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Comparative Research on River Basin Management in the Sagami River Basin (Japan) and the Muda River Basin (Malaysia)

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Abstract: In the world, river basins often interwoven into two or more states or prefectures and because of that, disputes over water are common. Nevertheless, not all shared river basins are associated with water conflicts. Rivers in Japan and Malaysia play a significant role in regional economic development. They also play a significant role as water sources for industrial, domestic, agricultural, aquaculture, hydroelectric power generation, and the environment. The research aim is to determine the similarities and differences between the Sagami and Muda River Basins in order to have a better understanding of the governance needed for effectively implementing the lessons drawn from the Sagami River Basin for improving the management of the Muda River Basin in Malaysia. This research adopts qualitative and quantitative approaches. Semi-structured interviews were held with the key stakeholders from both basins and show that Japan has endeavored to present policy efforts to accommodate the innovative approaches in the management of their water resources, including the establishment of a river basin council. In Malaysia, there is little or no stakeholder involvement in the Muda River Basin, and the water resource management is not holistic and is not integrated as it should be. Besides that, there is little or no Integrated Resources Water Management, a pre-requisite for sustainable water resources. The results from this comparative study concluded that full support and participation from public stakeholders (meaning the non-government and non-private sector stakeholders) is vital for achieving sustainable water use in the Muda River Basin. Integrated Water Resources Management (IWRM) approaches such as the introduction of payments for ecosystems services and the development of river basin organization in the Muda River Basin should take place in the spirit of political willingness.

Keywords: water governance; stakeholder participation; Sagami River Basin; Muda River Basin

1. Introduction

Water is a fundamental element of life and plays a crucial role in regional economic development. There are also water sources for industrial, domestic, agricultural, aquaculture, hydroelectric power generation, and the environment. However, the pressure of an intensifying population, urbanization, water scarcity, and economic and political water-related issues are major contributors to water insecurity in the world. Worldwide, 286 transboundary river basins are shared by 2.8 billion people; these either cross or demarcate international political boundaries of two or more nations [1]. The shared river basins lead to either water disputes or co-operation, and examples of co-operation of shared river

basins can be seen in the Baltic and Red seas, the Rhine riparian states, and in the Danube basin [2]. Water disputes in the shared basin could lead to a higher risk of military action when there is water scarcity that is intertwined with a high demand for water due to domestic uses and needs [3].

Water governance is found at all levels of organizations from the international level to the local level, and it is comprised of all types of stakeholders from various sectors such as the government, the private sector, and civil society. Water governance is the management of water resources in the country by the authority on behalf of the citizens, and it is a makeup of political, social-economic, environmental, and administrative systems regarding the regulation of the development and management of water resources [4].

1.1. IWRM and PES

The two concepts of Integrated Water Resources Management (IWRM) and Payment for Ecosystem Services (PES) are becoming so common and evolved in the field of water governance that we tend to take them for granted without realizing that they could have distinct concepts [5]. In recent years, many countries have been implementing and practicing IWRM as a novel approach of water governance in their countries [6]. IWRM is an approach that encourages a more coordinated sustainable management of land and water resources to improve livelihoods among all water users [7]. Payment for Ecosystem Services (PES) as a concept in the context of IWRM is becoming increasingly popular and plays a significant role in promoting and improving the management of watershed goods and services [8–13]. Payment for ecosystem services (PES) is defined as a set of market-based environmental policy tools created to compensate the service provider that helps to secure environmental service provisions for the benefits of the users [14]. The payments could be in terms of cash, assistance, or materials. For example, PES is a concept initiated by Yokohama City in the Kanagawa Prefectures to overcome the inadequacy of the IWRM framework and to help in addressing the issues of the deterioration of forests and the delayed sewage treatment in the upstream watershed Doshi-mura that is in the Yamanashi Prefectures, as Yokohama relied fully on the water supply from the Doshi River [15]. PES can pave the way for much greater cooperation between both prefectures, economic integration, and sustainable river management practices. The effective PES scheme could create a symbiotic relationship between the user and the provider [16].

1.2. Research Aim and Research Questions

The research aim is to determine the similarities and differences between the Sagami and Muda River Basins and to examine the applicability of lessons drawn from the Sagami River Basin for the improvement of the management of the Muda River Basin in Malaysia. From this research, the challenges in existing water resources management in both countries and their adaptations in addressing the problems are highlighted. Both the Sagami River Basin and the Muda River Basin are compared, as these basins are shared between two prefectures/states, and both have attempted to incorporate the IWRM principle in their river basin management. The efforts of implementing IWRM in Malaysia included the incorporation of the Integrated River Basin Management (a subset of IWRM) in the water planning and development of the Ninth Malaysia Plan (2006–2010) and the National Physical Plan (2006–2020) [17].

In this paper, we will compare the river management in Japan and Malaysia and examine the applicability of lessons drawn from the Sagami River Basin for improving the management of the Muda River Basin in Malaysia; the three questions are addressed to the respective key stakeholders in both river basins:

1. Who are the key stakeholders relevant to the water resource governance in the Sagami River Basin and the Muda River Basin?
2. Which factors would support the successful implementation of the Integrated Water Resource Management (IWRM) in the river basin?

3. What are the PES lessons learned from the Sagami River Basin and how can they be applied to improve the management of the Muda River Basin in Malaysia?

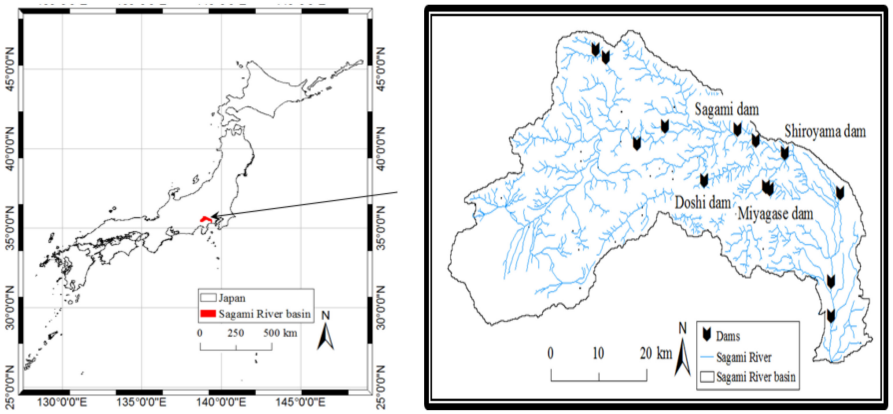
2. Study Area

2.1. Study Area 1: Sagami River Basin

Rivers in Japan are short, narrow, and steep, causing sharp hydrographs [18]. In Japan, rivers are sorted into three groups based on the River Law 1896; Class A rivers, Class B rivers, and locally designated rivers [19]. Class A rivers are managed by Minister of Land, Infrastructure, and Transport, whereas class B rivers are administrated by the prefectural government. Locally designated rivers are managed by the head of cities, towns, or villages, apart from Class A Rivers and Class B rivers [20]. Class A rivers are designated by Government Ordinance and are deemed economically valuable and worth conserving. Prefectural governors manage the Class B rivers, whereas the locally designated rivers are managed by the head of the cities, towns, or villages [19,20].

In the past, the purpose of the river law 1896 enacted in Japan was to control the flood and erosion due to the steep and short profiles of the rivers. Then, the River Law 1896 was further improved and amended in 1964 and changed to New River Law Act. The New River Law Act 1964 mainly focused on comprehensive river administration system for flood control, water use and environmental conservation, and restoration of the rivers in Japan [21]. Enforcement of the basic water cycle policy in 2014 focused on sound water cycle restoration to achieve sustainable forms of water use systems and socio-economic state in Japan [22]. In Japan, the strong local authority of the Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) takes full responsibility for the water resources management and development throughout Japan [23,24]. Strong local bureaucratic control of water sectors by MLIT continues due to the instability of Japanese government itself [25]. The instability of the Japanese government scenario has been caused by rapid changes in top political leadership (the position of Prime Minister) in 2009 and factionalism between political parties, which have led to the water sectors remaining under the control of MLIT [25].

Sagami River is a Class A river that is in Kanagawa and Yamanashi Prefecture and runs into Lake Yamanaka at Yamanashi Prefecture (Figure 1). The length of Sagami River Basin is 592 km with a drainage area of 1667 km^2 [26]. Sagami River which has its headwaters in Mt. Fuji, is located in central Honshu, Japan with a length of 109 km. The Sagami River flows from Lake Yamanaka, Yamanakako Village in Yamanashi Prefecture into Sagami Bay. Main tributaries of Sagami River Basin are Doshigawa (152 km), Nakatsugawa (140 km), Sasagogawa (93 km), Kuzunogawa (115 km), and Mekujirigawa (34 km) rivers. The total water sources for Yokohama City come from Sagami, Doshi, Banyu, Sakawa, and Kanagawa rivers, with total capacity of 1955.7 m^3 per day [27].



(**a**) (**b**)

Figure 1. Sagami River Basin in Japan (**a**) Sagami River Basin; (**b**) Dams in Kanagawa Prefectures.

Sagami Dam (multi-purpose dam), Shiroyama Dam, and Miyagase dam are three major dams within Sagami River Basin. The Sagami and Shiroyama dams are located on the main stream Sagami River in Sagamihara, Kanagawa Prefecture on the island of Honshū, Japan, while Miyagase Dam is a dam on Nakatsu River, the main tributary of the Sagami River in Aikō District, Kanagawa Prefecture on the island of Honshū, Japan (Figure 2). Miyagase Dam, Sagami Dam, and Shiroyama Dam are interconnected via Doshi and Tsukui Headraces for integrated operations to assure effective use of water resources at Sagami River Basin. In case of water shortages, the dams at the mainstream will be the first to supply the water. In view of the condition of the reservoir surfaces, once 30% of the capacities of the dams in the mainstream have been used, Miyagase Dam will start to supply the water through Shiroyama Dam. When water is in short supply, each dam supplies water based on its capacity.

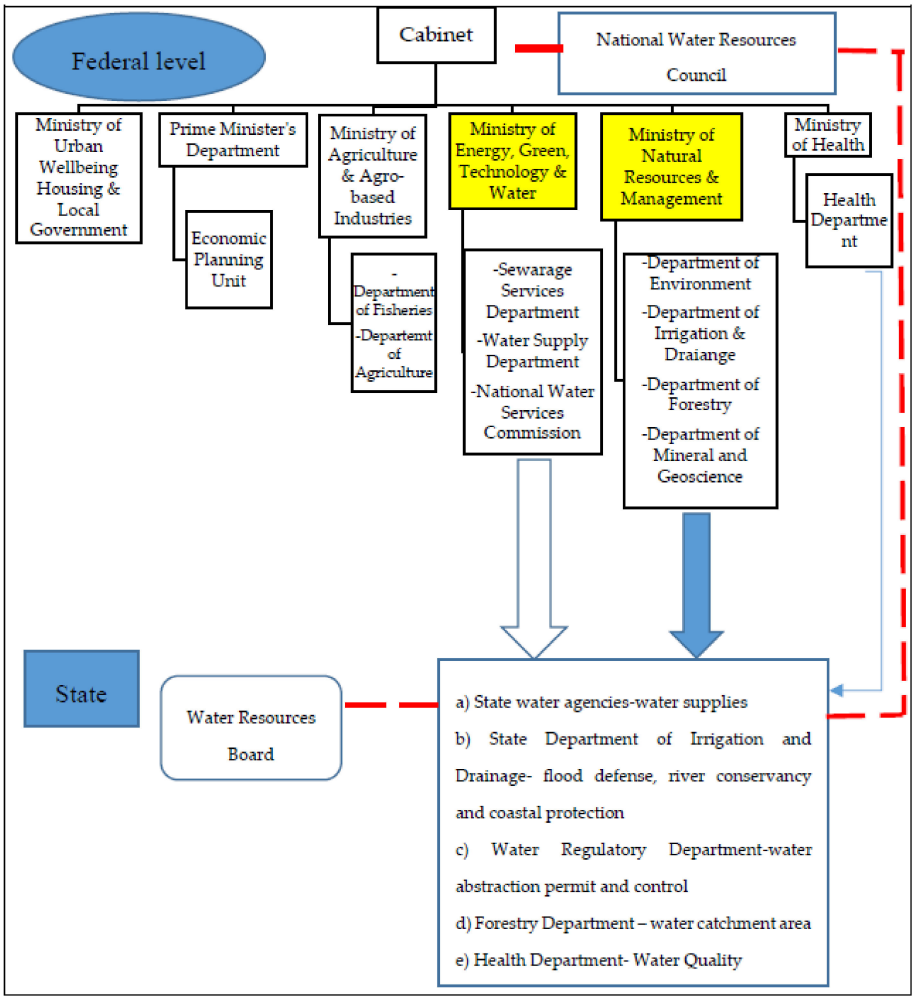


Figure 2. Institutional management of water resources in Peninsular Malaysia [27,28].

Table 1 shows Japan's water policies that are categorized into three parts: affairs, authorities, and main laws. Domestic water supply is under the supervision of Ministry of Health, Labor, and Welfare, whereas the quality and the environment of water are under the supervision of Ministry of Environment. Generally, water policies in Japan are still fragmented, except for the coordination among the central government and local governments during the drought/water shortages issues in Japan.

Table 1. Water Policies in Japan [28].

Concerned Organization	Tasks	Sub-Section	Main Laws
Ministry of Health, Labour, and Welfare	Water supply	• Water Supply Division • Health Service Bureau	• Waterworks Law • Law on Execution of Preservation • Water for Water Supply Project
Ministry of Agriculture, Forestry, and Fisheries	• Water use for agriculture • Water conservation • Forest	• Rural Development Bureau • Forest Agency	• Land Improvement Act • Forest Law
Ministry of Economy, Trade, and Industry	• Industrial water supply • Hydropower	• Industrial Facilities Division, Economic and Industrial Policy Bureau • Agency of Natural Resources and Energy	• Industrial Water Law • Industrial Water Supply Business Law • Electric Power Development Promotion Law
Ministry of Land, Infrastructure, and Transport (MLIT)	• Sewerage • Rivers, water resource facilities • Comprehensive and basic policies for water supply and demand, reservoir area	• Sewerage and wastewater management development, city and Regional Development Bureau • River Bureau • Water Resources Department, Land and Water Bureau	• Sewerage Law • River Law • Specified Multipurpose Dams Law • Water Resource Development Promotion Law • Water Resources Development Public Corporation Law • Law Concerning Special Measures for Reservoir Areas
Ministry of Environment	• Water quality, environmental conservation	• Water Environment Department, Environmental Management Bureau	• The Basic Environmental Law • Water Pollution Control Law

2.2. Study Area 2: Muda River Basin

In Malaysia, river basins often fall into two or more states, and each state often manages its own territory. Malaysia has only used the Top-Down, Government-centric Model in the management of rivers. Using the top-down approach, each state government in Malaysia possesses the authority to make its own decisions about river management issues without any kind of consultation with the public [29,30]. The top-down approach is ineffective in controlling water pollution, as 97% of water supply in Malaysia is mainly from rivers [31]. Overlapping tasks and fragmented river basin management have caused

inefficient water supply systems and conflicting responsibilities among federal, state, and local institutions, as there is no single organization or committee entrusted with the overall responsibility of managing the Muda River Basin [32–34]. As seen in Figure 2, water resources in Malaysia are managed by two different ministries. The Ministry of Natural Resources and Environment (NRE) in Malaysia mainly deals with raw water and water policies, whereas the Ministry of Energy, Green Technology, and Water (KeTTHA) oversees the treated water. The 'departmentalism' [35] between these ministries in water resource management has resulted in inefficient water management. Kedah and Penang states are all interconnected by shared water resources, and together they are facing major water problems.

Muda River is situated in the northwestern part of Peninsular Malaysia, and it is the longest river in the state of Kedah. Ketil River (868 km), Sedim River (626 km), and Chepir River (335 km) are the three main tributaries of Muda River system. Muda Dam, Pedu Dam, Ahning Dam, and Beris Dam are four major dams within Muda River Basin (Figure 3). The length of Muda River is 180 km, and it has a drainage area of 4210 km^2. The upper and middle reaches of the basin belong to the Kedah state, and the 30 km river downstream forms an inter-state boundary between Kedah and Penang. Both states have the right to use water from the Muda River. The Muda River is used for irrigation of rice cultivation, as well as a navigation canal for local fishing boats, especially around the river mouth [36,37]. Muda River is one of the most important water resources for agriculture and water supply for Kedah and Penang.

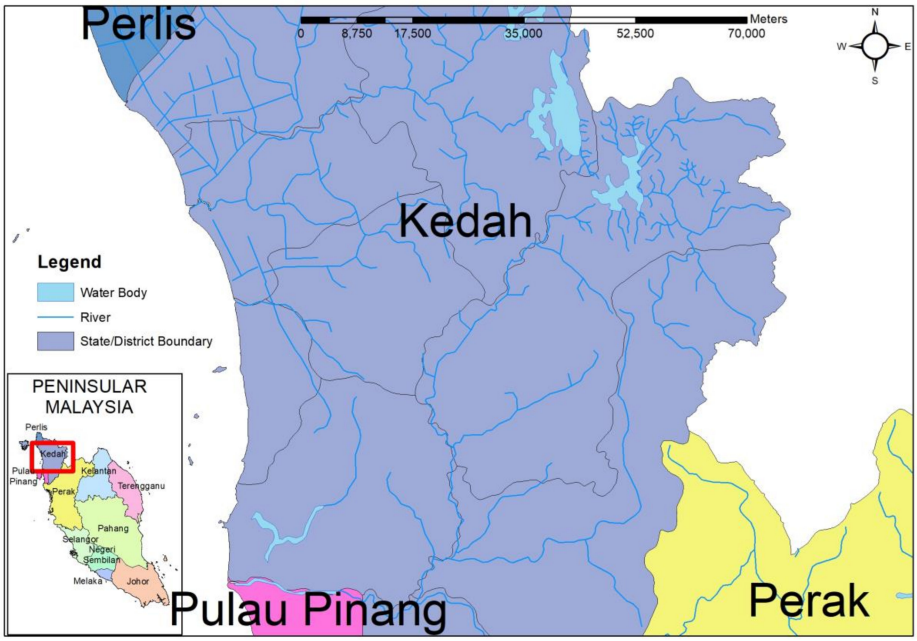


Figure 3. Muda River Basin.

The 160,000 hectares Ulu Muda forest, located in the north-eastern corner of Kedah, provides an invaluable environmental service to northern Peninsular Malaysia through its function as a water catchment area for three large man-made lakes, namely the Muda, Pedu, and Ahning dams.

The state governments in Malaysia are accountable for the development, operation, and maintenance of natural resources, including water supplies (Figure 4) [31,38]. Federal government is responsible for providing soft loans to state governments for public water supply infrastructure and grants for rural water supply development, as water is essential for the socio-economic evolution of the nation [39]. River basins in Malaysia often fall into two or more states, and because of that, disputes over water issues are inevitable, as some states in Malaysia are water-poor states, and some are water-rich states. Building of dams and water use of upstream countries has always had an impact on downstream water availability and, in some cases, it might lead to increased water scarcity in downstream part of a basin.

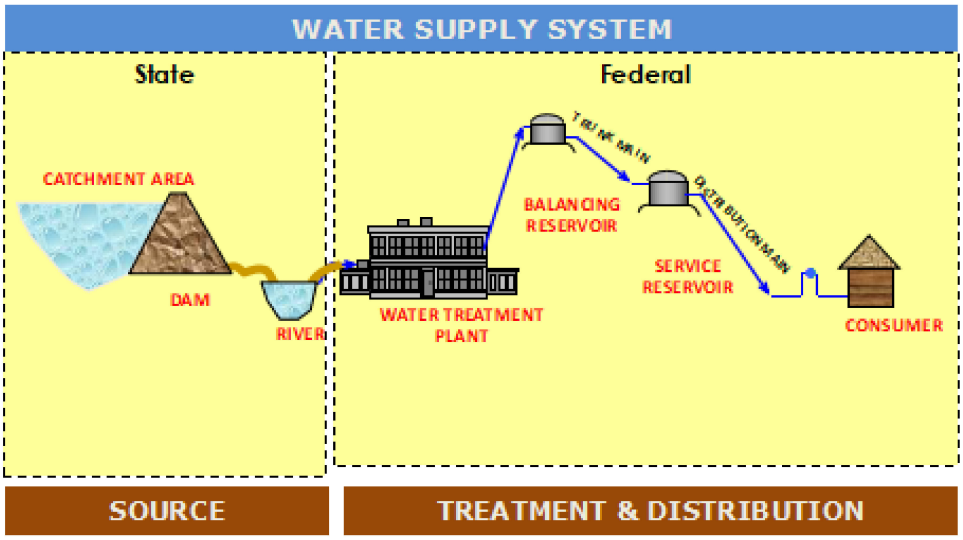


Figure 4. Water management in Malaysia [40].

2.3. Features of the Selected Basins

As can be seen in Table 2, Sagami River Basin and Muda River Basin were chosen, as both are important watersheds and have at least some degree of variation, including at least one case in which flow variability has led to conflict, as required by intensity sampling [41]. It also showed some differences in terms of geographical location and status of the economic condition in studied area, expected climate change impacts, existence and design of transboundary regime and its institutions for a joint body or river basin commission, existence of flexibility mechanisms in the transboundary or treaty agreement, and the success of the basin in dealing with past flow variability.

Table 2. Water Policies in Japan and Malaysia [28,40].

Basin	Riparian Prefectures/States	Status of Countries	Climate	Impacts of Climate Changes (I) and Adaptations (A)
Sagami	Yamanashi and Kanagawa, Japan	Developed	Temperate, warm	I: Floods A: Sagami river basin had a transboundary agreement and appointed river basin commission with intervention from strong top-down management from central government. There is a collaboration between the prefectures, disaster reduction strategy using software and hardware measures, and conversion of environment-focused river management and maintenance
Muda	Kedah and Penang, Malaysia	Developing	Tropical, equatorial	I: Floods, dry season (from early March till the end of June 2016, Malaysia experienced dry season resulting from El-Nino and equinox phenomena, leading to a reduction of water in dams, rivers, and other water resources) A: Basin has treaty agreement, which is rather weak in terms of environmental protection at the upper stream. There are joint studies and impact assessments, but these are weakened by fragmented functions, as local agencies manage their own territories

3. Materials and Methods

Case study approach has become popular in social research [42,43]. This is an intensive exploratory study, which is a means for learning about certain outcomes and clarifying the understanding of a problem—stakeholders' participation in sustainable water resource management in Sagami and Muda river basins. Case study approach allows researchers to integrate qualitative and quantitative data for the study to attain valuable, in-depth knowledge of particular event [44]. This research is mainly focused on qualitative data collection techniques and analysis procedures. This research was conducted by applying qualitative methods, consisting of semi-structured interviews, observations, and field notes. A semi-structured interview is used, as they are generally organized with open-ended questions with self-generation questions emerging from the conversation or dialogue between interviewer and interviewee/s [45]. It is insightful as it allows the researcher to understand people's perceptions, the definition of situations, and interpretations of reality, which capture the interviewees' points of view [46]. The open and semi-structured interviews allow the key respondents room to express themselves and are not limited in the amount of information they share. Observations and field notes are secondary methods that also produce qualitative data. We conducted face-to-face interviews with key stakeholders from the central government, state, or prefectural government, non-governmental organisations (NGOs), industries, and local citizens to get an insight into different events and also to collect their opinions. Moreover, we reviewed the policy documents from the government and NGOs, and reports from research organizations, journal papers, and news reports, as part of our secondary data collection to complement the primary data.

Transect walks are defined as community-based environmental assessments [47]. A total of four interviews were carried out while walking to and within the headwater of Muda River Basin (Ulu Muda forest), wildlife cruise, and saltlicks visit along the Muda River and Beris Dam (one of the dams in the Muda River Basin). A total of two interviews were conducted during the site visit to Doshi-mura (headwater of Sagami River Basin) and Miyagase Dam. Each visit is necessary for us to collect the published material about both basins. After each visit to the basins, we combined our observations, field notes, and notes from interviews, revisited and reviewed the basin reports, and made a compilation of working papers summarizing and analyzing each basin [48,49] to better understand the research problems and enhance the completeness and significance of the information compiled in the study area.

3.1. Selection of Target Group

The target groups of managers of the Sagami River Basin and Muda River Basin include the stakeholders from agriculture, fishing industry, experts, NGOs, and local citizens. The determination and classification of key stakeholders that are affected or have an influence on policy-making in the study area can be conducted using snow-ball sampling, experts or other stakeholders, self-selection, semi-structured interviews, or combination of the listed methods. The first participant to be interviewed was selected using purposive sampling (also known as judgmental sampling). This technique was used to identify and select the information-rich cases for the most effective use of limited resources, such as during financial and constraints and to get insightful information required in research [50]. The purposive sampling method targets a selection of participants due to specific nature of their qualities, meaning that they have knowledge or skills in the field of research [51]. The people selected using the purposive sampling method were the director of the government authorities, the manager of the NGOs, and chief executive officer (CEO) of the water companies. They are concerned and will be in the best position to provide responses and assign a relevant member to participate in the semi-structured interview. For qualitative studies, purposive sampling can be very useful, as key informants are chosen to inform on the research questions studied [52].

The snowball sampling technique often follows purposive sampling in explorative research and was applied by requesting the interviewees to select or suggest other potential acquaintances participate in the interview. Snowball sampling is defined as a technique for selecting research

respondents in a network, where it begins with one or a few people [53]. It is also one of the techniques that is used to identify new potential stakeholders throughout the study tenure until a theoretical saturation level is achieved [54]. Thus, purposive and snowball sampling techniques were used to select the key stakeholders in both basins.

3.2. Data Collection

To address the first research question regarding the key stakeholders relevant to water resource governance in Sagami and Muda River Basins, we use the snowball sampling technique, which follows purposive sampling to identify the relevant stakeholders for this research (Table 3). Qualitative research methods using open and semi-structured interviews with key stakeholders were conducted from following sectors, as shown in Table 3.

Table 3. Key stakeholders in Sagami and Muda river basins.

Sectors	Sagami River Basin	Muda River Basin
National Level	• Ministry of Land, Transport, and Infrastructure • Ministry of the Environment • Ministry of Health, Labor, and Welfare • Ministry of Economy, Trade, and Industry • Ministry of Agriculture, Forest, and Fisheries	• National Water Services Commission • Muda Agricultural Development Authority (MADA) • Department Forestry Kedah • Fisheries Department of Kedah • Department of Irrigation and Drainage Kedah and Penang
Prefectural/state government	• Yamanashi and Kanagawa Prefectural government (Yokohama City) • Katsuragawa-Sagamigawa River Basin Council	• Penang and Kedah state
Environmental NGO	• Citizens' Networking Sagamigawa (CNS)	• Friends of Ulu Muda (FOUM II)
Water supply agencies	• Yokohama Waterwork Bureau	• Penang Water Supply Corporation • Syarikat Air Darul Aman Sdn Bhd (SADA)
Industry	• Yokohama–Kanagawa industrial belt	• Kulim Hi-Tech Park • Bayan Lepas Free Industrial Zone
Tourism	• Tourists—local or international	• Tourists—local or international
Local	• Residents of Yamanashi and Kanagawa Prefecture, farmers, fishermen	• Residents of Penang and Kedah state, farmers, fishermen

Data collection started from August 2015 till mid December 2016 from baseline study of "Yokohama Urban Solutions Study Program (YUSS)" and individual survey research. The YUSS

is the 10-week-long study course that we participate in as part of our research. During the baseline study, we interviewed fourteen organizations, and seven of them were managers of the Sagami River Basin. From early August 2015 till August 2016, semi-structured interviews with twenty-three individuals involved in various aspects of water governance in Muda River Basin (Malaysia) were conducted, and about seven interviews were conducted directly in the Sagami River Basin (Japan) with key stakeholders during the period from end of October till end of December 2016. The first author participated in Penang Green Agenda 2017 Workshop organized by Penang Institute to get an insight into the water governance in Penang. The target groups included the managers of the river basin, NGOs, officers from the government (state and federal), and industry. Interviews were audio-recorded with permission from the key respondents and transcribed immediately following interviews.

3.3. Data Analysis

Interviews were conducted directly in both Japan (Sagami River Basin) and Malaysia (Muda River Basin) during the period between early August 2015 and the end of December 2016. The target groups from representatives of an organization that participate are the managers of the river basin, NGOs, and officers from government and private sectors. The data from semi-structured interviews with key stakeholders were organized, sorted, triangulated, and compared in a way to establish the quality of the information [55]. This data analysis consists of identification, coding, and pattern categorization found in the data. In the data analysis, we need to interpret the data for better understanding of what we have gained from study areas. The coding technique involves grouping or breaking down data into components and parts, and then linking the different ideas and themes to one another [56–58], as shown in Table 4. All interviews were recorded and then transcribed using Microsoft Word before interview transcriptions were exported into NVivo 11 Pro, a qualitative data analysis software package that helped to arrange the analytical procedures and facilitate storage and management of large data collected (interview transcripts, video, reports, and minutes). The interviewee presented as 'CSRB 1' means that the candidates at the Sagami River Basin were interviewed in numerical order 1 (C = Candidate, SRB = Sagami River Basin). Similarly, 'CAMRC 2' represents candidates at Muda River Basin in an interview schedule order of 2.

Table 4. Category codes for analysing organisation interview data.

Code	Information	Category Code
1. Basin Description	- Sagami River Basin (SRB): length, width, catchment areas, and tributaries - Muda River Basin (MRB): length, width, catchment areas, and tributaries	- 1.1 - 1.2
2. River governance	- SRB: strong top-down - MRB: weak top-down	- 2.1 - 2.2
3. Limitations to implementation IWRM	- No limitations - Financial - Fragmented responsibilities	- 3.1 - 3.2 - 3.3
Willingness to participate in PES	- Conservation of watershed at the headwater - Opinion: yes or no	- 4.1 - 4.2 A, 4.2 B

We are using the three broad tasks in qualitative analysis process proposed by using data reduction, data display, and conclusion drawing (see Figure 5) [59]. Data reduction is defined as the procedure of choosing, focusing, simplifying, abstracting, and altering the interview transcripts. The summary of the data is then sorted and organized in data reduction. One of the important tools used in data reduction is code systems. Data display is an organized and compressed assembly of collected data. It makes the compressed data easily accessible. Matrices and networks are 'two main categories of displays for qualitative data.' A matrix consists of series of rows and columns that can be based on codes, evaluation questions, chronology, or other themes extracted from the data. In the section of conclusion drawing, testing the meanings emerging from the data for their likelihood and for whether they can be confirmed is the verification procedure. There are three types of strategies that can be used to test the analysis and conclusion such as looking for an alternative or for competing subjects, reviewing outliers, and triangulation or cross check. Each sorted category document was then scrutinized for trends and areas of unity, diversity, and controversy, and the data bits within each sorted category were split and spliced together to further aid analysis.

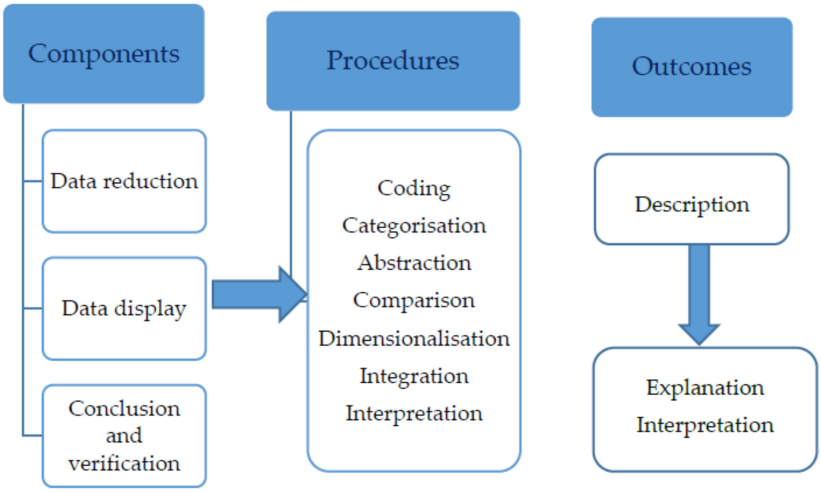


Figure 5. The Qualitative Analytical Process [59,60].

4. Results and Discussion

Returning to the second research question, we discuss factors that prevent or support the successful implementation of IWRM in river basins (Table 5). In the Muda River Basin, there appears to be a factor that prevents the implementation of successful IWRM due to a limited degree of regulatory responsibilities. Penang state does not have the power or control to set the regulations and enforce them in terms of protection of the Ulu Muda forest in the upper stream of Muda River Basin, as the headwater is in Kedah state, and the management of Ulu Muda solely belongs to Kedah. The lack of financial resources can be seen in the case study in Kedah due to the status of Kedah as the rice bowl of Malaysia [61], and because of that, the state is less developed compared to Penang state. Conflicts of interest can be observed in both states. This is due to the decentralization of water policy implementation and management in Malaysia, and there are several agencies and departments at all levels (federal, state, and local) involved in implementation and development of water resource policies at both the state and local level, causing fragmented and overlapping roles among the institutions. Lacking participation from public stakeholders is identified as one of the obstacles, as there appears to be a negative relationship between participation from public stakeholders and transparency as each state government in Malaysia holds the authority to make its own decision on river management issues without any kind of consultation with the public, and information was not easily accessible to the public.

Table 5. Co-operation or obstacles in Sagami and Muda river basins.

Prefectures/States	River Basin	Sector	Obstacles	Co-Operation
Yamanashi (Y)-Kanagawa (Ka), Japan	Sagami	Water	Not Applicable	Y & Ka: PES scheme in terms of exchange of assistance in managing in watershed Doshi-mura to overcome inadequacy of IWRM framework
Kedah(K)-Penang (P), Malaysia	Muda	Water	K: Lack of financial resources P: Degree of regulatory responsibilities K & P: Conflicts of Interests	Not Applicable

Table 6 shows the fundamental differences in water governance between Sagami River Basin and Muda River with the physical description of the river basin, key stakeholders involved, water governance model, and practices of preserving the headwater by the introduction of payment of ecosystem services and river basin council.

Table 6. Comparisons of Sagami River Basin and Muda River Basin.

Descriptions	Sagami River Basin	Muda River Basin (Adaptation Measures)
Features of Basin	• Sagami River Basin has a drainage area of 1667 km^2 • Mt Fuji is the headwater of Sagami River.	• The length of Muda River is 180 km, and it has a drainage area of 4210 km^2 • Ulu Muda forest is the headwater of Muda River basin
Transboundary	• Kanagawa Prefecture and Yamanashi Prefecture	• Penang and Kedah state
River basin council	• Establishment of Katsura-Sagami River Basin council	• No river basin council
Stakeholders	• Primary stakeholders: (a) Citizens of Yamanashi and Kanagawa Prefecture (Yokohama City) (b) Farmers (c) Fishermen (d) Yokohama Waterwork Bureau (e) NGO (f) Industrial (g) Tourism • Secondary stakeholders: (a) Ministry of Land, Transport, and Infrastructure (b) Ministry of the Environment (c) Ministry of Health, Labor, and Welfare (d) Ministry of Economy, Trade, and Industry (e) Ministry of Agriculture, Forest, and Fisheries	• Primary stakeholders: (a) citizens of Penang and Kedah (b) farmers (c) fishermen (d) Penang Water Supply Corporation (e) Syarikat Air Darul Aman Sdn Bhd (SADA) (f) NGO (g) industrial (h) tourism • Secondary stakeholders: (a) National Water Services Commission (b) Muda Agricultural Development Authority (MADA) (c) Department Forestry Kedah (d) Fisheries department of Kedah (e) Department of Irrigation and Drainage Kedah and Penang
Water governance model	• Strong top-down policy and government investment of Japan	• weak top-down policy and government
Payments for ecosystems services (PES)	• Yamanashi prefectural: Mineral Water Tax • Kanagawa Prefecture: Forest Conservation Tax • Yokohama City: Green Tax	• None

There were two diverse types of water governance model: Sagami River basin has the powerful Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) that makes decisions about the water sector in the whole of Japan, whereas in the Muda River Basin, weak top-down policy and governance

is observed due to fragmented institutions with no identifiable core role, and there is a notable absence of strong coordination amongst institutions.

Establishment of Katsura-Sagami River Basin council was to foster partnerships between Yamanashi and Kanagawa Prefectures for clean water and to improve 50 fish species and biodiversity, and the quality watershed, in the Sagami River Basin. Agenda 21 was formulated and adopted through the partnership between Yamanashi and Kanagawa Prefectures including local governments, private sectors, NGOs, and citizens from both upstream (Katsura River) and downstream (Sagami River). The original initiative of the Council is to improve the water quality along the Katsura-Sagami River Basin. The depletion of the quality of the river basin started in the 1980s due to rapidly increasing demands from both domestic and industrial with the growth of population and economy. "Clean Campaign" and the "Upstream/Downstream Exchange Project" were initiated by both governments in Kanagawa and Yamanashi Prefectures to educate the local community about the importance of the river and the protection of the river [62]. However, in Muda River Basin, there is no river basin council. There is no co-ordination of water policy-making between the state government, the federal government, and other local stakeholders, as water is a state matter.

Now moving on to the final research question: What are Payments for Ecosystem Services (PES) lessons learned from the Sagami River Basin and how can they be applied to improving the management of the Muda River Basin in Malaysia? In many prefectures in Japan, the payment schemes for ecosystem services have been implemented by both local governments and companies to manage the forest in the upper watershed [63]. To protect and restore the forests and water catchment areas to secure their water resources, Yamanashi Prefectural government and Kanagawa Prefectural governments have implemented Mineral Water Tax and Forest Conservation Tax, respectively. The local government from Yokohama City introduced Green Tax to secure and sustain the quantity and quality of water at the Doshi headwater at Yamanashi Prefecture to secure the safe and continuous supply of drinking water for citizens in Yokohama, as one-third of Doshi village (2873 ha) is under Yokohama City's Water Conservation Forest. Staff from Water Resource Forest Management Office (CSRB 1) shared the important components of successful Watershed Payment for Ecosystems Services schemes implemented by Yokohama City in Kanagawa Prefecture such as:

- a legal and institutional framework to ensure sustainable and predictable funding from beneficiaries (Yokohama City in Kanagawa) to Doshi-mura in Kanagawa for managing the forests at the upstream of Sagami river basin;
- institutional and technical capacity to implement proper forest management;
- benefit sharing with local communities to support their livelihoods and ensure their contribution to forest management;
- the promotion of awareness-raising among beneficiaries (citizens of Kanagawa, especially citizens of Yokohama, as 80% of the city comes from headwater that is located at the forest of Doshi-mura) of the environmental services provided by Doshi-mura forest in Yamanashi.

In Malaysia, the PES schemes have not yet been developed at the policy level for the management of Muda River Basin and other river basins in Malaysia, as the states have not reached an agreement (staff member of Water Regulatory Department). The upper part of Muda River Basin is Ulu Muda forest reserve, an important headwater source for both Kedah and Penang states. The management and conservation of the Ulu Muda forest reserve represent a top-down approach and are focused only on targeted activities such as tourism and irrigation schemes for the farmers. Residents of Penang state who are living downstream are enjoying the ecosystems services provided by the Ulu Muda forest reserve and the conservation efforts provided by the people living upstream of Muda River Basin. Logging and deforestation in Ulu Muda forest reserve will directly impact the natural ecosystem services, which include provisioning services, regulating services, cultural services, and supporting services. The Sagami River Basin PES scheme provides many lessons that the Muda River Basin can adopt for the establishment of PES in Muda river basin.

5. Conclusions

Our findings contribute to an understanding that collaboration has been unsuccessful between the national government, local government, the private sector, and civil society (farmers, residents, and NGO) in the management of the Muda River Basin. The Muda River Basin in Malaysia is faced with increasing problems regarding the deterioration of water quantity and quality for many reasons, including logging threats causing sedimentation and pollution. Although civil society and NGOs are actively pushing for the conservation and restoration of this river, there is poor cooperation between federal and state governments, little support from the private sector, lack of funds, public apathy, and, most of all, lack of stakeholder involvement. The findings indicate that Penang and Kedah state are willing to receive financial support from the federal government to invest in PES to conserve and preserve the watershed of the Muda River Basin. However, no amicable agreement has been reached between the disputes states and the federal government regarding the PES. On the other hand, the Sagami River Basin management is an example of good river management that the state government of Kedah, which manages the Muda River Basin, could use as a guide to ensure sustainable management of this river. Successful implementation of the watershed PES approach in the Sagami River Basin between Kanagawa and Yamanashi Prefectures depends on careful scheme design, a benefit-sharing approach, and persistent trust-building to harmonize the Doshi-mura watershed for the benefits of the citizens from both prefectures. However, the decentralized and fragmented responsibilities among the organizations in involved in Muda River Basin management remains a challenge to IWRM and the PES approach with regard to water management.

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References

1. UNEP, UD. *Transboundary River Basins: Status and Trends*; United Nations Environment Programme (UNEP): Nairobi, Kenya, 2016; Available online: http://www.geftwap.org/publications/river-basins-spm (accessed on 10 April 2018).
2. Sadoff, C.W.; Grey, D. Beyond the river: The benefits of cooperation on international rivers. *Water Policy* **2002**, *4*, 389–403. [CrossRef]
3. Gleditsch, N.P.; Furlong, K.; Hegre, H.; Lacina, B.; Owen, T. Conflicts over shared rivers: Resource scarcity or fuzzy boundaries? *Political Geogr.* **2006**, *25*, 361–382. [CrossRef]
4. De Stefano, L.; Svendsen, M.; Giordano, M.; Steel, B.S.; Brown, B.; Wolf, A.T. Water governance benchmarking: Concepts and approach framework as applied to Middle East and North Africa countries. *Water Policy* **2014**, *16*, 1121–1139. [CrossRef]
5. Cook, B.R.; Spray, C.J. Ecosystem services and integrated water resource management: Different paths to the same end? *J. Environ. Manag.* **2012**, *109*, 93–100. [CrossRef] [PubMed]
6. Hooper, B.P. Integrated water resources management and river basin governance. *Water Resour.* **2003**, *126*, 12–20.
7. Implementing Integrated Water Resources Management (IWRM): Based on Thailand's Experience. Available online: https://cmsdata.iucn.org/downloads/implementing_iwrm__rm_changes_130510___2_.pdf (accessed on 16 June 2016).

8. Berkes, F.L.; Folke, C.; Colding, J. *Linking Social and Ecological Systems: Management Practices and Social Mechanisms for Building Resilience*; Cambridge University Press: Cambridge, UK, 1998.
9. Folke, C.; Hahn, T.; Olsson, P.; Norberg, J. Adaptive governance of socioecological systems. *Annu. Rev. Environ. Resour.* **2005**, *30*, 441–473. [CrossRef]
10. Huitema, D.; Mostert, E.; Egas, W.; Moellenkamp, S.; Pahl-Wostl, C.; Yalcin, R. Adaptive water governance: Assessing the institutional prescriptions of adaptive co-management from a governance perspective and defining a research agenda. *Ecol. Soc.* **2009**, *14*, 26. [CrossRef]
11. Pahl-Wostl, C.; Sendzimir, J.; Jeffrey, P.; Aerts, J.; Berkamp, G.; Cross, K. Managing change toward adaptive water management through social learning. *Ecol. Soc.* **2007**, *12*, 30. [CrossRef]
12. Yashiro, M.; Duraiappah, A.; Kosoy, N. Chapter 10: A nested institutional approach for managing bundled ecosystem services: Experience from managing Satoyama landscapes in Japan. In *Governing the Provision of Ecosystem Services*; Rival, L., Muradian, R., Eds.; Springer: London, UK, 2013; pp. 191–206.
13. Schomers, S.; Matzdorf, B. Payments for ecosystem services: A review and comparison of developing and industrialized countries. *Ecosyst. Serv.* **2013**. [CrossRef]
14. Wunder, S. *Payments for Environmental Services: Some Nuts and Bolts, Center for International Forestry Research Occasional Paper No. 42*; Center for International Forestry Research: Bogor Barat, Indonesia, 2005.
15. Japan International Cooperation Agency (JICA). Japan's Experiences on Water Supply Development. March 2017. Available online: https://www.jica.go.jp/english/our_work/thematic_issues/water/c8h0vm0000ammj2q-att/activity_01.pdf (accessed on 30 October 2016).
16. Kagombe, J.K.; Kungu, J.; Mugendi, D.; Cheboiwo, J.K. Evaluating the Willingness to Pay for Watershed Protection in Ndaka-ini Dam, Muranga County, Kenya. 2018. Available online: https://www.researchgate.net/profile/Joram_Kagombe/publication/322861627_Evaluating_the_Willingness_to_Pay_for_Watershed_Protection_in_Ndakaini_Dam_Muranga_County_Kenya/links/5a732629458515512076cf23/Evaluating-the-Willingness-to-Pay-for-Watershed-Protection-in-Ndaka-ini-Dam-Muranga-County-Kenya.pdf (accessed on 1 April 2018).
17. Mokhtar, M.B.; Tan, K.W. *Integrated Water Resources Management in Malaysia: An Effective Institutional Framework*; Institute for Environment and Development (LESTARI), National University of Malaysia, UKM Bangi: Bangi, Malaysia, 2004.
18. Terakawa, A. Integrated flood management for urbanized river basin in Japan. In Proceedings of the World Water Forum: Local Actions for a Global Challenge, Mexico City, Mexico, 16–22 March 2006; pp. 1–36.
19. Nakai, M. The Outline of the River Law NARBO Associate, Asian Development Bank Institute. 2001. Available online: http://www.narbo.jp/narbo/event/materials/twwa03/tw03_09_01-2.pdf (accessed on 20 November 2016).
20. River Bureau of the Ministry of Land, Infrastructure, Transport, and Tourism Efforts to Prevent Urban Flood Disaster in Japan, 9 June 2008. Available online: http://www.mlit.go.jp/river/basic_info/english/pdf/conf_07.pdf (accessed on 27 May 2016).
21. World Water Assessment Programme (United Nations). Water: A Shared Responsibility (Volume 2). Berghahn Books. Available online: http://unesdoc.unesco.org/images/0014/001454/145405e.pdf (accessed on 19 September 2016).
22. Yoshimura, C.; Omura, T.; Furumai, H.; Tockner, K. Present state of rivers and streams in Japan. *River Res. Appl.* **2005**, *21*, 93–112. [CrossRef]
23. World Bank. Water Resources Management in Japan-Policy, Institutional and Legal Issues. In *Analytical and Advisory Assistance (AAA) Program, China: Addressing Water Scarcity, Background Paper 1*; The World Bank: Washington, DC, USA, 2006.
24. Ministry of Land and Transport. *Water Resources of Japan*; Ministry of Land and Transport: Tokyo, Japan, 2009.
25. Chakraborty, A. Developing Rivers: How Strong State and Bureaucracy Continue to Suffocate Environment-Oriented River Governance in Japan. *SAGE Open* **2013**, *3*. [CrossRef]
26. Latief, S.S. Water Supply and JICA's Role in Eastern Indonesia (3), Turn the Tap and Drink the Water. *Fajar Daily*. 15 November 2010. Available online: https://www.jica.go.jp/topics/2010/pdf/20101213_02_indonesia.pdf (accessed on 1 November 2016).
27. National Land Numerical Information Download Service Rivers, Basin Mesh, Dams, Elevation, Degree of Slope 5th Mesh Data. Available online: http://nlftp.mlit.go.jp/ksj-e/index.html (accessed on 22 May 2017).

28. Ministry of Land, Infrastructure, Transport and Tourism, Water Resources in Japan. 2008. Available online: https://www.mlit.go.jp/tochimizushigen/mizsei/water_resources/contents/policy.html (accessed on 30 October 2016).
29. Chan, N.W.; Ibrahim, A.L.; Hajar, A.R. The role of Non-Governmental Organisations in water resources management in Malaysia. In Proceedings of the Regional Symposium on Environment and Natural Resources, Kuala Lumpur, Malaysia, 10–11 April 2002.
30. Sim, L.M.; Chan, N.W.; Ao, M. Stakeholders' Participation in Sustainable Water Resource Management, Lessons from Tsurumi River for Muda River Basin. *New Water Policy Pract.* **2015**, *2*, 51–62.
31. Chan, N.W. *Pembangunan, Pembandaran Dan Peningkatan Bahaya Dan Bencana Air Di Malaysia: Isu, Pengurusan Dan Cabaran*; Penerbit Universiti Sains Malaysia: Penang, Malaysia, 2002.
32. Chan, N.W. A critical review of Malaysia's accomplishment on water resources management under AGENDA 21. *Malays. J. Environ. Manag.* **2004**, *5*, 55–78.
33. Ti, L.H.; Façon, T.G. Malaysia's Water Vision: The Way Forward-the Malaysian Water Partnership in From Vision to Action: A Synthesis of National Water Visions in Southeast Asia. In *The FAO-ESCAP Pilot Project on National Water Visions*; Food and Agriculture Organization of the United Nations: Bangkok, Thailand, 2002; pp. 25–42.
34. Rahman, S.A.; Khalid, R.M. Water Resource Management in Malaysia: Legal Issues and Challenges. *Int. J. Sustain. Dev. Plan.* **2009**, *4*, 258–264. [CrossRef]
35. Richards, D.; Smith, M. *Governance and Public Policy in the UK*; Oxford University Press: Oxford, UK, 2003.
36. Abidin, N.A.Z. Holistic Management of Water Resources in Malaysia, Water Supply Department, KeTTHA. 2015. Available online: http://www.mwa.org.my/pdf/bwwe2015/keynote/Keynote%201%20-%20Hj.%20Noor%20Azahari.pdf (accessed on 30 October 2016).
37. DID; JICA. Comprehensive Management Plan of Muda River Basin–Final Report. Government of Penang Gazette. 1995. Available online: http://open_jicareport.jica.go.jp/pdf/11253218_01.pdf (accessed on 1 October 2015).
38. Azhar, M. Managing Malaysian water resources development. *J. Kesihat. Masy.* **2000**, *6*, 40–58.
39. Abidin, R.Z.R.Z. Water resources management in Malaysia: The way forward. Presented at the Asia Water 2004, Kuala Lumpur, Malaysia, 30 March–2 April 2004.
40. Nor 'Aini Abdul Wahab. Overview of the Water Services Industry in Malaysia (Powerpoint Slides), Ministry of Energy, Green and Technology and Water, Malaysia. 2011. Available online: http://www.mlit.go.jp/common/000135515.pdf (accessed on 2 April 2016).
41. Yin, R.K. *Case Study Research—Design and Methods*; Applied Social Research Methods Series; SAGE Publications: Thousand Oaks, CA, USA, 2003.
42. Patton, M.Q. *Qualitative Evaluation and Research Methods*, 2nd ed.; Sage Publications: London, UK; New Delhi, India, 1990.
43. Thomas, G. A typology for the case study in social science following a review of definition, discourse, and structure. *Qual. Inq.* **2011**, *17*, 511–521. [CrossRef]
44. Wedawatta, G.; Ingirige, B.; Amaratunga, D. *Case Study as a Research Strategy: Investigating Extreme Weather Resilience of Construction SMEs in the UK*; School of the Built Environment, the University of Salford: Salford, UK, 2011.
45. Edwards, R.; Holland, J. What Is Qualitative Interviewing; A&C Black, 2013. Available online: http://eprints.ncrm.ac.uk/3276/1/complete_proofs.pdf (accessed on 7 April 2018).
46. Punch, K.R. *Introduction to Social Research: Quantitative and Qualitative Approaches*; Sage: Thousand Oaks, CA, USA, 1998.
47. International Union for Conservation of Nature. Indigenous Peoples and Sustainability. Cases and Actions. IUCN InterCommission Task Force on Indigenous Peoples. In *IUCN Indigenous Peoples and Conservation Initiative International Books*; IUCN: Utrecht, The Netherlands, 1997; p. 162.
48. Blomquist, W.; Giansante, C.; Bhat, A.; Kemper, K. *Institutional and Policy Analysis of River Basin Management in the Guadalquivir River, Spain*; Policy Research Working Paper; The World Bank: Washington, DC, USA, 2004.
49. Formiga-Johnsson, R.M.; Kemper, K. *Institutional and Policy Analysis of River Basin Management in the Jaguaribe River, Brazil*; Policy Research Working Paper; The World Bank: Washington, DC, USA, 2005.

50. Patton, M.Q. *Qualitative Research and Evaluation Methods*, 3rd ed.; Sage Publications: Thousand Oaks, CA, USA; London, UK; New Delhi, India, 2002.
51. Cresswell, J.W.; Clark, V.L.P. *Designing and Conducting Mixed Method Research*; Sage: Thousand Oaks, CA, USA, 2007; p. 273. Available online: https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1753-6405.2007.00097.x (accessed on 23 May 2018).
52. Sensing, T. *Qualitative Research. A Multi-Methods Approach to Projects for Doctor of Ministry Theses*; Wipf & Stock: Eugene, OR, USA, 2011.
53. Neuman, W.L. *Basics of Social Research: Qualitative and Quantitative Approaches*; Pearson Education, Inc.: Boston, NY, USA, 2004.
54. Sarantakos, S. *Social Research*; Palgrave Macmillan: London, UK, 2012.
55. Mikkelsen, B. *Methods for Development Work and Research—A Guide for Practitioners*, 2nd ed.; SAGE Publication: London, UK, 2005.
56. Bazeley, P. *Qualitative Data Analysis with Nvivo*; Sage Publication Inc.: Thousand Oaks, CA, USA, 2010.
57. Bryman, A.; Teevan, J.; Bell, E. *Social Research Methods*, 2nd ed.; Oxford University Press Inc.: Don Mills, ON, Canada, 2009.
58. Kvale, S. *Interview: An Introduction to Qualitative Research Interviewing*; SAGE Publications Inc.: Thousand Oaks, CA, USA, 1996.
59. Miles, M.B.; Huberman, A.M. *Qualitative Data Analysis: An Expanded Sourcebook*, 2nd ed.; Sage: Thousand Oaks, CA, USA, 1994; pp. 10–11.
60. Spiggle, S. Analysis and interpretation of qualitative data in consumer research. *J. Consum. Res.* **1994**, *21*, 491–503. [CrossRef]
61. Melissa, D.C. Kedah's Padi Hindering Progress. *New Straits Times*. 4 October 2016. Available online: http://www.nst.com.my/news/2016/10/177861/kedahs-padi-fields-hindering-progress?d=1 (accessed on 18 February 2017).
62. Himiyama, Y. *Regional Sustainable Development Review: Japan*; Eolss Publishers Co., Ltd.: Oxford, United Kingdom, 2009; pp. 237–242.
63. Hayashi, K.; Nishimiya, H. Good practices of payments for ecosystem services in Japan. In EcoTopia Science Institute Policy Brief; Revised in October 2010; Nagoya, Japan, 2010. Volume 1. Available online: http://www.esi.nagoya-u.ac.jp/eng/publications/ESI%20IGES%202011april%20re%20for%20web.pdf (accessed on 12 April 2018).