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# Flood Protection Investments in Indonesia, Japan, and the Philippines: A Comparative Analysis

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# **Flood Protection Investments in Indonesia, Japan, and the Philippines: A Comparative Analysis**

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## **Abstract**

This comprehensive study examines flood protection investments and the damage trends in Indonesia, Japan, and the Philippines over the past decades. Through a detailed analysis of budget allocation trends, damage patterns, and financing mechanisms in these countries, this research reveals varying approaches to flood protection investment and their effectiveness. The study highlights the importance of cost-sharing among national and local governments and local communities, offering insights into effective strategies for flood risk management in diverse economic and geographic contexts. By comparing each country's successes and challenges, this research aims to contribute to the global understanding of effective flood protection strategies and inform policy decisions in flood-prone regions worldwide.

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**Keywords:** Cost-sharing, Financial mechanism, Local community, Subsidy, Water Resource Management

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## **1. Introduction**

Flood protection remains a critical issue for many countries. Flood-prone countries need to make effective investments in flood protection measures as extreme weather events become more frequent and severe with climate change. This study focuses on three archipelago countries in the Asian monsoon area with significant flood risks—Indonesia, Japan, and the Philippines. The study aims to identify effective strategies and potential areas for improvement in flood risk management by comparing these countries' approaches to flood protection investments and flood damage trends. The diverse economic and geographic characteristics of these countries provide a context for understanding the challenges and opportunities associated with flood protection investments.

The study examines flood protection investments and damage across the three countries in terms of the absolute value and percentage of gross domestic product (GDP). It analyzes the correlation between investment and damage and surveys the financing mechanisms for flood protection in these countries. This study contributes to the broader discussion on climate change adaptation and disaster risk reduction, particularly in the context of water-related disasters.

## **2. Mobilizing financing for flood protection**

This section reviews key findings in the literature, highlighting the complexities of maintaining long-term investment, the potential of diverse funding sources, and innovative financing mechanisms.

Research examining practical data on investment and damage, as well as cost-sharing policies among different levels of government, has been limited. However, studies have shown that while national authorities often increase flood protection funding in the aftermath of significant flood events, they find it challenging to maintain high levels of investment over time because of external shocks such as war, economic recession, disaster, and tightened national finance. Ishiwatari and Sasaki (2021) identified cyclical patterns in flood protection investments, with the ratios of flood budgets and damages to GDP forming distinct investment cycles. In a subsequent study, Ishiwatari and Sasaki (2022) observed five such cycles in Japan over a period of nearly 150 years. This cyclical nature of investment highlights the need for developing strategies to sustain funding beyond immediate postdisaster periods.

Recent trends in Europe and elsewhere point toward a more diverse approach to flood protection financing. Driessen et al. (2018) noted the increasing involvement of local governments, private companies (including insurance firms), municipalities, and property owners in flood protection efforts. Such involvement can expand financial resources, allow for a community-based approach,

and strengthen the capacity to prepare for and respond to disasters. However, financial resources and expertise are not always available at the community level and thus pose a challenge (Driessen et al 2018).

Various financing mechanisms have been proposed for disaster risk reduction and climate change adaptation (Girishankar 2009). Kunreuther and Linnerooth-Bayer (2003) studied pre-disaster hedging instruments, such as insurance and catastrophe bonds, in emerging economies. They found that these instruments can effectively channel funds from international capital markets to support post-disaster recovery. Brugmann (2012) proposed a paradigm shift regarding investments in disaster risk reduction and climate change adaptation. By framing assets less vulnerable to climate change and disasters as producing more stable returns and maintaining more stable values, Brugmann argued that investing in resilience can increase investment returns and confidence in asset values. This prospective position considers resilience not a risk reduction cost but a value-enhancing investment strategy. Kok et al. (2018) proposed mechanisms to leverage public investments in the projects of nature-based flood defenses. Value capture refers to the receipt of revenue by a public agency from private beneficiaries through taxes raised by the project. Co-investment also refers to collecting contributions, both in kind and cash, from the private sector and other stakeholders.

### **3. Methodology**

This study utilizes a mixed-methods approach, combining the quantitative analysis of historical data with the qualitative assessment of policy documents and expert interviews. The data collection process involved gathering budgetary and damage data from multiple sources. Information was collected from government statistics, interviews were conducted with officials and experts, and the EM-DAT database was used (CRED undated; MLIT undated). All financial data have been converted to 2015 USD to ensure comparability across different economies and periods. The analysis considers absolute values and percentages of GDP to account for economic differences between countries, providing a more holistic view of each nation's flood protection efforts relative to its financial capacity. GDP data was collected from IMF (undated).

We reviewed the recent literature and reports from government agencies and international organizations. In January and June 2024, we conducted semi-structured interviews with Indonesian officers, Filipino officers, and experts in global organizations and aid agencies.

There is no standard definition of flood protection budgets among the three countries. Budget data include protection works against floods, landslides, and coastal hazards, but they are not clearly differentiated between Indonesia and the Philippines. Data are publicly available for Japan and

the Philippines but not for Indonesia (Department of Budget and Management annually; Cabinet Office 2024). Japanese data include local government budgets, but Indonesian and Philippine data do not. Collecting data from all local governments in the two countries would be difficult. Budget data from the Indonesian provinces of the Jakarta Special Region and West Java and Bandung City were collected to understand local government investment. The difficulty of collecting such standardized data is a limitation of budget analysis studies in disaster risk reduction.

#### **4. Recent damage and investment in the three countries**

This section examines investments in flood protection and damage in the three countries. Indonesia has not increased its budget in terms of the share of GDP. The Philippines has increased its budget following major disasters as predicted. Japan decreased budget because of a stagnated economy from the 2000s but increased its budget after recent several disasters.

##### **4.1 Indonesia**

Indonesia comprises more than 17,000 islands stretching along the equator. With a population exceeding 270 million and a rapidly growing economy, the country faces significant challenges in managing flood risks. The country's major cities, including its capital, Jakarta, are situated in low-lying coastal areas, making them particularly vulnerable to flooding from heavy rainfall and rising sea levels.

###### **4.1.1 Damage**

From 2006 to 2023, the country suffered flood damages amounting to USD 8.6 trillion in 2015 prices, or an average of approximately USD 500 million per year. This is equivalent to 0.06% of Indonesia's GDP.

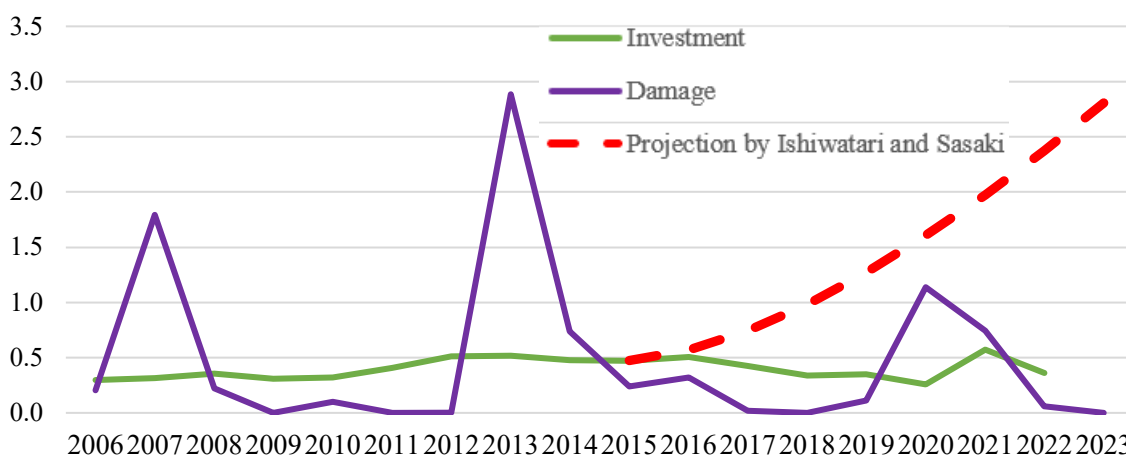
Damage in Jakarta is increasing because of population migration, climate change, land subsidence, and land use change (Budiyono et al. 2016). The 2007 flood inundated 340,000 people in 35% of the city area, caused 70 deaths, and closed the Jakarta International Airport for 3 days (World Bank 2019). The 2013 flood damages in the capital region of Jakarta amounted to approximately USD 3 billion, or 0.37% of the country's GDP, and the 2020 flood damages were USD 1.2 billion, or 0.11% of the GDP.

#### 4.1.2 Investment

The flood protection budgets of the Ministry of Public Works and Housing (MPWH) have varied over time, often fluctuating rather than consistently increasing. The budget was around 5 trillion IDR, or 300 million USD in 2015 prices, until 2010 and has increased to 3.5–7.7 trillion IDR, or 260–570 million USD from 2010 until 2022 (Figure 1). The flood protection budget accounts for approximately 15% of the total water resources budget. The overall water resource budget has remained unchanged, but priority is given to dam construction and water resource development in the new capital.

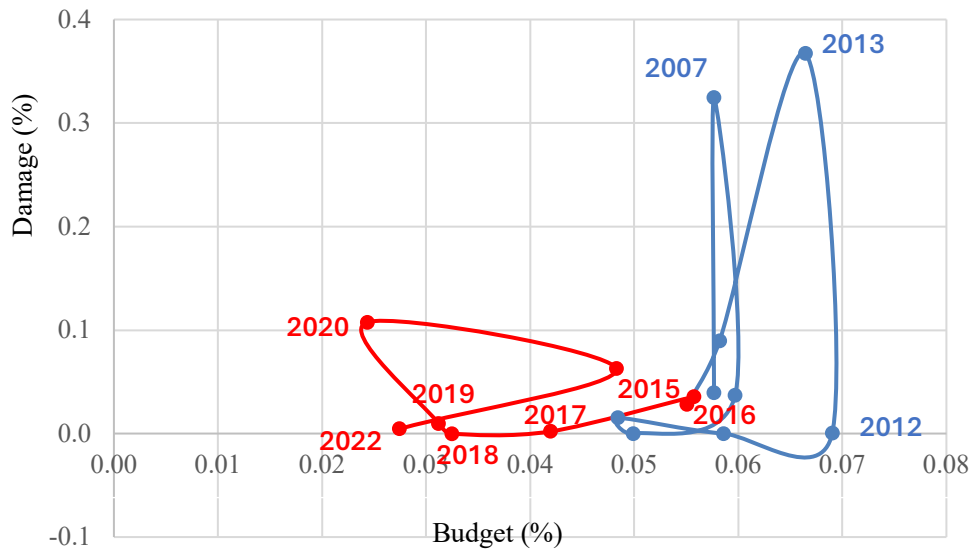
The budgets did not increase according to the country’s growth. Before 2016, the ratios were over 0.05%, except 2010, but from 2016, they were less than 0.05% from 2016. Over the past two decades, the budget has been in the range of 0.03%–0.07% of GDP (Figure 2).

There are financial gaps with needs estimated and planned. Ishiwatari and Sasaki (2020) produced a multi-regression model of budgets from panel data on investments and socio-economy in Asian countries and estimated that Indonesia needs 3.1 billion USD, or 42 trillion IDR annually from 2015 to 2030. The gap is expanding since Ishiwatari and Sasaki (2020) predicted an increasing trend (Figure 1). The Asian Development Bank (2023) estimated that 1.6 billion USD/ year, or 21 trillion IDR/year, is needed for the coming two decades. The Ministry’s sector plan envisaged 15 trillion IDR/year, or 1.1 billion USD/ year, for flood protection from 2020 until 2024 (ADB 2023).



**Figure 1:** Flood protection budget and damage in Indonesia (in billion USD in 2015 price)

Source: Data from Ishiwatari and Sasaki (2020), ADB (2023) and CRED



**Figure 2:** Flood protection budget and damage in Indonesia (as ratio of GDP)

Blue: from 2006 until 2014, Red: from 2015 until 2022

Source: Data from Ishiwatari and Sasaki (2020), ADB (2023), CRED, and IMF

#### 4.1.3 Financing mechanism

Indonesia employs an integrated approach to flood risk management, incorporating it with other water resource issues at the river basin level. This approach aims to optimize water resource management by coordinating different sectors from the perspective of the river basin. The country has developed legislation, institutions, and planning mechanisms to promote the integrated approach.

The Water Resources Law stipulates five pillars of water resources management, three of which are substantive components: (1) conservation, (2) utilization, and (3) disaster risk reduction; and two supportive components: (4) information system and (5) community participation (ADB 2016). The law establishes the governance mechanism of organizations, planning, and councils in the river basin.

MPWH finances most of its budget for flood protection projects, while the local government's investment is limited. The exceptions are small subsidy programs and projects in the Special Capital Region of Jakarta. This subsection examines investment by selected local governments and public cooperation.



#### **4.1.3.1 Subsidy program**

MPWH implements the subsidy program (DKA) with limited-scale budgets compared with national projects. This program covers eight flood protection projects of 24 km in total with 120 billion IDR, or 9 million USD, under irrigation programs from 2020 to 2024. This budget scale accounts for approximately one-hundredth of the national project budget.

#### **4.1.3.2 The Special Capital Region of Jakarta**

The Special Capital Region of Jakarta allocated 2.2 trillion IDR, or 160 million USD, to flood protection in 2023 and 2.3 trillion IDR, or 170 million USD, in 2024. This accounts for approximately one-third of the flood protection budget in MPWH and approximately 3% of the capital region's total budget of 72 trillion IDR. This budget is about one-fifth of the Tokyo metropolitan government's flood protection budget of 122 billion JPY in 2023.

The special capital region's flood protection budget is directed to 942 projects, such as the construction of pumping stations and reservoirs. The financial sources of this budget constitute regional funds (30%) and loans from the central government (70%). The loan has an 18-year repayment period without interest. The national government allocated a budget of 1 trillion IDR, or 75 million USD, in 2021 through the National Economic Recovery program, which aims to support recovery from the COVID-19 pandemic.

The operation and maintenance budget reaches 500 billion IDR, or 37 million USD, accounting for about 20% of the total flood protection budget. This share is higher than the 8.5% share of prefectural governments in Japan. This is because the special capital region operates and maintains large-scale facilities, including diversion channels and pumping stations constructed by the central government.

Local communities are engaged in operations and maintenance. The region allocates funds to five districts to operate and maintain facilities. Members of local communities, organized into "blue troops" and "green troops," are involved in the operation and maintenance of the pumping stations and gate facilities and cleaning works on a contract basis.

#### **4.1.3.3 West Java Province and Bandung City**

Bandung City, located in the West Java Province, is the 4th-largest city in the country with a population of 2.5 million. The flood protection budget of Bandung City is 106 billion IDR, or 8 million USD, 1.5% of the total city budget, and that of West Java Province is 16 billion IDR, or 1.2 million USD. While MPWH is responsible for flood protection works in the Citarum River, a major river flowing in the city, the city and provincial governments are responsible for developing

urban drainage and managing small rivers.

The city identified 12 flood-prone locations and formulated a mitigation plan to manage the total flood volume of approximately 37,000 m<sup>3</sup>. Currently, there are ten retention ponds with a depth of 1.5–4 m. The city is installing infiltration wells (Setiadi 2023). Furthermore, the municipal government enforces infiltration wells as approval conditions for construction and provides financial support.

#### **4.1.3.4 Public Corporation**

State-owned enterprises (PJT: Perum Jasa Tirta) operate and maintain facilities in some river basins. PJT I was formed in 1986 to manage facilities in the Brantas River and expanded its functions to the Bengawan Solo, Jratunseluna, and Serayo Bgowanto river basins in Central Java and Toba Asahan North Sumatra province. PJT II was established to manage the Jatiluhur dam in 1967 and expanded its functions for the Citarum River Basin as well as for (a) Ciliwung–Cisadane, (b) Cimanuk–Cisanggarung, (c) Cidanau–Ciujung–Cidurian, and (d) Seputih–Sekampung river basins. PJT I and PJT II hold no significant water infrastructure assets, and their primary functions are the operation and maintenance of facilities. These enterprises collect water tariffs from water supply utilities and the private sector and profit from their businesses, including hydropower generation. The enterprises use the revenue for operation and maintenance of their facilities, including flood protection facilities (World Bank 2015).

## **4.2 The Philippines**

The Philippines, an archipelagic country comprising more than 7,000 islands, is vulnerable to natural disasters, particularly typhoons and consequent flooding. With a population of over 100 million, a significant portion of which inhabits coastal areas, the country faces challenges in protecting its people and infrastructure from flood risks.

### **4.2.1 Damage**

From 2006 to 2023, the country suffered from flood damages amounting to USD 12 trillion in 2015 prices, or an average of about USD 670 million annually, equivalent to 0.3% of GDP. Typhoons Ondoy and Pepeng caused severe floods and landslides in Metro Manila and Luzon Island in September and October 2009. The total economic damage in 2009 was estimated at 1.1 billion USD, accounting for 0.5% of the country's GDP. Following the 2009 disasters, several successive typhoons caused severe damage. In particular, Typhoon Yolanda caused high tide flooding on Leyte Island in 2013. This year's economic damage is estimated at 2.3 billion USD, or 0.8% of the GDP. In 2020 and 2021 as well, typhoons caused damage valued at approximately 1 billion USD, or 0.3% of the GDP (Figures 3 and 4).

#### **4.2.2 Investment**

The Philippines increased its flood protection budget following the 2013 Typhoon Yolanda disaster. The 2023 budget was more than eight times greater than the 2013 budget.

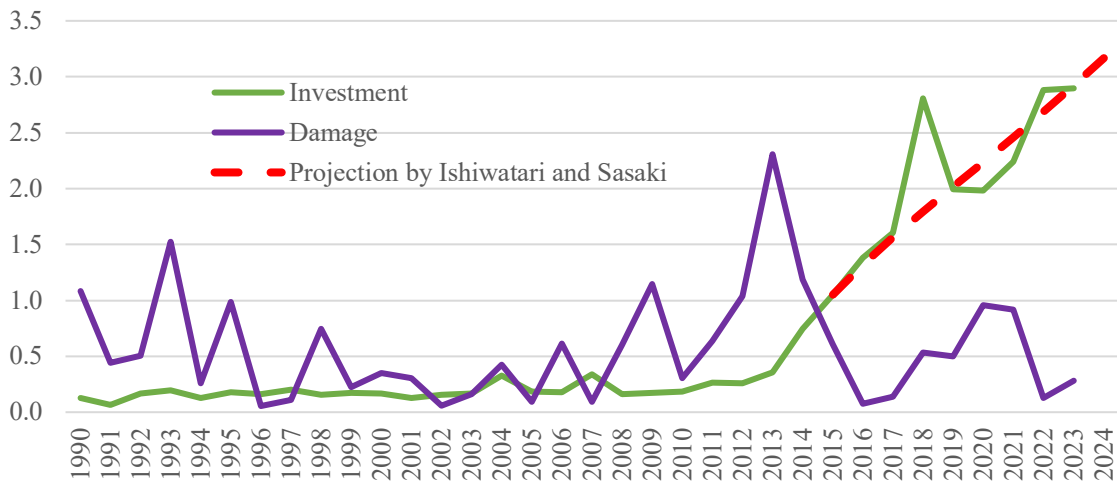
Moreover, the country increased its budget to cover the country's growth. The budget fluctuated less than 0.2% of GDP until 2013. However, it increased to over 0.5% in the 2020s, reaching 0.7% in 2018. GDP per capita reached USD2,000 in the late 2000s and had room to increase budgets for flood protection. This trend is almost the same as the prediction by Ishiwatari and Sasaki (2020, Figure 3).

#### **4.2.3 Financing mechanism**

The Department of Public Works and Highways (DPWH) implements most flood protection projects. DPWH prioritized 18 major river basins and is implementing projects in 12 of them. The Metro Manila Development Agency, the national agency of the Metro Manila Region, is responsible for managing flood protection facilities such as channels, weirs, gates, and pumping stations.

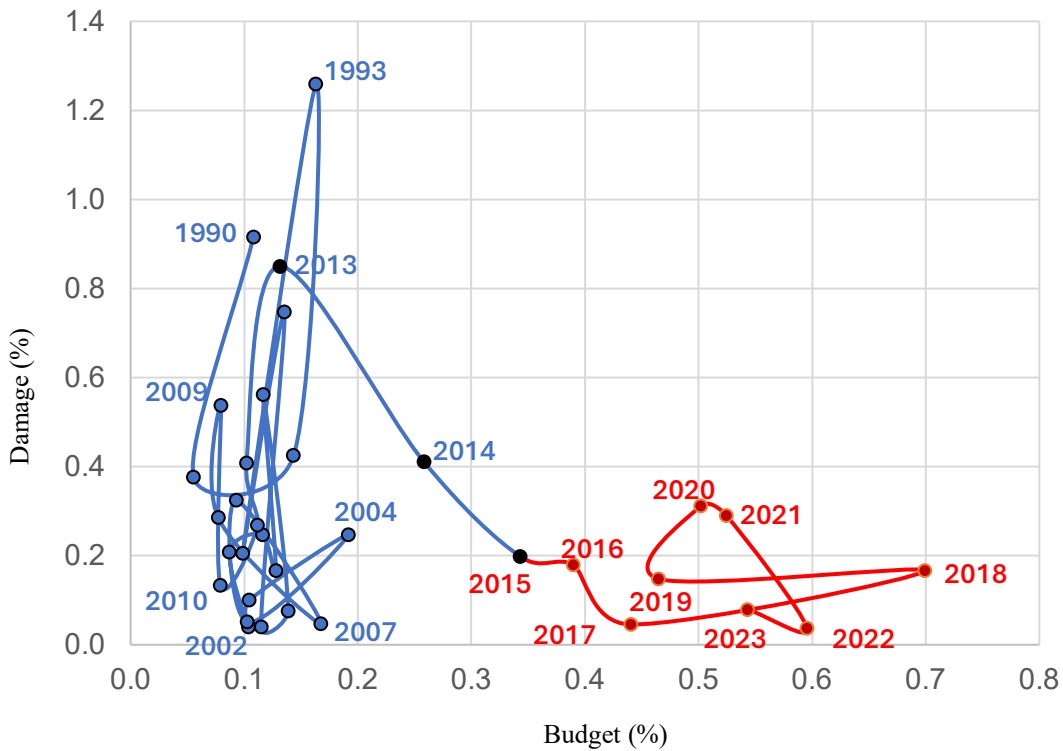
DPWH usually covers all costs for flood protection works without a contribution from local governments. While the 1976 Water Act allows local governments to take over the facilities built by the DPWH, in reality, the DPWH continues to operate and maintain the facilities following construction. Since the division of responsibilities between the national and local governments for river management is unclear, the local governments can also work on the rivers.

Additionally, the government allocates the National Disaster Risk Reduction and Management Fund mainly to response and rehabilitation after disasters. In 2024, the fund's budget was 31 billion PHP or 680 million USD.



**Figure 3:** Flood protection budget and flood damage in the Philippines (in billion USD in 2015 price)

Source: Data from Ishiwatari and Sasaki (2020), CRED, and DBM



**Figure 4:** Flood protection budget and flood damage in Philippines (as ratio of GDP)

Blue: from 1990 until 2014, Red: from 2015 until 2023

Source: Data from Ishiwatari and Sasaki (2020), CRED, IMF, and DBM

### **4.3 Japan**

Japan, an archipelagic nation with a long history of flood risk management, serves as a contrasting example of how a developed country approaches flood protection. With most of its population concentrated in flood-prone coastal areas and river basins, Japan has developed sophisticated flood risk management systems over the centuries.

#### **4.3.1 Damage**

Japan decreased flood damage to less than 0.5% of GDP from 1962 and to less than 0.2% from 1984, except in 2004. However, the damage was recorded at 0.25%, or 12 billion USD, and 0.39%, or 18 billion USD, in 2018 and 2019, respectively (Figures 5 and 6). The damage amount in 2019 is a record high.

#### **4.3.2 Investment**

Japan invested more than 0.9% of its GDP in flood protection in the late 1970s and early 1980s, but this fell to less than 0.4% in the early 2010s. Due to a stagnant economy and a tight fiscal situation, the country halved its investment in flood protection from 2000 to the 2010s. However, following a series of severe flood disasters, Japan began increasing its investment in flood protection in 2019, reaching over 20 billion JPY or 0.50% of GDP in 2020 (Figures 5 and 6).

#### **4.3.3 Financing mechanism**

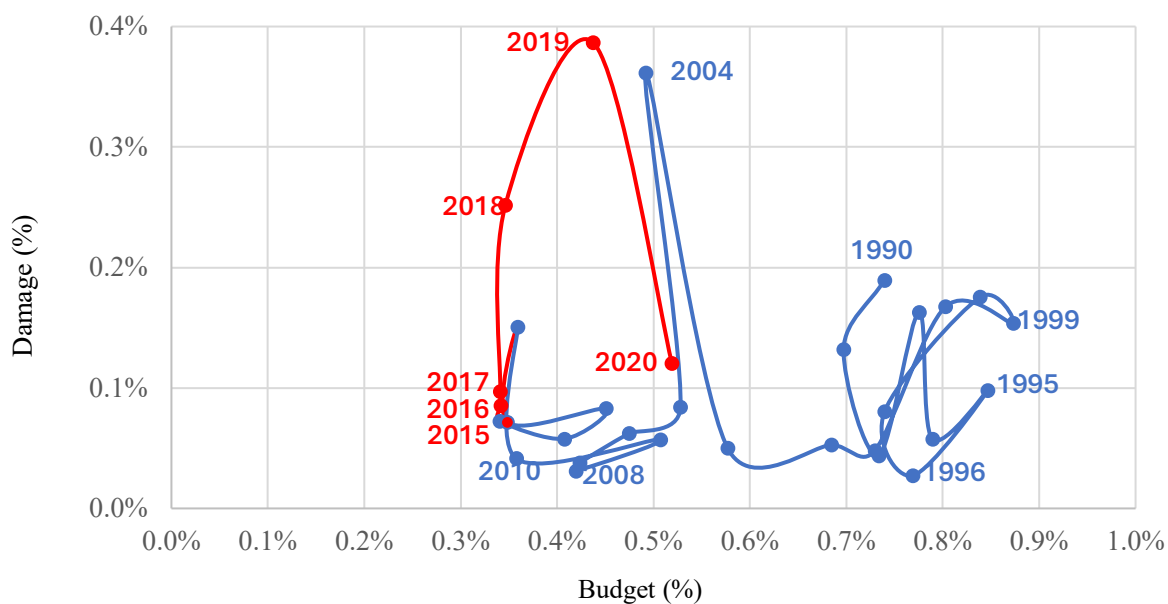
Japan enacted the River Law in 1896, and the national government began national flood protection projects on major rivers for which local governments had been responsible. Local governments contributed one-third to these national projects, a ratio that has been maintained to the present day (Ishiwatari and Aldrich 2024).

Japan started a subsidy program for local governments to facilitate the maintenance of medium and small rivers in 1932 (Matsuura 1986). For most local government projects, the national government subsidizes 50% of the cost. This sharing continues today. Before this subsidy program, local communities contributed financially to local government projects: communities covered 30% in Saitama Prefecture and 50% in Niigata Prefecture (Matsuura 2016; Uchida 1994). Until now community members continue to be engaged in operation and maintenance works, such as operating gates and other facilities and cleaning the rivers.



**Figure 5:** Flood protection budget and flood damage in Japan (in billion USD in 2015 price)

Source: Data from Ishiwatari and Sasaki (2020), Cabinet Office (2024), MLIT



**Figure 6:** Flood protection budget and flood damage in Japan (as ratio of GDP)

Blue: from 1990 until 2014, Red: from 2015 until 2022

Source: Data from Ishiwatari and Sasaki (2020), Cabinet Office (2024), MLIT, and IMF

## **5. Discussion**

### **5.1 Investment trends**

The analysis reveals divergent trends in flood protection investment across the three countries. The Philippines is increasing its flood protection budget, demonstrating the trend predicted by Ishiwatari and Sasaki (2020). This proves the appropriateness of the prediction model.

However, contrary to the prediction, Indonesia has not consistently increased its budget. This highlights the challenges of maintaining flood protection as a priority in the face of competing national interests. This inconsistency may leave critical infrastructure gaps, potentially worsening future flood risks.

While the national government in Indonesia has not increased the budget for flood protection, the Special Capital Region of Jakarta invested in flood protection projects with a scale of one-third of the national budget, demonstrating the potential for subnational entities to take leadership roles in addressing localized flood risks. Also, the Jakarta region can afford to cover the cost because of the solid economic and budgetary situation.

Japan's investment pattern recently increased after a period of decline. This reflects a renewed focus on flood protection in response to severe events (Cabinet Office 2020).

### **5.2 Comparison of financing mechanisms among the three countries**

The financing mechanisms employed by each country offer insights into potential strategies for sustainable flood protection investment. This subsection examines the three countries' budgetary mechanisms of flood protection, focusing on cost-sharing among national and local governments and local communities. Table 1 compares the budget mechanisms of flood protection in the three countries and reveals the policy gaps.

Indonesia and the Philippines rely primarily on national government funding. Japan's model of cost-sharing among national and local governments at the prefectural and municipality levels, as well as local communities, presents an alternative approach. Japan's system of mandatory cost-sharing for local governments ensures consistent local involvement in flood protection projects. This cost-sharing model contributes to the country's historically high levels of investment in flood protection (Ishiwatari and Aldrich 2024). The modern system is built on a system that has changed through the millennia. It began with the sharing of the costs of water resources and agricultural land development between the imperial court and the private sector in the 7th century Ritsuryo system, by local powerful clans and temples and shrines in the medieval manorial system, and by the Tokugawa shogunate, federal domains, merchants and local communities in the modern period.

Additionally, active community participation can enhance the effectiveness of flood protection measures and foster a culture of flood risk awareness. Japan’s millennia-long history of cost-sharing for flood protection highlights the importance of cultural and historical factors in shaping effective flood management strategies. In Indonesia and the Philippines, the current centralized approach can be explained by the loss of traditional community-based water management practices due to colonial rule and the centralized development approach adopted after independence (Henley 2008; Tamaki 2002).

**Table 1:** Comparison of the financial mechanisms

	Central	Local government River basin organization	Community
<b>Indonesia</b>			
National project	✓		
Subsidy/DKA	✓		
PJT		✓ Water tariff	✓
Local govt. project		✓	✓ Troops (JKT)
<b>Philippines</b>			
National project	✓		
Local govt. project		✓	
<b>Japan</b>			
National project	✓	✓	✓
Local (Subsidy)	✓	✓	✓
Local govt. project		✓	✓

### 5.3 Policy recommendations for enhanced flood protection investment

A multifaceted approach leveraging diverse financial resources is recommended to address the challenges of increasing and sustaining investment in flood protection. The following policy recommendations are based on analyzing successful practices in Japan and the current situations in Indonesia and the Philippines.

#### 5.3.1 Cost-sharing with the local government

Implementing a robust cost-sharing mechanism between national and local governments can boost investment in flood protection. The Japanese model demonstrates the effectiveness of this approach. Adopting a similar strategy for Indonesia and the Philippines could lead to more comprehensive coverage and sustained investment.



It is recommended that the cost-sharing model implemented in the Special Province of Jakarta be extended to other provinces in Indonesia. In this model, local governments contribute to the costs of national projects, particularly in operation and maintenance. This approach increases the overall investment, ensures interregional equity, and promotes local ownership of flood protection initiatives.

A national framework for the cost-sharing of flood protection projects should be developed to implement this strategy. This framework could include a tiered system that considers differences in local governments' financial capacities.

### **5.3.2 Financial incentives for local governments**

Financial incentives for local governments should be introduced to promote the nationwide provision of minimum flood protection services. It is recommended that a system of subsidies and grants be established for local governments that initiate or participate in flood protection projects. This approach is expected to stimulate regional participation and increase overall investment in flood protection infrastructure.

A national fund should be created specifically to support local flood protection initiatives. Furthermore, a matching fund system in which national government contributions are tied to local government investments would encourage greater local commitment to flood protection projects.

### **5.3.3 Expansion of public corporation financing mechanisms**

The financing mechanism of public enterprises such as PJT in Indonesia shows potential for further development. It is recommended that public enterprises' role and financing capabilities in flood protection be expanded. This could include broadening their mandate to manage flood protection facilities and allowing them to contribute financially to construction projects, similar to the Japan Water Resources Agency model (Ishiwatari et al. 2023).

Laws and regulations should be amended to allow public enterprises such as PJT to manage flood protection facilities to implement this strategy. A mechanism should be developed for these enterprises to reinvest some of their water user fees into flood protection infrastructure. Creating public-private partnership models would allow these corporations to leverage private-sector funding for large-scale flood protection projects.

### **5.3.4 Community engagement and contribution**

Engaging local communities in flood protection efforts can enhance resilience and complement national-level investments. It is recommended that programs facilitating community contributions

to flood protection through cash or in-kind contributions be developed. The success of river management initiatives in Japan and the “blue troops” in Jakarta demonstrate the potential of this approach. A framework for recognizing and integrating in-kind community contributions (e.g., labor and local knowledge) into flood protection projects should be created. Furthermore, implementing a small-scale community grant program for local flood protection initiatives could encourage grassroots participation in flood protection efforts.

The three countries have historically developed unique water resource management practices, but some of these efforts have been weakened through colonization and modernization, as discussed in section 5.2. These archipelagic nations have traditionally employed region-specific management mechanisms. Building on this historical foundation, traditional water management practices should be revitalized and integrated into modern contexts. Each region should be encouraged to develop decentralized management mechanisms tailored to local conditions, and communities should be empowered to participate in water resource decision-making processes. Integrating traditional knowledge with modern scientific approaches could lead to more effective and culturally appropriate water management approaches. These efforts could strengthen community integrity, enhance climate change resilience, and ensure more sustainable and equitable water resource management across the countries.

### **5.3.5 Long-term financial planning and climate adaptation**

Long-term financial planning that accounts for the impacts of climate change is crucial to ensuring sustainable investment in flood protection. Comprehensive, long-term economic plans for flood protection should be developed. Flood protection financing should be integrated into national development plans and climate change adaptation strategies to ensure a cohesive approach to addressing future flood risks (Ishiwatari and Sasaki 2020). Implementing this recommendation should start with conducting regular national assessments of long-term flood protection needs, incorporating climate change scenarios.

## **6. Conclusion**

This comparative analysis of flood protection investments and financing mechanisms in Indonesia, the Philippines, and Japan has revealed the complex relationships between economic development, historical practices, governance structures, and effective flood protection strategies. While each nation grapples with unique challenges, several overarching conclusions emerge from this study, offering valuable insights for flood-prone countries worldwide.

A key finding of this research is the critical importance of engaging multiple stakeholders in financing and managing flood protection initiatives. Diverse actors, from national governments

to local governments and communities, can lead to more comprehensive and sustainable approaches. This multistakeholder engagement enhances the financial base for flood protection and fosters a sense of shared responsibility and ownership, which is crucial for the long-term success of these initiatives.

The study also underscores the significant influence of historical and cultural contexts on current flood protection strategies. Each country's approach is deeply rooted in its unique, evolving water management practices. This highlights the need for flood protection strategies that are both technologically sound and culturally appropriate and aligned with local traditions and practices.

This study identified several research areas for future studies. First, the long-term benefits of different approaches to financing flood protection need to be more quantitatively analyzed. Additionally, how flood protection affects poverty alleviation and inequality reduction can be investigated to obtain valuable data to support policy decisions and investment strategies. Second, future studies should explore how emerging technologies such as green infrastructure and risk assessment can be appropriately integrated into flood protection planning and investment.

This comparative analysis underscores flood protection's complex and dynamic nature in a changing world. It highlights the need for adaptive, multifaceted approaches that combine robust financing mechanisms, stakeholder engagement, and flexible policy frameworks. As countries worldwide grapple with increasing flood risks, the lessons drawn from Indonesia, Japan, and the Philippines offer valuable insights for developing resilient and sustainable flood protection strategies.

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## Abstract (in Japanese)

### 要 約

このペーパーはインドネシア、日本、フィリピンでの20年以上にわたる治水投資と被害を分析している。予算配分の傾向、被害の状況、投資の仕組みを分析することで、さまざまな治水投資の手法やその有効性を明らかにしている。中央政府、地方自治体、地域社会の間での費用分担に焦点を当て、様々な経済状況や地形での有効な治水事業について検討を行った。それぞれの国での施工事例や課題を比較することで、効果的な治水事業方式を明らかにし、洪水被害を受けている国々での効果的なアプローチについて理解を進め、政策決定に貢献することを目的としている。

**キーワード：** 費用負担、財政手段、地域社会、補助金、水資源管理