Landslide mitigation and adaptation to rising sea levels |
| | 2. Countermeasures against increasing salinity and water scarcity |
| | 3. Climate change surveillance and reinforcing prediction methods |
| Economy. Industries. Innovation | 4. Developing infrastructure for agricultural and industrial fishing sectors |
| | 5. Expanding industries and promoting Regional Innovation |
| Living conditions. Environment. Ecosystem | 6. Improving living conditions in preparation of urbanization |
| | 7. Preserving and restoring the ecosystem |
| Policy implementation system | 8. Developing governance infrastructure and facilitating international cooperation |

In addition, the promotion system was able to derive issues of establishing governance and strengthening international cooperation for solving the Mekong problem. The 13 issues included rising sea levels, water scarcity propagated by increasing salinity, monitoring and predicting climate change, overcoming water scarcity for the farming industry, strengthening science and technological innovation system, facilitating international cooperation to solve local issues, improving quality of life for residents, expanding infrastructure to accommodate

urbanization and expectant migrants, preserving the ecosystem and biological diversity, and strengthening Korean-Vietnamese relations.

**Table 3 Mekong Delta regional Issues**

| No. | Mekong Delta Regional Issues |
|---|---|
| 1 | Landslide mitigation and adaptation to rising sea levels issues |
| 2 | water scarcity propagated by increasing salinity issues |
| 3 | monitoring and predicting climate change issues |
| 4 | Urgent issue of agriculture sector countermeasures against desalination issues |
| 5 | Overcoming water scarcity for the farming industry issues |
| 6 | Advancement of industrial structure and Regional Innovation issues |
| 7 | Regional of Human Resource Development and Settlement Issues |
| 8 | Regional of strengthening science and technological innovation system issues |
| 9 | Facilitating international cooperation to solve local issues |
| 10 | Improving the quality of life for residents issues |
| 11 | Expanding infrastructure to accommodate urbanization and expectant migrants issues |
| 12 | Preserving the ecosystem and biological diversity issues |
| 13 | Strengthening Korean-Vietnamese relations issues |

## IV. Research Outcome

### 1. Awareness regarding the issues affecting the Mekong Delta

Participants were asked to grade the 13 most prominent issues, as determined by experts, on the Likert scale, where 5 indicates knowledgeability on the subject 1 signifies unfamiliarity. The 13 issues included rising sea levels, water scarcity propagated by increasing salinity, monitoring and predicting climate change, overcoming water scarcity for the farming industry, strengthening science and technological innovation system, facilitating international cooperation to solve local issues, improving quality of life for residents, expanding infrastructure to accommodate urbanization and expectant migrants, preserving the ecosystem and biological diversity, and strengthening Korean-

Vietnamese relations. The average score, representing the perception of experts, is listed in Table 4.

**Table 4 Differences in perception of issues for Mekong Delta region**

| No. | Mekong Delta regional issues | perception of experts (KOREA) | perception of experts (Vietnam) |
|---|---|---|---|
| 1 | Landslide mitigation and adaptation to rising sea levels issues | 2.85 | 3.8 |
| 2 | water scarcity propagated by increasing salinity issues | 2.88 | 4.3 |
| 3 | monitoring and predicting climate change issues | 3.09 | 3.4 |
| 4 | Urgent issue of agriculture sector countermeasures against desalination issues | 2.82 | 3.9 |
| 5 | Overcoming water scarcity for the farming industry issues | 2.48 | 3.1 |
| 6 | Advancement of industrial structure and Regional Innovation issues | 2.88 | 2.8 |
| 7 | Regional of Human Resource Development and Settlement Issues | 2.58 | 2.8 |
| 8 | Regional of strengthening science and technological innovation system issues | 2.68 | 3.3 |
| 9 | Facilitating international cooperation to solve local issues | 2.94 | 3.3 |
| 10 | Improving quality of life for residents issues | 3.00 | 3.0 |
| 11 | Expanding infrastructure to accommodate urbanization and expectant migrants issues | 2.77 | 3.0 |
| 12 | Preserving the ecosystem and biological diversity issues | 3.09 | 3.2 |
| 13 | Strengthening Korean-Vietnamese relations issues | 3.45 | 3.1 |

As evidenced by the scores, the Korean respondents generally displayed a lower perceived knowledgeability than their Vietnamese counterparts. Only "strengthening Korean-Vietnamese relations," "inability to adequately monitoring and predicting climate change," and "preserving the ecosystem and biological diversity" had scores greater than 3, which indicates some knowledgeability, which showed a trend where Korean respondents were more likely to be familiar with issues that matter on a global scale.

In contrast, the Vietnamese respondents, on average, scored higher in the remaining 11 categories. Notably, Vietnamese respondents displayed familiarity regarding water scarcity induced by increasing salinity, countermeasures against increasing salinity for the farming industry, and rising sea levels. The survey results are expected to benefit both parties in deriving fields of collaborative research that aim to solve key issues.

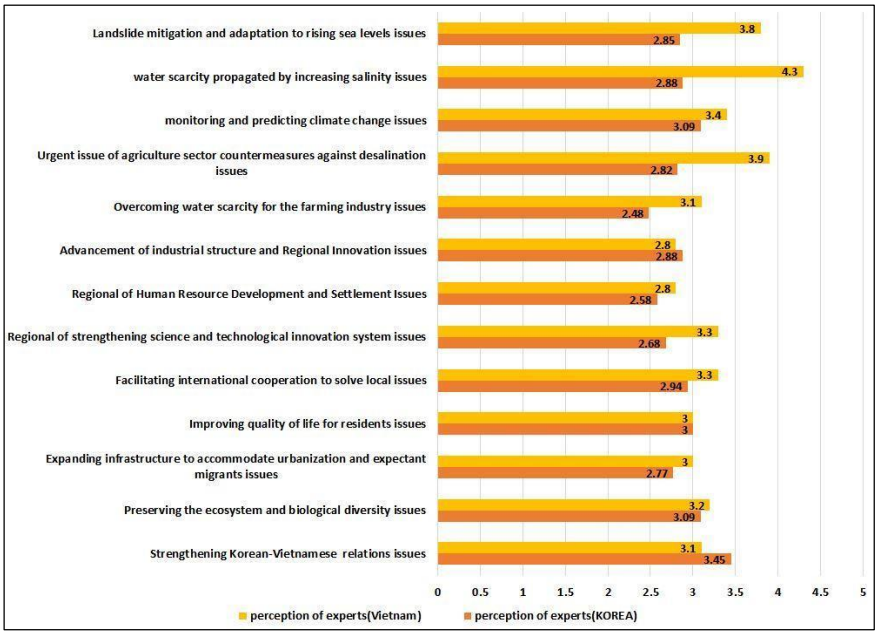



**Figure 5 Differences in perception of issues in the Mekong Delta region between Korea and Vietnam**

## 2. List of issues affecting the Mekong Delta in decreasing importance

Analytic Hierarchy Process was applied to prioritize the issues affecting the Mekong Delta. As a result, response to climate change, improving residential areas (weight 0.24), preparing countermeasures for agricultural and industrial fishing sectors, advancement of industrial structure and Science and Technology Innovation, and developing government response at the local and federal level were deemed by the Korean participants to be the most crucial in decreasing importance.

In contrast, Vietnamese participants ranked the issues in a slightly different order: response to climate change, preparing countermeasures for agricultural and industrial fishing sectors, advancement of industrial structure and Science and Technology Innovation, improving residential areas, and developing government response at the local and federal level. Both results satisfied the validation criteria defined by Satty (ref.) as evidenced by a C.R less than 0.1. Thus, it was evident that the Vietnamese personnel considered climate change and protecting the agricultural and fishing industry as most important and should be prioritized when addressing the various issues affecting the Mekong Delta.

**Table 5 Priority comparison of problems in the Mekong Delta**

| Issue at hand | Perceived Importance (Korea) | Perceived Importance (Vietnam) |
|---|---|---|
| Climate Change Response | 0.24 | 0.35 |
| Response to Industrial Issues pertaining to Agriculture and Fisheries | 0.19 | 0.24 |
| Advancement of Industrial and STI | 0.19 | 0.17 |
| Improving living conditions and environment | 0.24 | 0.13 |
| Strengthening government response at local and federal level | 0.14 | 0.11 |
| CR | 0.035 | 0.059 |

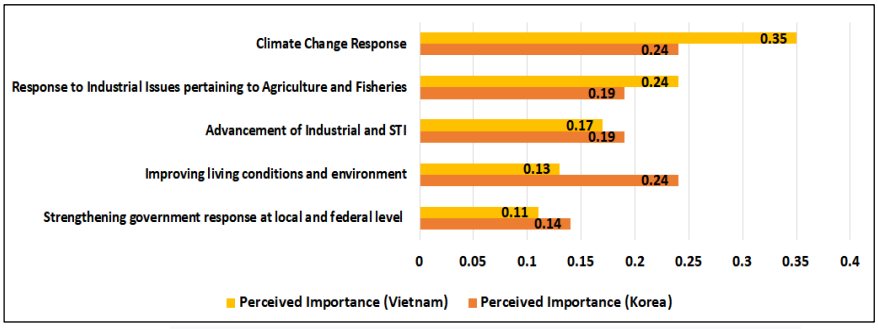



**Figure 6 Priority comparison graph of problems in the Mekong Delta (Korea and Vietnam)**

## 3. Perceptions on the proposed policies and solutions

Expert opinions on the proposed policies that address the issues in Mekong Delta were compiled to survey the participants on a Likert scale. A score of 5 indicates complete agreement, whereas a score of 1 signifies strong disagreement.

**Table 6 Comparison of survey results on the perception of policy instruments for problem pertaining**

| No. | problems pertaining to the Mekong region | Awareness (Korea) | Awareness (Vietnam) |
|---|---|---|---|
| 1 | Implementation of region-specific ecological laws to combat sea level rise | 3.94 | 4.4 |
| 2 | Development and validation of small-scale sustainable solar-powered desalination system | 3.50 | 4.0 |
| 3 | Development and validation of large-scale nuclear-powered desalination system | 2.88 | 2.7 |
| 4 | Desalination via application of membrane technology | 3.91 | 3.78 |
| 5 | Renovation of research facilities to strengthen climate change monitoring and prediction | 4.33 | 4.56 |
| 6 | Establishment of a regional branch of an international organization to monitor climate change and prepare countermeasures | 4.03 | 4.3 |
| 7 | Development of a climate change monitoring system that utilizes satellite images | 4.21 | 4.1 |
| 8 | Reinforcing federal and local government response to climate change | 4.09 | 4.2 |
| 9 | Developing salt resistant crop | 3.79 | 4.5 |
| 10 | Smartfarms and innovations in agricultural production | 3.78 | 4.4 |
| 11 | Financing the advancement of regional industries | 3.97 | 4.1 |
| 12 | Renovating education to combat human capital flight | 4.27 | 4.11 |
| 13 | Reinforcing Technical and Vocational Education and Training (TVET) | 4.22 | 4.0 |
| 14 | Expansion of study abroad programs to | 3.81 | 3.67 |
| 15 | Expanding regional STI capacity | 4.03 | 4.56 |
| 16 | Expanding problem solving programs by facilitating collaborative efforts with international organizations | 4.24 | 4.44 |
| 17 | Expanding Korea-Vietnam ODA specific to Mekong region | 4.24 | 4.67 |
| 18 | Implementation of science and technology to improve quality of life and increase ecological sustainability | 4.18 | 4.33 |
| 19 | Building the infrastructure for smart villages | 3.48 | 3.56 |
| 20 | Devising policies to protect the fauna and flora | 3.87 | 4.44 |
| 21 | Preserving the biological diversity in the Mekong Delta | 4.00 | 4.33 |
| 22 | Strengthening collaborative efforts between the Korean and Vietnamese research facilities | 4.18 | 4.67 |
| 23 | Expanding the role of VKIST in government projects | 4.96 | 4.4 |

Both Korean and Vietnamese personnel concurred on the necessity of various policies to collectively address the problems pertaining to the Mekong region, but both expressed disapproval regarding the 'Development and validation of large-scale nuclear-powered desalination system.' This disapproval appears to stem from negative perceptions associated with nuclear power as Korea is transitioning away from nuclear power altogether. However, given that Vietnam has plans to increase nuclear energy production by 10,000MW by 2030 in their stated plan, this discrepancy in approval from intended nuclear expansion requires further study.

The highest priority policies as perceived by Korean personnel were found to be the following: Expanding the role of VKIST in government projects (4.96), Renovation of research facilities to strengthen climate change monitoring and prediction (4.33), Renovating education to combat human capital flight (4.27), Expanding Korea-Vietnam ODA specific to Mekong region (4.67), Strengthening collaborative efforts between the Korean and Vietnamese research facilities (4.67), Renovation of research facilities to strengthen climate change monitoring and prediction (4.56), Expanding regional STI capacity (4.56).


**Figure 7 Comparison of survey results on the perception of policy instruments for problem pertaining**

## 4. Investigating the urgency and relative priority of problem solving policies

The aforementioned 23 policies and their evaluation of relative importance and urgency by Korean personnel were compared to those of Vietnamese personnel. Based on the responses, the top five proposed policies were listed separately based on perceived importance and urgency.

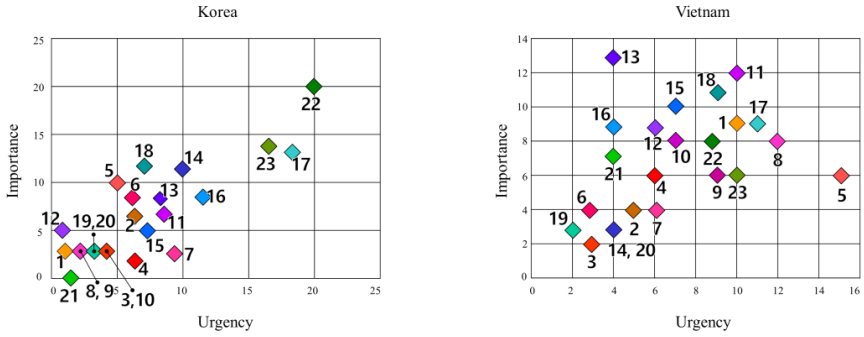


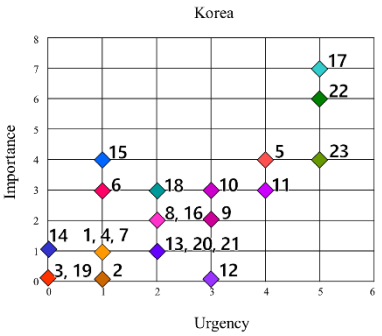

**Figure 8(a) Distribution of urgency and importance among policy instruments in the position of Korea responded by Korean experts**

**Figure 8(b) Distribution of urgency and importance among policy instruments in the position of Vietnam responded by Korean experts**

As shown above, 'Strengthening collaborative efforts between the Korean and Vietnamese research facilities,' 'Expanding the role of VKIST in government projects,' and 'Expanding Korea-Vietnam ODA specific to Mekong region' were deemed both important and urgent by Korean personnel. This evaluation differed from the responses of Vietnamese personnel whose evaluation placed 'Financing the advancement of regional industries,' 'Implementation of science and technology to improve quality of life and increase ecological sustainability,' 'Expanding Korea-Vietnam ODA specific to Mekong region,' 'Implementation of region-specific ecological laws to combat sea level rise,' 'Reinforcing federal and local government response to climate change,' and 'Strengthening collaborative efforts between the Korean and Vietnamese research facilities' as having comparable importance and urgency. These results indicate that while the Korean personnel failed to accurately assess the needs of the Vietnamese personnel, the commonality in responses shows a positive disposition for collaborative endeavors in numerous fields.

| | |
|---|---|
| 1 | Implementation~ |
| 2 | Development and validation of small~ |
| 3 | Development and validation of large~ |
| 4 | Desalination via application~ |
| 5 | Renovation of research~ |
| 6 | Establishment~ |
| 7 | Development of a climate~ |
| 8 | Reinforcing federal~ |
| 9 | Developing salt resistant crop |
| 10 | Smartfarms and innovations~ |
| 11 | Financing the advancement~ |
| 12 | Renovating education to ~ |
| 13 | Reinforcing Technical~ |
| 14 | Expansion of study abroad~ |
| 15 | Expanding regional STI capacity |
| 16 | Expanding problem solving ~ |
| 17 | Expanding Korea-Vietnam ODA~ |
| 18 | Implementation of science~ |
| 19 | Building the infrastructure~ |
| 20 | Devising policies to protect ~ |
| 21 | Preserving the biological ~ |
| 22 | Strengthening collaborative efforts ~ |
| 23 | Expanding the role of VKIST~ |

Numbers refer to policy instruments in the order listed previously



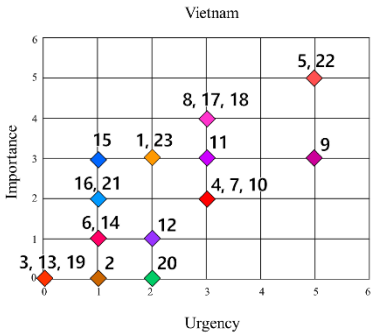
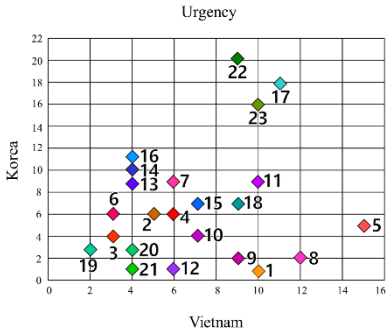




**Figure 9(a) Distribution of urgency and importance among policy instruments in the position of Korea responded by Vietnam experts**

**Figure 9(b) Distribution of urgency and importance among policy instruments in the position of Vietnam responded by Vietnam experts**

In contrast, the Vietnamese personnel 'Expanding Korea-Vietnam ODA specific to Mekong region,' 'Expanding the role of VKIST in government projects,' 'Strengthening collaborative efforts between the Korean and Vietnamese research facilities.'



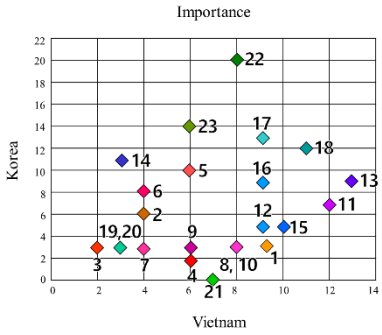




**Figure 10 (a) Perceptions of Korean expert on the difference in urgency from the perspective of Korea and Vietnam**

**Figure 10 (b) Perceptions of Korean expert on the difference in importance from the perspective of Korea and Vietnam**

According to the responses of Korean associates, "Financing the advancement of regional industries," "Reinforcing Technical and Vocational Education and Training (TVET)," and "Expanding problem solving programs by facilitating collaborative efforts with international organizations" are deemed to be of pressing matters while Vietnamese associates see those issues as less urgent. Instead, the Vietnamese personnel considers "Renovation of research facilities to strengthen climate change monitoring and prediction" and "Reinforcing federal and local government response to climate change" to be of higher priority, which was contrary to the evaluation of the Korean associates.

When comparing how the two groups' policy instruments, it seems that the Vietnamese group tends to prioritize practical needs while the Korean group tends to give more weight to intent and rationale.

Table 7 shows the Interview result for policy recommendation. In considering the resolution of issues that affect the Mekong Delta by the implementation of science and technology, experts were consulted in order to set both a short-term plan and a long-term plan. Based on the above research results, the Mekong Delta region was consulted by experts to solve the problem with scientific and technical factors. The proposal was compiled in the form of a proposal for a project to solve science and technology with the target year of 2030 in the short term and 2050 in the long term.

**Table 7 Interview result for policy recommendation**

| Project | 2025 milestone | 2030 milestone | 2050 milestone |
|---|---|---|---|
| Application of region-tailored environmentally friendly methods for preventing sea level rise | 10% decreases from current levels | 30% decreases from current levels | 50% decreases from current levels |
| Utilization of solar energy for deslation; development and application of a small-scale desalination system | Localization of Buoyant Membrane Distillation technology | Application of localized technologies to other regions | Application of localized technologies to other regions |
| Development of a filtration membrane to desalinate groundwater to remedy water crisis | Localization of PV panel integrated BWRO water treatment fabrication based desalination | Application of localized technologies to other regions | Application of localized technologies to other regions |
| Utilization of satellite images to strengthen climate change response | development of a satellite based disaster alert | Application of alert system in villages | Expansion of alert system to national level |
| Strengthening climate change response and pursuing climate neutral policies | Implementation of pilot projects | Expansion of Sustainable Development Goals | Expansion of Sustainable Development Goals |
| | 20% reduction in $CO_2$ emission/20% increase in energy efficiency | | |
| Advancement of agricultural sector | Cultivation of salt resistant crops | | |
| | Development and management of seawater greenhouses | | |
| | Automation of agricultural production | optimization of smart farms using big data | Development of AI-based a plant factory |
| Advancement of Fishing Industry | Incorporation of state of the art technology for quality control and improved preservation | | |
| Strengthening the quantity and quality of education and inducing the settlement of local talent to strengthen industrial and regional innovation capabilities | Develop and implement a TVET curriculum tailored to the needs of businesses and society and a teacher education system, Global training of next-generation talent, Expand education for local technical research officials | | |

| | | | |
|---|---|---|---|
| | Expanding the role of international organizations to strengthen their industrial and regional innovation capabilities<br>Strengthen the Korea-Vietnam ODA Program | | |
| Smart village organization | Conduct a pilot project in 13 provinces | Building Smart Villages by 13 provinces | Smart Villages expansion by 13 provinces |
| Urban-Rural cooperative model development & application | Urban-Rural cooperative model Implementation of pilot projects with Can Tho | Construction of Urban and Rural Cooperation Model with Cities Near Ho Chi Minh City | Expanding Urban and Rural Cooperation Models with Cities in Southern Vietnam |
| Establishing and promoting a mid- to long-term master plan for sustainable ecological environment | Reduced pollution load by pollution inventory<br>Reduce by more than 50% | Mekong River pollution Load at 50%+ | Growth rate of ecological conservation resources above 30%/ concurrent economic growth rate above 6% |
| Conservation of Mekong Biodiversity | Identifying the risk factors of biodiversity in the Mekong River using satellite image data | Biodiversity of the Mekong River Using Satellite Imaging Data | Map habitat and analyze 3D structure using LiDAR |
| Expansion of investment to strengthen regional innovation capabilities | Expand regional innovation investment to 150% of the current level | Expand regional innovation investment to 200% of the current level | Continuous Expand |
| Expansion of entities for Regional Innovation Tecchnology research | Expansion of specialized industrial, academic, and research innovation entities | Mekong Delta Innovation Cluster (Mekong Delta Innovation Triangle, Mekong Innovation Delta) frame propulsion | |
| Establishment of Regional Joint Science and Technology Information System | Establishment of Information System for Mekong Delta Innovation Program Management | Establishment of Integrated Science and Technology Information System in Mekong Delta Region | |
| Establishment of Regional Innovation Governance | Establishment of an organization dedicated to science and technology innovation in one or more provinces (CTnThh) and five or more provinces | | |

## V. Conclusion

As a result of this study, we have identified policy issues in the Mekong Delta region that Landslide mitigation and adaptation to rising sea levels issues, water scarcity propagated by increasing salinity issues, monitoring and predicting climate change issues, Urgent issue of agriculture sector countermeasures against desalination issues, Advancement of industrial structure and Regional Innovation issues, Improving quality of life for residents issues, Expanding infrastructure to accommodate urbanization and expectant migrants issues, Preserving the ecosystem and biological diversity issues, and Facilitating international cooperation to solve local issues.

To solve these problems, policy instruments were reviewed and in considering the resolution of issues that affect the Mekong Delta by the implementation of science and technology, and in order to establish both a short-term plan and a long-term plan. The results of this study are expected to be used not only as a guideline for expanding cooperation between Korea and Vietnam, but also to supplement the master plan supported by ODA or others. In addition, it is significant that VKIST, a symbol of the Korea-Vietnam cooperation project, presented a basis and intervention method to contribute to solving Vietnam's Mekong Delta problem.

This study was able to derive policy issues in the Mekong Delta region. The summaries of some resolutions of the issues that affect the Mekong Delta regions show that in-land slide and coastal erosion problems, saline and clean water shortages, and strong climate change monitoring and forecasting capacity, upgrading the structure of agriculture and fisheries, cultivation of industrial innovation and regional innovation capacity, preparation of living environment and urbanization and expansion of infrastructure, preservation of environment and ecology, and governance building to solve the Mekong problem and international Problems such as strengthening cooperation are very important. In order to solve these problems with the next research, the research of the solution and the establishment of a long-term master plan and roadmap are needed as follow-up studies. Our proposed guideline suggests an effective strategy for navigating the numerous challenges present in the Mekong Delta. We provide a policy instrument for RIS construction in the Mekong Delta Region. An AHP analysis based on expert opinions reinforces the model. Korea must build Regional innovation system oriented packages. Vietnam must target countries with strong leadership to be the beginning of scientific fundamental research in the mid to long-term view of the Mekong Delta region innovation system with Korea and to assess the master plan. Furthermore, the framework used in this study serves as a precedent of international collaboration. Therefore, it is

important for Korea to connect these roles in Korea and find domestic innovators to support Vietnam's national innovation system and regional innovation system in the Mekong Delta region and establish a cooperative system with VKIST. In addition, central government support measures should be devised to facilitate this process.

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