From Public-Private Partnerships to Build a Disaster-Preventive and Resilient City

Jiun-chuan Chao *

Abstract

As a result of climate change, major flooding has affected multiple cities worldwide. To mitigate the damage caused by extreme weather, disaster prevention and rescue technologies have received considerable attention. Given that floods often occur in low-altitude areas, we selected Yunlin as our primary research subject in this study. Yunlin is a county-level administrative division of Taiwan, characterized by an area of 1,291 km2 and with a population of 659,468 in 2024. It has approximately flat terrain but is higher in the east and lower in the west. When heavy rainfall occurs, torrents from mountainous areas rush onto plains, where their flow speed sharply drops. This paper applies a qualitative analysis method based on public–private partnership (PPP) concept and a case study to explore how the Yunlin County Government and the private sector establish a cooperation model to respond to the floods. Our results indicated that the Yunlin County Government can build a data center in the Yunlin Technology Industrial Park or Huawei Industrial Park with the help of the private sector to collect data for decision-makers. Additionally, annual preorder and emergency priority procurement models can support the proposed PPP-based cooperation model. Nongovernmental organizations focusing on disaster prevention—such as the Taiwan Association of Disaster Prevention Industry, Disaster Management Society of Taiwan, and National Science and Technology Center for Disaster Reduction—can bridge the gap between local governments and city residents to support cooperation models.

Keywords: Disaster Prevention and Rescue Technology, Resilient City, Yunlin, Public–Private Partnership, Flooding

* Science & Technology Policy Research and Information Center (STPI), National Institutes of Applied Research (NIAR), Taiwan
Email: chaoeric2012@gmail.com
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Introduction

As a result of climate change, extreme weather conditions have substantially affected the living environment in many cities. Cities in low-altitude areas are likely to be affected by flooding, leading to the destruction of high-rise buildings and large residential structures. Therefore, disaster prevention and rescue technologies have attracted major attention as effective strategies for mitigating the damage caused by extreme weather on cities, with the ultimate goal of improving resilience and increasing the ability of cities to recover from disasters.

Although many studies have considered the implications of resilient cities, few have examined the effects of disaster prevention and rescue technologies on resilient cities. To our knowledge, no studies have yet proposed feasible plans or measures for disaster prevention or rescue that can be adopted by policymakers. In this study, to understand how public-sector and private-sector stakeholders can collaborate to enhance a city's resilience, we examined the effectiveness of integrating disaster prevention and rescue technologies to establish resilience in cities. This paper wants to examine how local governments can cooperate with companies, non-governmental organizations (NGOs), and other stakeholders to address natural disasters, particularly those that involve floods.

Given that each city has unique characteristics and is prone to specific types of disasters, selecting individual cases is essential for in-depth analysis. Additionally, because each disaster type has distinct features and corresponding response strategies, identifying a suitable type of disaster for analysis is crucial. In this study, we examined the occurrence patterns, response measures, and disaster prevention and rescue technologies associated with floods, and we developed various resilience programs. Given that floods often occur in cities with low and relatively flat terrain, we selected Yunlin as our research subject.

Our goal was to answer the following two research questions. First, can the Yunlin County Government and the private sector establish a cooperation model to respond to floods? Second, can this model of cooperation between the Yunlin County Government and the private sector function smoothly? To answer these questions, we hypothesized that the Yunlin County Government and the private sector can collaborate through a public–private partnership (PPP) framework to increase the resilience of Yunlin. We also hypothesized that the Yunlin County Government and private sector can

establish a cooperation model for recovery. To test these hypotheses, we adopted a PPP-based approach and collected relevant documents from government agencies and research institutes.

This paper is divided into five sections. Section 1 provides background information on disaster prevention and rescue technologies for resilient cities. Section 2 outlines the research methodology. Section 3 presents background information on Yunlin and discusses the relationships between city resilience and relevant disaster prevention and rescue policies. Section 4 presents the proposed PPP-based cooperation model and operational framework. Section 5 provides answers to the two research questions.

Methods

Connotations of PPPs

This paper applies a qualitative analysis method based on PPP concept and a case study to explore how the Yunlin County Government and the private sector establish a cooperation model to respond to the floods. All research materials were qualitatively analyzed. The first step in this analysis was to define the concept of the PPP. Generally, PPPs play a key role in public administration. In a paper published on the International Monetary Fund website, Gerrard (2001) defined a PPP as a combination of public-sector capital and sometimes private-sector capital, aiming to improve the output of public services. In the framework of a PPP, the public and private sectors draft a contract that specifies the public sector's long-term demands for public services and outlines how the private sector should provide these services. This contract protects the rights and obligations of both parties; it regulates the business scope and potential profitability of the PPP and is not restricted by market intervention or regulatory agencies. In other words, the source of supervision for a PPP is controlled by the service content specified in the contract and is not control-free. The public sector favors PPPs because when resources are limited, PPPs enable the combination of private-sector capital and capabilities to deliver public services that the public sector cannot afford (Gerrard, 2001).

According to the Organization for Economic Co-operation and Development (OECD), a PPP is an agreement between a government and one or more private partners (which may include operators and financers) in which the private sector delivers services in a manner that aligns the government's service delivery objectives with the private partners' profit objectives, with the effectiveness of this alignment depending on the sufficient transfer of risk to the private partners (OECD, 2008). According

to the Ministry of Finance, PPPs are used to produce public buildings that would typically be constructed by the government but are instead entrusted to the private sector in terms of their construction and operation. In this context, the purpose of a PPP is to enhance the quality of public services through private-sector funding, technology, and innovation. According to Article 1 of the Act for Promotion of Private Participation in Infrastructure Projects (hereinafter referred to as the Act for PPPs), this act was enacted to enhance the quality of public services, accelerate socioeconomic development, and encourage private-sector participation in infrastructure projects.

The scope of public construction involves infrastructure and services that promote the public interest. As defined in Article 3 of the Act for PPPs, an infrastructure project is a project or service that involves the construction of public-use facilities that promote the public interest. Depending on the nature of the public construction, PPPs can take various forms, including build–transfer–operate, build–operate–transfer, build–own–operate, and rehabilitate–operate–transfer (Ministry of Finance, 2000a).

In the context of PPPs, the public sector leads major infrastructure projects, whereas the private sector provides technical services, construction engineering support, or any other services that provide project support. The two sectors collaborate to ensure the coordination and efficiency of each project. Infrastructure projects refer to public facilities established by the central government or local authorities. The importance of clearly defining these terms will become evident in the following discussion.

Case Study

The second step in the qualitative analysis conducted in this study was to examine a case study. A case study is an in-depth investigation of a single research subject, rather than a comparative analysis of multiple similar subjects. By collecting, analyzing, verifying, and comparing relevant data and proposing solutions, case studies enable the evaluation of theories or guidance of theoretical construction (Gerring, 2004; Lin, 2010). Huwei, a township in Yunlin County, is the first township in the region to emphasize the concept of a resilient city. This study conducted a case study analysis to explore the disaster prevention and resilience-building strategies adopted by Yunlin. To understand the context of Yunlin, official sources were reviewed, including the Statistical Yearbook of Yunlin County 2023, the Global Natural Disaster Event Notebook website, and the Yunlin County Government website.

Literature Review

Background on Yunlin

Yunlin County, located in south-central Taiwan, is bordered by the Central Mountain Range to the east and the Taiwan Strait to the west. It has a total land area of 1,291 km2, accounting for approximately 3.59 percent of Taiwan's land area, and it has a population of 659,468 in 2024. Yunlin has generally flat terrain, with higher elevations in the east than in the west. The easternmost region has an altitude of 1,770 m, and from here the land gradually slopes downward to the west; the average altitude is 200–300 m. During periods of heavy rainfall, torrents from the mountainous areas rush toward the plains. As the flows' speed drops sharply, the water level increases substantially, often leading to overflows and making the region prone to floods (Yunlin County Government, 2024; National Science and Technology Center for Disaster Reduction, 2018).

Resilient City: Definition and Benchmarking Literature

According to the United Nations Human Settlements Program, a resilient city is a city that ensures its continuity and that can transform in response to various shocks. The primary goal of such resilience is to improve quality of life, particularly for disadvantaged populations. Resilient cities are typically characterized by continuity, adaptation, inclusion, integration, reflection, and change.

Continuity means that a city can anticipate and respond to future shocks. Adaptation refers to a city's ability to adjust and evolve under varying conditions. Inclusion refers to the ability of a city to prioritize people and protect them against adverse impacts. Integration refers to a city's capacity to facilitate interdisciplinary collaboration, encourage open communication, and promote coordination to support collective functioning. Reflection refers to the ability of a city to incorporate new information and revise existing structures. Change refers to a city's ability to take proactive measures to improve its resilience and promote positive change (UN-Habitat's Urban Resilience Hub, 2018).

Four types of aspects are typically used to measure the resilience of cities: economic orientation, social, environmental, and governance orientation aspects. The economic orientation aspects are the economic growth rate, unemployment rate, labor force size, and age distribution. The social aspects are the household income per unit, the number and age group of individuals in poverty, and the number of immigrants. The environmental aspects are the population density and

urban building density. Finally, the governance orientation aspects are the number of community organizations, public institutions, and local governments (OECD, 2023).

Current Disaster Prevention Policies

In Taiwan, the Ministry of the Interior promotes the Resilient Taiwan Program: Massive Typhoon and Earthquake Disaster Preparedness, a program based on future environmental forecasts and that aims to review the content of the current disaster prevention policies. Within this program, simulations and assessments are conducted to evaluate response plans developed by the Ministry of the Interior, the Ministry of Economic Affairs, and the Ministry of Health and Welfare. The objective of this program is to enhance the current disaster-related plans. The program is primarily promoted by the central government, local governments, and the Project Management Office. The central government provides financial subsidies and formulates annual plans, whereas local governments develop implementation plans in accordance with operational standards and report progress to the central government (Ministry of the Interior, 2022).

In response to risks of disasters that are potentially driven by climate change, the government must adopt digital transformation strategies to improve the effectiveness of their disaster prevention and rescue efforts. It should focus on utilizing digital technologies to enhance disaster risk assessments, improve disaster prevention and response capabilities, and increase cities' resilience.

In 2020, the 10th Executive Yuan's Expert Advisory Committee on Disaster Prevention and Protection emphasized the importance of digital transformation in disaster preparedness and response. First, the government should strengthen meteorological monitoring and forecasting technologies to provide real-time and accurate climate data, which can serve as the basis for early warning and decision-making. For example, disaster risk assessments can be conducted and integrated into urban planning and development to enhance resilience. Second, when a disaster occurs, the government should immediately activate rescue mechanisms and provide real-time disaster information. Simultaneously, it should be able to dispatch machinery and materials to enhance its assistance capacity. To achieve this goal, a cross-departmental digital service platform should be established that integrates forecasting and monitoring information, current disaster conditions, and resource management systems to enhance information sharing and coordination. This digital service platform can support decision-making and increase the effectiveness of disaster prevention efforts, thereby strengthening overall societal resilience and promoting sustainable development.

The Basic Plan for Disaster Prevention and Protection (2024–2028) analyzes environmental change trends and global disaster cases. It draws on policy documents such as the Disaster Prevention White Paper and the National Science and Technology Development Plan to propose disaster prevention strategies centered on the themes of strong recovery, disaster adaptation, and digital transformation (Central Disaster Prevention and Protection Council Report, 2023).

The Executive Yuan's Expert Advisory Committee on Disaster Prevention and Protection identified eight key elements for establishing resilient cities. These elements include establishing a disaster prevention and rescue system, understanding disaster risk scenarios, improving financial resilience, ensuring urban development accounting for disaster risks, and strengthening social resilience and infrastructure disaster response capabilities (National Science and Technology Council, 2020). To achieve these goals, the Disaster Prevention and Resilience Technology Plan, proposed in December 2023, was developed on the basis of the scientific and technological outcomes of previous initiatives. This plan aims to promote digital transformation of disaster prevention (National Science and Technology Council, 2023).

With the intensification of climate change, extreme rainfall events have become more frequent, resulting in the backflow of substantial rainwater. In 2018, the Executive Yuan introduced enhanced water management strategies in the 0823 Flood Control Mechanism Project Report on Central and Southern Floods, and the Water Resources Agency proposed the Smart Flood Prevention Plan (2020–2026) as an approach for flood prevention (Water Resources Agency, 2019a).

In 2019, the Water Resources Agency proposed the Resilient Water City Assessment—Reference Manual for Local Government Heads, which outlines key elements for establishing cities' water resource resilience. These elements are organizational resilience, infrastructure resilience and economic resilience (Water Resources Agency, 2019b).

According to the Yunlin County Regional Disaster Prevention and Rescue Plan of 2023, the eastern region of Yunlin has higher altitude compared with the western region. There are17 townships in the plain or in the coastal area in Yunlin. In recent years, short-duration heavy rainfall events have become increasingly common, resulting in difficult-to-predict floods.

When the cumulative rainfall reaches 650 mm within 24 hours, the plains and coastal areas of Yunlin tend to be at a risk of flooding. If such a condition occurs, 11 townships (Mailiao, Taixi, Kouhu, Sihu, Shuilin, Beigang, Yuanchang, Huwei, Dounan, Dapi, and Douliu) may experience floodwaters

exceeding 3 meters. A rainfall amount of 350 mm within 6 hours constitutes a short-term heavy rainfall event. If the rain is this intense, floodwaters exceeding 1 meter may affect five townships (Douliu, Huwei, Dounan, Dapi, and Shuilin). Given that these townships have high population density and given their overall aging population, considering the needs of vulnerable groups during disasters is essential (Disaster Prevention and Control Office, 2024).

Results and Discussion

By considering the PPP framework, this study devised models for public construction projects and service cooperation between the public and private sectors to enhance Yunlin's resilience through disaster prevention and rescue technologies. Regarding public construction projects, this study suggests that data centers can be established in Yunlin. In addition, according to the results of our service cooperation models, the two models can facilitate collaboration between the public and private sectors.

Establishing a Data Center through PPP

Establishing a data center in Yunlin would facilitate the collection, centralized processing, and analysis of various data essential for disaster prevention and decision-making. Flood sensors can be deployed in low-altitude areas to obtain water level data, and closed-circuit television cameras can be installed to capture visual water level data. These two types of data can be transmitted to the data center through fiber optic cables or wireless networks to provide timely warnings. In Yunlin, such a data center can be established in the Yunlin Technology Industrial Park, where Google's third data center is located. According to data from the county government, the Hushan Reservoir, with a water storage capacity of 53.47 million tons, can meet the water requirements of this data center. Moreover, in terms of electricity, Mai-Liao Power Corporation can supply 1.8 GW of power (Yunlin County Government, 2020). Another candidate site is the Huwei Industrial Park, which covers an area of approximately 29.75 ha. This site is a 15 min drive from National Freeway No. 1 (Sun Yat-sen Freeway) and 300 meters away the Central Taiwan Science Park and Taiwan High Speed Rail Yunlin Station Special District, which ensures access to substantial amenities (Yunlin County Government, 2024).

Through PPPs, companies can collaborate with the Yunlin County Government to establish data centers. In accordance with the Act for PPPs, the Yunlin County Government can offer incentives such as reductions or full exemptions of profit-seeking enterprise income tax, land value tax, or

housing tax to attract companies to invest in this public construction project (Ministry of Finance, 2000b). Candidate companies include Pacific Engineers & Constructors (PECL), Acter Group Corporation Limited (Acter), and Chief Telecom (Chief). Each of these companies has prior experience in establishing data centers. PECL established Google's data centers in the Changhua Coastal Industrial Park, Acter established web service data centers for Amazon, and Chief established its own Chief LY2 AI data center in Taipei (Wang, 2024; Zeng, 2024; Chief Telecom, 2024).

PPP-Based Cooperation Model

This article introduces two cooperation models within the PPP framework. The first model is an annual preorder model in which the public and private sectors draft an annual preorder contract granting the public sector the right of first refusal. In the event of a disaster, the public sector can purchase relief supplies within the terms of this contract. To protect the rights and interests of the private sector, this contract must clearly define the obligations of the public sector. The public sector must also have the right of first refusal, and a deposit must be made to facilitate procurement by the private sector. If this right is not exercised, it must be transferred to help other public-sector stakeholders purchase relief supplies.

The second model is an emergency priority procurement model in which the public and private sectors draft a contract that allows the public sector to purchase relief supplies at prices 30 to 40 percent above market value during a disaster. In this model, the private sector is responsible for delivering all materials to their designated locations. In the case of a disaster, the public sector is granted the highest purchasing priority.

If the cooperation model is implemented, the entire implementation process can be operationalized through scenario simulations. For example, the Yunlin County Government can analyze weather history data, tidal variations, and flood control measures in low-altitude areas to develop an annual disaster preparedness prepurchase and emergency procurement plan. In this plan, qualified suppliers would be selected, and labor entrustment contracts would be signed in accordance with the Government Procurement Act. In addition, 30 percent of the total project funds would be allocated to annual expenditures. In other words, 30 percent of the total project funds would be earmarked at the beginning of the year and would be covered by the total annual budget. In the event of a major disaster, the Yunlin County Government would directly utilize the First Reserve Fund, Secondary Reserve Fund, or Disaster Reserve Fund to purchase the necessary disaster prevention materials and

ensure a rapid disaster response. To access the First Reserve Fund or Secondary Reserve Fund, certain legal regulations must be followed. These regulations are the Management Guidelines for Applying for the First Reserve Fund, the Management Guidelines for Applying for the Secondary Reserve Fund, and the Budget Act.

PPP-Based Operational Framework

This article explains the measures of disaster prevention and rescue adopted in Yunlin, which are based on the Yunlin County Regional Disaster Prevention and Rescue Plan of 2023. When the Yunlin County Government seeks candidates to implement the annual disaster prepurchase plan, priority should be given to entities with either proprietary disaster prevention and rescue technologies or project management experience in disaster prevention and rescue. According to insights from the annual event of Fire & Safety, several NGOs are capable of supporting the proposed models. Many types of NGOs are available, each with a unique function. NGOs specializing in disaster prevention can effectively support the PPP-based operational framework. They can also bridge the gap between the government and local residents. These NGOs may include the Taiwan Association of Disaster Prevention Industry, the Disaster Management Society of Taiwan, the Crisis Management Society of Taiwan, or the National Science and Technology Center for Disaster Reduction.

According to the Regional Disaster Prevention Plan, disaster response involves three stages: a disaster mitigation stage, a preparation stage, and a response and recovery stage. These stages should be carefully considered by NGOs.

In the disaster mitigation stage, the establishment of databases is essential. Information equipment vendors and information service providers can provide data storage devices, computer hosts, computer room equipment, and other hardware to assist the public sector in establishing disaster prevention and rescue data centers. Information service providers can also provide software and hardware system integration services. Additionally, the establishment of monitoring, forecasting, and early warning systems is crucial. Sensor manufacturers can supply rainfall, wind, environment, and other types of sensors to help monitoring, forecasting, and early warning systems collect climate and environmental data and transmit them to the data center.

In the preparation stage, bottled water manufacturers and food factory operators can supply drinking water, rations, instant and canned foods, and pumping motors in advance. Public-sector

stakeholders should regularly establish cooperation mechanisms with relevant businesses to facilitate emergency equipment procurement, ensure timely supply to units in disaster-affected areas, and enable the distribution of emergency equipment to residents. In addition, epidemic prevention materials—including face masks, disinfectants, medications, and gloves—should be similarly managed.

In the response and recovery stage, NGOs specializing in disaster prevention can support the public sector. For example, they can integrate human, material, and financial resources to fully support local governments in conducting disaster relief operations. These NGOs typically comprise both corporate group members and individual members, each contributing with distinct technologies, expertise, and resources relevant to disaster relief. Corporate group members have access to disaster relief equipment, disaster prevention and relief kits, and other supplies. For instance, Thirty Well-Being has access to and distributes emergency evacuation bags and bug-out bags. Individual members are primarily disaster relief volunteers, emergency medical technicians, and individuals holding at least an EMT-2 license, and they may even include those with an EMT-P license.

When a disaster occurs, NGOs specializing in disaster prevention can contact long-term partner disaster relief organizations through Short Message Service or social media platforms. To mitigate the effects of a disaster, volunteers tend to prioritize supporting the public sector in disaster relief efforts. To address potential shortages in response teams, strategic alliances should be established with veterans' associations that possess expertise in military operations, disaster relief, and specialized services.

These associations include the Yunlin County Marine Corps Veterans Association, the Chinese Army Amphibious Reconnaissance Battalion Veterans Association, and the Chinese Navy UDT Retiree Association. To mobilize materials and financial resources, NGOs specializing in disaster prevention tend to operate within a memorandum of understanding to allocate equipment for disaster relief. For more information on material mobilization procedures, readers can refer to the machine rental process flowchart provided by the Armed Forces Reserve Command of the All-Out Defense Mobilization Agency (Armed Forces Reserve Command, 2024; Sinshih District Office, 2024).

In the model of cooperation between NGOs specializing in disaster prevention and the Yunlin County Government, the head of each NGO is designated as the primary liaison responsible for communicating with the county government. Regional groups are established in the northern, central, and southern districts of Yunlin. These groups consist of NGO members responsible for maintaining

contact with the designated liaison in each administrative district and for holding monthly regional meetings.

Yunlin comprises 20 administrative districts. Each district is assigned a representative who conducts regular patrols of flood-prone areas within their jurisdiction and uploads their inspection records to the data center. Coordination meetings, held either in person or online, are conducted every quarter or every month. These meetings focus on three main topics: (1) the progress of annual plan implementation, (2) the preparation of human and material resources, and (3) the strategies for responding to future emergency scenarios.

Conclusion

In this study, we considered PPPs and analyzed a case study to answer two research questions. First, can the Yunlin County Government and the private sector establish a cooperation model to respond to floods? Second, can this model of cooperation function smoothly between the Yunlin County Government and the private sector?

In response to the first question, we discovered that the Yunlin County Government and the private sector can cooperate within the PPP framework. In terms of public construction, the Yunlin County Government can collaborate with companies such as PECL, Acter, or Chief to establish data centers in the Yunlin Technology Industrial Park or Huwei Industrial Park. In terms of public service, the Yunlin County Government and the private sector can establish an annual preorder model or an emergency priority procurement model to ensure the timely distribution of disaster relief supplies. In response to the second question, we discovered that NGOs specializing in disaster prevention can bridge the gap between the government and city residents and can operate in alignment with the Regional Disaster Prevention Plan.

Overall, our findings provide a foundation for integrating disaster prevention and rescue technologies to build resilient cities. They offer insights into the development of models of cooperation among local governments, data center construction companies, and NGOs specializing in disaster prevention. These findings can be used as a reference to enhance flooding disaster prevention and related rescue technologies and to develop resilience programs. They can also be used to enhance case studies based on PPPs and flood control plans through disaster prevention and rescue technologies. More specifically, our findings may promote the study of public administration and

contribute to the integration of the two academic fields of public policy and disaster prevention and rescue technology. These findings may provide novel insights into key issues and help lay the foundation for future research seeking to consolidate the study of public administration theory.

In the future, this study offers a PPP-based case model based on Yunlin County that can be applied and verified in other flood-prone areas. This model can also be used as a reference for Yunlin County in cases of natural disasters such as typhoons. On the other hand, the paper will use this model to explore much more cases in Taiwan or in other countries.

References

Armed Forces Reserve Command. (2024, May 31). *Flowchart of Machine Rental Procedure.* All-Out Defense Mobilization Agency. https://afrc.mnd.gov.tw/AFRCWeb/Unit.aspx?MenuID=579&ListID=1342

Central Disaster Prevention and Protection Council. (2023). *Disaster Prevention and Protection Basic Plan (2024-2028).* Central Disaster Prevention and Protection Council Report. https://cdprc.ey.gov.tw/Page/B370E7DF675168E1/a222b428-b2b9-4f1a-a55f-7f05d108e8ed

Chief Telecom (2024, September 12). *AI-Powered Data Centers: The Cornerstone of The Future Digital Economy.* Chief Telecom. https://www.chief.com.tw/announce/news/20240912news/

Gerrard, M. B. (2001). Public-Private Partnerships: What are Public-Private Partnerships, and How Do They Differ from Privatizations?. *Finance & Development: A Quarterly Magazine of the IMF, 38*(3), 48-51. https://doi.org/10.5089/9781451952346.022

Gerring, J. (2004). What is a Case Study and What is it Good for?. *American Political Science Review, 98*(2), 341-354. https://doi.org/10.1017/S0003055404001182

Information Department. (2020, July 22). *Yunlin County Government and Buddhist Compassion Relief Tzu Chi Foundation Signed a Memorandum of Understanding.* Yunlin County Government. https://www.yunlin.gov.tw/News_Content.aspx?n=1244&s=301116

Lin, S. (2010). *Qualitative Research: Theory and Practice.* Chuliu Book Co., Ltd.

Ministry of Finance. (2000). Act for Promotion of Private Participation in Infrastructure Projects. *Presidential Office Gazette, 6323*, 28-39.

National Science and Technology Center for Disaster Reduction. (n.d.). *Yunlin.* Global Natural Disaster Event Notebook Website (GNDEN). https://den1.ncdr.nat.gov.tw/1178/1655/

National Science and Technology Council. (2022). *Resilient Taiwan Program: Massive Typhoon and Earthquake Disaster Preparedness Promoted.* Ministry of the Interior. https://rtp.nfa.gov.tw/page/rtp_intro

National Science and Technology Council. (2020, April 17). *The Ministry of Science and Technology Convened the Executive Yuan Expert Advisory Committee on Disaster Prevention and Protection to Complete a Disaster Prevention Policy Proposal - Focusing on the Response of Resilient Cities Under Extreme Disasters.* https://www.nstc.gov.tw/folksonomy/detail/5d431ca7-761c-41dc-b679-5c9a23174abe?l=ch

Office of Disaster Management of Executive Yuan. (2024). *Yunlin County Regional Disaster Prevention and Rescue Plan (2023).* Central Disaster Prevention and Protection Council of Executive Yuan. https://cdprc.ey.gov.tw/Page/C10B9C4A41D6D55F/59c68202-d0fb-4c57-92ec-74465a3bbede

Office of Disaster Management of Executive Yuan. (2023). *Project on Disaster Reduction and Resilience Technology (2023-2026).* Executive Yuan. https://www.ey.gov.tw/Page/448DE008087A1971/51b91279-c9ee-4404-a4f6-0b0b982f179f

Organisation for Economic Co-operation and Development. (2023). *A Territorial Approach to Climate Action and Resilience*. Paris: OECD Publishing. https://doi.org/10.1787/1ec42b0a-en

Organization for Economic Cooperation and Development. (2008). *Public-Private Partnerships: in Pursuit of Risk Sharing and Value for Money.* https://doi.org/10.1787/9789264046733-en

Pacific Engineers & Constructors, Ltd. (n.d.). *Data Center.* https://www.pecl.com.tw/TC/projects_info.aspx?mid=52&id=47&chk=5072edb6-e1c5-4b4b-92bf-aea404805c3d#gsc.tab=0

Sinshih District Office. (2024, November 22). *District Office Signs Disaster Prevention Cooperation Memorandum, Material Contract, Generator Support Agreement.* Tainan City Government Publicdisaste. https://web.tainan.gov.tw/publicdisaster/News_Content.aspx?n=21181&s=8712574

United Nations Human Settlements Programme (2018). *City Resilience Profiling Tool.* UN-Habitat 's Urban Resilience. https://unhabitat.org/guide-to-the-city-resilience-profiling-tool

Wang, Y. (2024, June 25). *Taiwan Adds more than 10 New Data Centers this Year, Acter's Two-Bid Bidding Grand Slam.* Economic Daily News, p. A12.

Water Resources Agency. (2019a). *Smart Flood Prevention Plan (2020-2026).* Water Resources Agency, Ministry of Economic Affairs. https://www-ws.wra.gov.tw/Download.ashx?u=LzAwMS9VcGxvYWQvb2xkRmlsZS9tZWRpYS8xNDQxMjMv5rC054G95pm65oWn6Ziy54G96KiI55WrLeaguOWumuacrC5wZGY%3D&n=5rC054G95pm65oWn6Ziy54G96KiI55WrKOaguOWumuacrCkucGRmLnBkZg%3D%3D&icon=.pdf

Water Resources Agency (2019b), *Ren Sing Shuei Cheng Shih Ping Gu-Di Fang Jheng Fu Shou Jhang Can Kao Shou Ce* [Resilient Water City Assessment-Reference Manual for Local Government Heads]. Water Resources Agency, Ministry of Economic Affairs. https://www.ws.wra.gov.tw/Download.ashx?u=LzAwMS9VcGxvYWQvb2xkRmlsZS9tZWRpYS82MDA4OC%2Fpn4zmgKfln47luILlj4PogIPmiYvlhooxMDgwNTIyLnBkZg%3D%3D&n=6Z%2BM5oCn5Z%2BO5biC5Y%2BD6ICD5omL5YaKMTA4MDUyMi5wZGYucGRm&icon=.pdf

Yunlin County Government. (2024). *Statistical Yearbook of Yunlin County 2023.* Yunlin County Government.