

# JAPANESE ODA IN VIETNAM FOR DISASTER RISK REDUCTION AND CLIMATE CHANGE ADAPTATION FROM 2011 TO 2025

## HỖ TRỢ PHÁT TRIỂN CHÍNH THỨC CỦA NHẬT BẢN CHO VIỆT NAM VỀ GIẢM NHẸ RỦI RO THIÊN TAI VÀ THÍCH ỨNG VỚI BIẾN ĐỔI KHÍ HẬU GIAI ĐOẠN 2011-2025

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**Abstract** - Climate change and natural disasters are increasingly intensifying, exposing Vietnam to severe risks and threatening sustainable development. In this context, strengthening response capacity and mobilizing international support becomes essential. This study examines the role of Japan - Vietnam's largest bilateral ODA donor in disaster risk reduction and climate change adaptation during 2011–2025. The research employs secondary data analysis, comparative methods, and case studies. Findings indicate that Japanese ODA has significantly contributed to upgrading disaster-prevention infrastructure, transferring forecasting technologies, developing human resources, and promoting integrated risk governance. However, declining grant aid and stricter loan conditions present notable challenges. The study provides scientific evidence to support policymaking and optimize ODA cooperation as Vietnam enters a new phase of development.

**Key words** - Official development assistance; Disaster risk reduction; Climate change adaptation; Vietnam; Japan

### 1. Introduction

Vietnam is a country heavily affected by natural hazards and climate change, with increasing frequency and severity of damage. Extreme weather, floods, landslides, droughts, and saltwater intrusion not only cause socio-economic losses but also threaten the country's sustainable development. In this context, enhancing response capacity, disaster risk reduction (DRR), and climate change adaptation (CCA) has become an urgent requirement, calling for comprehensive technological, financial, and experiential resources from the international community.

Japan is currently regarded as one of Vietnam's largest bilateral development partners. Its official development assistance (ODA) has not only helped improve infrastructure systems and transfer technology, but has also promoted governance capacity, human resource training, and social awareness of DRR and CCA. During 2011–2025, as Vietnam transitioned into the lower-middle-income country group [1], ODA cooperation between Vietnam and Japan underwent substantial adjustments in scale, modalities, and priority areas. Beyond a focus on physical infrastructure projects, ODA programs increasingly emphasized the transfer of integrated risk management initiatives, advanced forecasting techniques, and the development of green adaptation models to climate change.

**Tóm tắt** - Biến đổi khí hậu và thiên tai khiến Việt Nam đối mặt với nhiều rủi ro nghiêm trọng, đe dọa phát triển bền vững. Trong bối cảnh đó, việc tăng cường năng lực ứng phó và huy động hỗ trợ quốc tế trở nên cấp thiết. Bài viết đánh giá vai trò của Nhật Bản - nhà tài trợ ODA song phương lớn nhất của Việt Nam trong giảm nhẹ rủi ro thiên tai và thích ứng biến đổi khí hậu. Sử dụng các phương pháp phân tích – tổng hợp tài liệu thứ cấp, so sánh, nghiên cứu chính sách và nghiên cứu trường hợp, bài viết cho thấy ODA Nhật Bản đóng góp đáng kể trong nâng cấp hạ tầng phòng chống thiên tai, chuyển giao công nghệ dự báo, đào tạo nhân lực và thúc đẩy quản trị rủi ro tổng hợp, song xu hướng giảm viện trợ không hoàn lại và điều kiện vay chặt chẽ hơn đặt ra nhiều thách thức. Bài viết góp phần cung cấp cơ sở khoa học cho việc hoạch định chính sách, tối ưu hóa hợp tác ODA trong bối cảnh Việt Nam bước vào giai đoạn phát triển mới.

**Từ khóa** - Hỗ trợ phát triển chính thức; Giảm nhẹ rủi ro thiên tai; Thích ứng với biến đổi khí hậu; Việt Nam; Nhật Bản

With respect to international scholarship, in *The Evaluation Practices of ODA Providers in Assessing the Effectiveness of CCA and Mitigation Projects in Vietnam*, Duhem analyzed evaluation practices for the effectiveness of ODA related to CCA, primarily focusing on the Support Program to Respond to Climate Change (SP-RCC) and the donor group of the Development Assistance Committee (DAC) [2]. In addition, a study by Ikeda, Palakhamarn, and Anbumozhi highlights the importance of DRR investment and technology in ASEAN [3]. These studies approach ODA in DRR and CCA from the perspective of overall aid effectiveness, donor evaluation frameworks, or multilateral initiatives within the ASEAN region. However, they often do not provide an in-depth analysis of the role and distinctive impact mechanisms of bilateral ODA, particularly the case of Japan in Vietnam. In the domestic literature, *Effectiveness of Foreign Aid Projects For Climate Change Response And Sustainable Development In The Vietnamese Mekong River Delta* by Le Thi Ngoc Diep assesses the effectiveness of climate-related aid in the Mekong Delta, but lacks specialized, systematic, and longitudinal analyses of Japanese ODA in DRR and CCA [4]. Therefore, limitations remain in clarifying Japan's distinctive support model, key impact mechanisms (technology–institutions–governance), and the value

added by Japanese ODA compared with other ODA sources in DRR and CCA in Vietnam during 2011–2025.

This study focuses on two questions: (1) Through what forms and key impact mechanisms did Japanese ODA support Vietnam in DRR and CCA during 2011–2025? (2) Compared with other ODA sources, what value added and limitations does Japanese ODA exhibit, thereby offering lessons for the next phase of cooperation and for adjusting ODA absorption policies and orientations for bilateral collaboration?

To achieve these objectives, the paper employs the following methods: analysis and synthesis of secondary materials to systematize the theoretical and practical foundations of ODA, DRR, and CCA; a comparative method to assess the alignment of policy orientations between Vietnam and Japan in this field; case studies of representative projects to clarify implementation approaches and effectiveness; and policy analysis to examine the relevance and contributions of Japanese ODA to Vietnam's DRR and CCA needs.

## 2. Key concepts

### 2.1. Official Development Assistance (ODA)

According to the Organisation for Economic Co-operation and Development (OECD), ODA refers to the provision of financial flows by official agencies of donor countries to countries and organizations, with the objective of promoting economic development and improving welfare in developing countries. Such assistance must be concessional in character, specifically requiring a grant element of at least 25% [5].

Pursuant to Article 3, Clause 18 of Decree No. 242/2025/ND-CP promulgated by the Government of Vietnam, ODA refers to financial resources through which the State or the Government of Vietnam receives support from foreign donors for development, welfare, and social security [6]. This capital is classified into: (1) ODA grants, i.e., non-repayable support that may be delivered in project or non-project form; (2) ODA loans, i.e., foreign loans on highly concessional terms, with a minimum grant element of 35% for tied loans and 25% for untied loans; and (3) concessional loans, i.e., loans with terms more favorable than commercial borrowing but not meeting the requirements to be recognized as ODA loans [6].

The Government of Japan defines ODA as public funding intended to promote development cooperation, based on three criteria: it is provided by a public entity or an implementing agency of such an organization; its core purpose is to support economic development and improve living standards in developing countries and regions; and the terms of assistance - such as interest rates and repayment periods - are set in favor of the recipient country. Japan's ODA is divided into bilateral aid - direct support to developing countries - and multilateral aid (channeled through international organizations). Bilateral aid comprises ODA loans, grant aid, and technical cooperation [7].

Within the scope of this study, the author adopts an approach in which bilateral ODA includes ODA loans and

grant aid (including ODA grants and technical cooperation).

### 2.2. Disaster Risk Reduction (DRR)

According to the United Nations Office for DRR (UNDRR), DRR concerns reducing the impacts of threats on people and society while enhancing the capacity to manage disaster risk [8]. This includes strengthening the capacity to respond and adapt to disasters as part of a post-disaster recovery process, by implementing actions that prevent (or even eliminate) subsequent hazards and reduce their adverse impacts through prevention and mitigation measures [8].

### 2.3. Climate Change Adaptation (CCA)

According to the United Nations Development Programme (UNDP), CCA refers to actions that help reduce vulnerability to the current or anticipated impacts of climate change, such as extreme and hazardous weather, sea-level rise, biodiversity loss, or food and water insecurity [9].

## 3. Overview of Japan's ODA to Vietnam, 2011–2025

As of June 2025, Vietnam had received ODA from 51 international partners, including 28 bilateral partners and 23 multilateral organizations. Among these, Japan has become Vietnam's largest ODA partner, accounting for over 30% of total bilateral development assistance [10]. This has been driven by four main factors. First, Vietnam holds an important geopolitical position in Southeast Asia, located along vital international maritime routes and increasingly asserting its role within ASEAN. Strengthening support for Vietnam through ODA contributes to a peaceful and stable regional environment, thereby serving Japan's long-term security and development interests. Second, amid intensifying strategic competition, Japan uses ODA as an instrument of soft power to expand its influence and build an image as a "partner for sustainable development." Third, Vietnam is a promising market and investment destination; therefore, ODA plays a facilitative role for trade and foreign direct investment (FDI), particularly through infrastructure and technology projects. Fourth, cultural affinities and a foundation of friendship have helped foster cooperation between the two countries, with ODA becoming a key pillar.

The period 2011–2025 marked Vietnam's transition out of low-income and underdeveloped status and its official entry into the group of middle-income developing countries. Consequently, Japan's total ODA to Vietnam declined, and the modality of assistance shifted toward a higher share of concessional loans and loans with conditions. Specifically, 2023 recorded the highest level of concessional loans since 2017, while grant aid reached only 1.1 billion yen, the lowest level during 2011–2023.

During 2011–2025, Vietnam identified the following priority areas for attracting ODA: (1) economic infrastructure, including information and communications technology, transport, urban development, energy, irrigation, and dike systems; (2) social infrastructure, such as culture, health, education and training, vocational training,

social security, poverty reduction, population, and development; (3) strengthening high-quality human resources, scientific research, and technology development; (4) agriculture and rural development; (5) strengthening institutional capacity and administrative reform; and (6) environmental and natural resource protection, disaster prevention and risk reduction, CCA, sustainable development, and green growth [11], [12]. Japan's ODA orientation toward Vietnam is broadly aligned, identifying cooperation priorities as follows: (1) promoting growth and enhancing economic competitiveness through inflation control, state-owned enterprise reform, strengthening the competitiveness of key industries, and modernizing infrastructure systems; (2) supporting vulnerable groups through poverty reduction programs, narrowing development gaps, and improving basic social services linked to environmental protection and climate change response; and (3) strengthening state governance through legal and judicial reforms, improving administrative effectiveness, and expanding citizen participation [13].

**Table 1.** Scale of Japan's ODA to Vietnam, 2011–2023  
(Unit: billion Yen)

Fiscal Year	Loans	Grants	Technical cooperation
2011	270.0	5.4	10.5
2012	202.9	1.7	8.5
2013	201.9	1.5	8.3
2014	112.4	1.5	7.7
2015	178.8	3.3	10.2
2016	132.1	2.6	9.0
2017	100.3	3.0	6.7
2018	0	1.4	6.5
2019	11.9	3.0	5.0
2020	0	5.0	4.3
2021	10.8	3.7	4.9
2022	18.9	1.7	4.7
2023	102.2	1.1	5.2

Cumulatively through 2023, Japan's ODA to Vietnam exceeded 2,700 billion yen in ODA loans, nearly 100 billion yen in grant aid, and approximately 180 billion yen in support for technical cooperation, making an important contribution to Vietnam's socio-economic development. First, Japan's ODA has supported Vietnam in pursuing the Sustainable Development Goals (SDGs). Large-scale economic infrastructure projects financed by Japanese ODA have facilitated sustainable socio-economic growth and poverty reduction. At the same time, Vietnam's receipt of support for advanced technology transfer and human resource training has contributed to creating a favorable environment for attracting foreign investment. In addition, smaller infrastructure projects have also contributed to hunger eradication and poverty reduction by building schools and hospitals, upgrading rural roads, small bridges, and water and electricity supply systems in disadvantaged areas. Moreover, through multi-level cooperation frameworks and implementation across multiple socio-economic sectors in Vietnam, Japanese ODA has promoted a more substantive alignment of bilateral interests grounded in the economic pillar, thereby contributing to

the consolidation of the Vietnam–Japan Comprehensive Strategic Partnership.

#### 4. Implementation of Japan's ODA in Vietnam for DRR and CCA, 2011–2025

DRR and CCA constitute one of the priority areas of Japan's ODA in Vietnam [13]. Unlike earlier periods that focused primarily on infrastructure development, Japan's ODA in this period shows a clear shift toward an integrated approach that combines institutional strengthening, technology transfer, and enhanced risk governance capacity [14]. Accordingly, Japan's ODA for DRR and CCA emphasizes: support for management activities; infrastructure development with a focus on improving standards and regulations for planning, design, construction, and maintenance; technology exchange and application as well as equipment support; and human resource development [14].

During 2011–2025, numerous ODA projects for DRR and CCA were implemented through diverse modalities - ODA loans, grant aid, and particularly technical cooperation - concentrated along three main axes: (i) investment in technology, technical infrastructure, and digital transformation; (ii) institutional and policy support for DRR and CCA to serve disaster prevention and climate change response; and (iii) capacity building and adaptation models.

##### 4.1. Investment in technology, technical infrastructure, and digital transformation

First, investment in science and technology and digital transformation in disaster risk management and CCA is a prominent pillar of Japan's ODA to Vietnam.

The “*Project for Disaster and Climate Change Countermeasures Using Earth Observation Satellite*” is a project financed through concessional loans and technical support from Japan's ODA, comprising: (1) the launch of an Earth observation satellite; (2) construction of a ground system (headquarters, transmitting/receiving antenna, operations center, research–development–production facilities, and power infrastructure) to receive and process satellite information; and (3) consultancy services. The ODA loan for the project was divided into two phases: (1) Phase 1: 7,227 million yen (November 2011) [15]; and (2) Phase 2: 18,871 million yen (May 2022) [16]. At present, the LOTUSat-1 satellite has been completed, and the ground system in Hoa Lac (Hanoi) has also been completed and is ready to receive data once the satellite is launched into orbit.

The “*The Project for Emergency Reservoir Operation and Effective Flood Management Using Water related Disaster Management Information System*” is a JICA grant aid project valued at 1.844 billion yen, implemented in the Huong River basin; at the Binh Dien, Huong Dien, and Ta Trach dams; in Hue; and at the Directorate of Water Resources in Hanoi [16]. The project ran from August 2017 to December 2023; however, all equipment was accepted and handed over in December 2022, including: data acquisition equipment for monitoring in the Huong River basin (X-band radar, hydrometeorological stations,

CCTV); monitoring facilities at the three dams; a water-related disaster management information system for Hue and the dams; river cross-section and topography survey equipment using LiDAR remote-sensing data; and operational guidelines [17], [18].

The “*Strengthening the capacity to cope with and minimize damages caused by flash floods and landslides for the northern mountainous region of Vietnam*” is a technical cooperation ODA project aimed at assessing and developing plans to mitigate landslide risks. Japan’s ODA provided 329 million yen for experts and equipment, covering: landslide risk analysis, land-use planning, topographic and geological surveys, structural design, construction supervision, establishment of an early warning system, review of environmental and social impacts, disaster preparedness planning, provision of digital elevation model (DEM) data, and monitoring and landslide warning equipment [19]. In Yen Bai Province, the project developed landslide risk maps and installed an early warning system to detect abnormal ground mass movements and transmit alerts to residents via text messages and sirens.

Overall, these projects indicate that Japan has not only provided financial resources but has also transferred key technologies enabling data-driven risk governance. The integration of radar and remote-sensing data, monitoring systems, and digital information platforms has helped competent agencies strengthen forecasting, early warning, and decision-making capacities, while also improving community access to information.

#### 4.2. Institutional and policy support

Vietnam’s institutional and policy capacity in DRR and CCA has also been a focus of ODA support. Vietnam regarded the implementation of the Paris Agreement as an urgent task in its climate change response strategy when it submitted its Intended Nationally Determined Contribution (INDC) and registered its first Nationally Determined Contribution (NDC) in October 2015. In addition, the Government of Vietnam issued Decision No. 1338/QĐ-TTg on directing the development of guidance for NDC implementation (2014) and Decision No. 2053/QĐ-TTg on the Plan for Implementation of the Paris Agreement (2016), which specify tasks, roadmaps, and responsibilities of ministries and sectors in the process of implementation and institutionalization of commitments, including the incorporation of the NDC into the Law on Environmental Protection. In this context, in 2021 Vietnam and JICA signed a record of discussions on technical cooperation to strengthen capacity for NDC implementation [20].

The “*Project for Supporting the Planning and Implementation of Nationally Determined Contributions in Vietnam (SPI-NDC)*” supports the enhancement of national capacity to implement greenhouse gas emission reduction commitments under the Paris Agreement. The project focuses on refining the legal framework, strengthening institutional capacity, and promoting private-sector participation in NDC implementation. It supported the review, updating, and proposal of policies related to mitigation, particularly the development of a measurement,

reporting, and verification (MRV) system and national greenhouse gas-related data; and assisted ministries and agencies in developing NDC implementation action plans and enhancing inter-agency coordination. The project also cooperated with the Vietnam Chamber of Commerce and Industry (VCCI) to organize training courses for enterprises on emission reduction plans, energy management, and green technology applications; and piloted MRV models in sectors such as cement, waste, and transport, thereby establishing a data foundation for reporting and assessing NDC progress. Through the project, Vietnam established a set of indicators to monitor NDC implementation progress and finalized guidance documents for Decree No. 06/ND-CP, preparing for the application of a carbon market in 2028 [20].

In sum, with Japan’s support, Vietnam has gradually incorporated international commitments - particularly the Paris Agreement - into its domestic legal and policy system. Such support has gone beyond the design of the MRV system, helping to strengthen inter-ministerial coordination mechanisms, enhance policy formulation capacity, and encourage enterprise participation in NDC implementation.

#### 4.3. Capacity building and adaptation models

First, Japan’s ODA projects have directly contributed to developing Vietnam’s human resources and technical foundations for DRR and CCA. Notably, within the LOTUSat-1 satellite project, the Vietnam Academy of Science and Technology and the Japan Aerospace Exploration Agency signed an agreement on sharing experience in satellite operations, management of the Vietnam National Space Center, and the use of satellite imagery data [21]. The SPI-NDC project supported large-scale training on greenhouse gas inventories for staff in relevant sectors [20]. In addition, the “*The Project for Strengthening Capacity in Weather Forecasting and Flood Early Warning System*” was supported by Japan with 370 million yen for the dispatch of experts and 57 related items of equipment [22]. The project helped the Viet Nam Meteorological and Hydrological Administration acquire the full technical workflow - from maintenance, inspection, and calibration of monitoring systems to establishing quality control procedures and processing radar data for rainfall and storm monitoring. At the same time, the project developed channels for disseminating weather information via websites and mobile applications, enabling citizens and organizations to access early warnings more rapidly and conveniently.

Furthermore, Japan’s ODA projects have promoted the development of pilot models with potential for future scaling. For example, the project on emergency reservoir operation and flood management using a disaster information system in the Huong River basin, together with the project to strengthen capacity for reducing flash flood and landslide risks in the northern mountainous region, tested and put into operation the first SABO dam at Nam Pam stream (Son La) in 2025, thereby retaining debris and driftwood and reducing damage in downstream areas [23]. The “*Technical Cooperation Project on Innovation of Science and Technology on Natural Rubber for Global*

*Carbon Process*”, implemented jointly by Hanoi University of Science and Technology and Nagaoka University of Technology with funding of approximately 300 million yen, aims to produce protein-free rubber at industrial scale, contributing to carbon emission reductions and promoting a circular economy model [24].

## 5. Assessing the impacts of Japan’s ODA for DRR and CCA on Vietnam, 2011–2025

### 5.1. Achievements

First, Japan’s ODA has made an important contribution to strengthening Vietnam’s capacity for forecasting, early warning, and disaster management through support for the adoption of advanced technologies. Through projects aimed at improving weather forecasting, flood warning, and disaster management in the Huong River basin, Vietnam has been supported in establishing and operating X-band weather radar systems, automated monitoring networks, CCTV, and forecasting and data-quality analysis models consistent with international standards. As a result, the accuracy of forecasts for heavy rainfall, tropical storms, and floods has improved substantially, while warning lead times have been shortened and the ability of competent authorities to direct timely responses in extreme events has been enhanced [25].

Second, Japan’s ODA has significantly reinforced disaster prevention and mitigation infrastructure in vulnerable areas such as the northern mountainous region, which frequently experiences flash floods and landslides. Through technical cooperation projects, Vietnam has developed risk-mapping systems, expanded ground-movement monitoring and warning networks, and implemented a SABO dam at Nam Pam (Son La), thereby intercepting debris flows, reducing downstream damage, and strengthening community preparedness and proactive response capacity [23].

Third, Japan has contributed to strengthening Vietnam’s climate change institutional framework through the project supporting NDC implementation. Through SPI-NDC, Vietnam developed an MRV system; provisions in the Law on Environmental Protection and Decree No. 06 were further refined; and large-scale training courses were organized for public officials and businesses on greenhouse gas emissions management [20]. Accordingly, Vietnam has gradually moved from a phase of commitment to a phase of substantive action, establishing an important foundation toward the goal of achieving net-zero emissions by 2050.

Fourth, Japan’s ODA has promoted the application of space technology to DRR and CCA. Through the LOTUSat-1 project, Vietnam has built capacity to manufacture and operate an Earth observation satellite and completed the control center and data receiving station in Hoa Lac. Once officially operational, LOTUSat-1 is expected to enhance Vietnam’s capacity to monitor storms, saltwater intrusion, landslides, and flooding, while providing a reliable data basis for climate adaptation solutions [15].

Fifth, Japan has also accompanied Vietnam in advancing science and technology in support of sustainable

growth goals, exemplified by the SATREPS program on emissions reduction in natural rubber production. The project contributes to improving recycling processes, reducing pollution, and progressing toward international ISO standards, thereby enhancing the sustainability of agriculture and the processing industry under increasingly severe climate change conditions [24].

### 5.2. Limitations

In essence, ODA is economic support for development; however, to some extent, it can also be viewed as a political instrument through which Japan shapes the policy environment and development orientation of recipient countries in ways favorable to its own interests. For instance, the disaster prevention and climate change project using an Earth observation satellite applied special terms under the Special Terms for Economic Partnership (STEP), requiring the main contractor to be a Japanese enterprise or a joint venture with a Vietnamese partner, and stipulating that at least 30% of the value of goods be of Japanese origin [26], [27]. This mechanism enables Vietnam to access advanced technologies and management standards in the short term. Nevertheless, dependence on Japanese contractors, equipment, and technical services increases project life-cycle costs, narrows the scope for choosing alternative partners and technologies, and may constrain the space for developing endogenous technological capabilities in Vietnam.

Alongside Vietnam’s economic growth, the overall scale of Japan’s ODA has tended to decline, especially grant aid, while a rising share of concessional lending may create certain pressures on Vietnam’s budget and public debt. Meanwhile, DRR and CCA require long-term investment, are unlikely to generate direct financial returns, and rely largely on public resources. Greater reliance on loans compels Vietnam to prioritize projects with clear economic and technical efficiency, thereby potentially limiting more foundational interventions such as institutional strengthening, community-based risk governance, and ecosystem-based adaptation.

A characteristic of Japanese ODA is its close linkage to modern high-technology packages - such as weather radar, landslide warning sensor networks, and satellite equipment - which require high maintenance costs and highly specialized technical teams. This may exceed the budgets and human resource capacities of many localities. As a consequence, many DRR and CCA models are difficult to scale down to the provincial and community levels - where the impacts of disasters and climate change are most directly felt. Coordination among the meteorological, water resources, disaster management, and climate change sectors also remains fragmented. Difficulties in data sharing and standardization, as well as unclear delineation of responsibilities across ministries and agencies, have slowed the translation of project outputs into practical management applications. This reduces the overall effectiveness of ODA in supporting the implementation of Vietnam’s national DRR and CCA strategy from a systems-based perspective.

Finally, some large-scale and technically intensive projects have faced implementation delays due to complex

procedures and slow disbursement in public investment. For example, the emergency reservoir operation and flood management project using a disaster information system was initially designed for implementation during 2017–2020 [16]. However, constraints related to national defense and security requirements in LiDAR surveying, the impacts of the Covid-19 pandemic, and differences in technical perspectives among stakeholders resulted in the handover being postponed to late 2022 [18]. Prolonged implementation not only increases costs but also delays the realization of the project's social impacts, affecting the confidence of beneficiary communities and the efficiency of resource utilization.

## 6. Outlook and policy recommendations

Overall, the outlook for Japan's ODA cooperation through 2030 in the areas of DRR and CCA in Vietnam is highly promising. First, Japan continues to regard Vietnam as an important partner in its strategy to strengthen climate resilience and advance the energy transition in Asia. Moreover, as the frequency and intensity of disasters and climate change impacts increase, Vietnam's demand for modern forecasting technologies, resilient and sustainable infrastructure, and carbon management instruments is becoming more urgent. In this context, cooperation in the digital transformation of disaster and climate change management is projected to expand significantly. The integration of LOTUSat-1 satellite data, weather radar, IoT sensors, and artificial intelligence-based forecasting models is likely to be a dominant direction in the coming period. Given its technological strengths and experience in operating multi-hazard early warning systems, Japan is a well-suited partner to support Vietnam in developing a modern, intelligent, and interoperable disaster and climate risk management system.

In addition, cooperation on the Joint Crediting Mechanism (JCM) and the development of the carbon market is expected to become a key pillar of Japan–Vietnam ODA cooperation toward 2030, building on Circular No. 17/2015/TT-BTNMT on the JCM within the Vietnam–Japan cooperation framework and the Government's Decree No. 06 on greenhouse gas emission mitigation and ozone layer protection [28], [29]. Alongside the expansion of ecosystem-based adaptation projects, forest restoration, and river-basin management, Japan is likely to continue playing a leading role in providing technical and financial support to Vietnam.

To optimize the effectiveness of Japan's ODA in DRR and CCA, Vietnam should implement a set of coordinated priority measures.

(i) *Policy and institutions.* Vietnam should continue to improve the legal framework and inter-sectoral coordination mechanisms for ODA receipt and implementation, especially regarding the sharing of meteorological–hydrological–satellite data and the mainstreaming of climate adaptation objectives into socio-economic development planning at all levels. Strengthened coordination among ministries, agencies, and local authorities would help reduce fragmentation in ODA

project management.

(ii) *Absorptive capacity enhancement.* Vietnam should prioritize developing human resources capable of operating, maintaining, and mastering the advanced technological systems supported by Japan. Specialized training programs, scholarships, and expert exchanges should be designed to enable long-term knowledge transfer, thereby gradually reducing reliance on external technical assistance.

(iii) *Implementation and sustainability.* Vietnam should establish stable financing mechanisms to sustain the operation of early warning systems and disaster prevention infrastructure after ODA projects end. At the same time, it should prioritize scaling up proven models such as SABO dams, landslide early warning systems, and smart flood management in high-risk areas. Encouraging public–private partnerships in climate technology is also an important solution to mobilize additional societal resources, expand scale, and enhance the sustainability of ODA-supported programs.

## 7. Conclusion

During 2011–2025, Japan's ODA made an important contribution to strengthening Vietnam's capacity for DRR and CCA, particularly through technological modernization, technical assistance, and the consolidation of the policy framework. These cooperative projects helped improve forecasting capacity, risk management, and the resilience of many localities.

Nevertheless, constraints related to limited autonomous operation of advanced technologies, high maintenance costs, and insufficient inter-sectoral coordination have reduced the spillover effects of these projects. In the coming period, Vietnam should strengthen its domestic science and technology capabilities, enhance human resource capacity, and improve coordination mechanisms in order to better leverage Japan's ODA, thereby advancing adaptation objectives and sustainable development.

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