บทความวิจัย

บทบาทขององค์กรปกครองส่วนท้องถิ่นไทยกับการจัดการด้านสิ่งแวดล้อม เพื่อรองรับการเปลี่ยนแปลงสภาพภูมิอากาศ

The Role of Local Government in Thailand in Environmental Management for Climate Change Adaptation

จิตรานุช เกียรติอดิศร

Chittranut Kiatadisorn

นักวิชาการ, สถาบันพระปกเกล้า

Academician, King Prajadhipok's Institute

E-mail: chittranut.ki@kpi.ac.th

This article is presented in the 17th National Conference on Public Administration of Public Administration Association of Thailand at Ubon Ratchathani University, November 17, 2023

Received: October 12, 2023; Revised: November 21, 2023; Accepted: December 15, 2023

บทคัดย่อ

งานวิจัยชิ้นนี้ จัดทำขึ้นเพื่อศึกษาบทบาท ความรับผิดชอบ และความสามารถขององค์กรปกครองส่วนท้องถิ่นในการบริหารจัดการด้านสิ่งแวดล้อมเพื่อรองรับการเปลี่ยนแปลงสภาพภูมิอากาศ โดยการศึกษาวิจัยครั้งนี้ เป็นการวิจัยแบบผสมผสาน (Mixed Method Research) ที่สำรวจองค์กรปกครองส่วนท้องถิ่นทั่วประเทศ 2,149 แห่ง ผ่านแบบสอบถามและวิจัยเอกสารที่เกี่ยวข้อง ผลการศึกษาพบว่า องค์กรปกครองส่วนท้องถิ่นในประเทศไทยยังไม่จัดลำดับความสำคัญให้เรื่องการจัดการด้านสิ่งแวดล้อมเป็นเรื่องสำคัญลำดับต้น อย่างไรก็ตามพบว่า โครงการเกี่ยวกับการจัดการด้านสิ่งแวดล้อมส่วนใหญ่เป็นโครงการที่มาจากความต้องการของประชาชนในพื้นที่ โดยองค์กรปกครองส่วนท้องถิ่นที่มีขนาดเล็กมีสัดส่วนการใช้งบประมาณสำหรับการบริหารจัดการด้านสิ่งแวดล้อมมากกว่าองค์กรปกครองส่วนท้องถิ่นที่มีขนาดใหญ่ โดยท้องถิ่นให้ความสำคัญกับมีเรื่องการจัดการขยะ ซึ่งเป็นหน้าที่หลักขององค์กรปกครองส่วนท้องถิ่นส่วนใหญ่เป็นอันดับแรก

ในมิติด้านการปรับตัว (adaptation) พบว่า แม้ว่าท้องถิ่นจะมีการตระหนักรู้อย่างมากเกี่ยวกับความท้าทายด้านการเปลี่ยนแปลงสภาพภูมิอากาศ แต่มีเพียงร้อยละ 38.43 ของผู้ตอบแบบสอบถามเท่านั้นที่ดำเนินกิจกรรมการปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศอย่างจริงจัง ในมิติด้านการลดก๊าซเรือนกระจก (mitigation) พบว่าท้องถิ่นได้ดำเนินกิจกรรมด้านการลดก๊าซเรือนกระจก ค่าเฉลี่ยอยู่ที่ร้อยละ 36.82 ซึ่งมักเป็นกิจกรรมหลักตามภารกิจท้องถิ่นและเมื่อสำรวจในประเด็นความเพียงพอของการจัดเก็บขยะมูลฝอยและสิ่งปฏิกูล พบว่า ไม่มีเพียงพอสูงถึงร้อยละ 47.15 ของพื้นที่สำรวจ และในการสำรวจมิติด้านการสร้างขีดความสามารถและขับเคลื่อนการดำเนินงานรองรับการเปลี่ยนแปลงสภาพภูมิอากาศ พบว่าร้อยละ 60.66 ขององค์กรปกครองส่วนท้องถิ่นยังขาดกิจกรรมด้านการพัฒนาข้อมูล งานวิจัย และเทคโนโลยีเกี่ยวกับการเปลี่ยนแปลงสภาพภูมิอากาศ นอกจากนี้พบว่า ท้องถิ่นส่วนใหญ่สนับสนุนแนวคิดในการกระจายอำนาจให้ท้องถิ่นสามารถประกาศเขตพื้นที่ภัยพิบัติเองได้ เพื่อสามารถใช้อำนาจหน้าที่และงบประมาณ ในการแก้ไข

ปัญหาภัยพิบัติได้อย่างทันท่วงที (70.40%) และสนับสนุนการเพิ่มงบประมาณสำหรับการพัฒนาแหล่งน้ำ (63.70%) และต้องการการสนับสนุนจากส่วนกลางสำหรับโครงการริเริ่มเมืองสีเขียวที่ยั่งยืน (55.80%)

การศึกษาในครั้งนี้ เน้นย้ำถึงภูมิทัศน์การจัดการสิ่งแวดล้อมที่หลากหลายภายในองค์กรปกครองส่วนท้องถิ่นของไทย โดยเน้นย้ำถึงความจำเป็นในการปรับปรุงการจัดสรรทรัพยากร และความพยายามในการทำงานร่วมกันเพื่อต่อสู้กับการเปลี่ยนแปลงสภาพภูมิอากาศอย่างมีประสิทธิภาพ

คำสำคัญ: การเปลี่ยนแปลงสภาพภูมิอากาศ; การปรับตัวต่อการเปลี่ยนแปลงสภาพภูมิอากาศ; การบรรเทาผลกระทบจากการเปลี่ยนแปลงสภาพภูมิอากาศ; ก๊าซเรือนกระจก; ภาวะเรือนกระจก; เมืองพร้อมรับภัยพิบัติ; เมืองที่เป็นมิตรต่อสิ่งแวดล้อม

Abstract

This research aims to investigate the roles, responsibilities, and capacities of local government concerning environmental management, particularly in relation to addressing climate change conditions. Employing a mixed method research approach, this research studies the related documents and surveys of 2,149 local government organizations across the country through a structured questionnaire that addressed the local governments' environmental management practices and three dimensions: adaptation, mitigation, and capacity-building, all of which are linked to climate change conditions. The study discovers that environmental management isn't a primary focus for most organizations, with smaller bodies showing more commitment to environmental spending. Waste management emerges as the top priority, driven by community concerns.

Regarding adaptation, there's decent awareness of climate change issues among local governments, with 38.43% engaging in adaptation activities, primarily policy-driven measures and aiding vulnerable groups. Insufficient green spaces cover less than 20% of the country, indicating a need for more environmentally friendly areas. Concerning greenhouse gas mitigation, local governments undertake activities, scoring an average of 36.82%. Key actions focus on waste management and building controls, yet nearly half the surveyed area lacks adequate waste management. In terms of capacity building, about 60.66% lack activities related to data, research, and technology for climate change adaptation. The majority of local government support the concept of decentralizing power to handle emergencies independently (70.40%), increasing budgets for water source development (63.70%), and seeking central authority support for sustainable green city initiatives (55.80%).

This study highlights the varied environmental management landscape within Thai local governments, emphasizing the need for enhanced focus, resource allocation, and collaborative efforts to combat climate change effectively.

Keywords: Climate Change; Climate Change Adaptation; Climate Change Mitigation; Greenhouse Gas; Greenhouse Effect; Resilient City; Green City

Introduction

Every two years, the College of Local Government Development at King Prajadhipok's Institute releases a report on the state of decentralization and local governance called the "Decentralization Report." The report covers Thailand's current decentralization situation and current important issues relevant to the Thai local government.

In the 2023, the issue of local governance and environmental management to support climate change adaptation has gained significant attention. This is due to the situation that Thailand has increasingly experienced severe impacts every year. These impacts encompass increasing temperatures, precipitation trends linked to unpredictable conditions departing from typical seasonal expectations. These factors affect the environment, the economic situation, and the quality of life for people in the local communities.

The issue of adaptation and coping with climate change in the future has become continuously concerned. The consideration of the roles played by local government organizations in Thailand, as the primary public service providers, regarding environmental management for climate change adaptation has increasingly become a topic of interest. Therefore, this research aims to investigate the roles, responsibilities, and capacities of local government concerning environmental management, particularly in relation to addressing climate change conditions.

Research Theme. Assessing the Role of Local Government in Thailand in Environmental Management for Climate Change Adaptation: A Mixed-Method Investigation

Objectives

1. To investigate the roles and responsibilities of local government organizations in environmental management with their contribution to climate change adaptation.

2. To study the capabilities of the local government organizations in Thailand in providing support to communities impacted by climate change.

3. To analyze the existing plans and strategies implemented by local government organizations intended to strengthen efforts in climate change mitigation and enhance resilience to the impacts of climate change.

Research Question

1. What are the role of local government organizations in environmental management to support climate change adaptation?

2. To what extent can local government organizations help communities affected by climate change?

3. What plans do local government organizations have in place to address climate change and natural disaster resilience?

Literature reviews

This research reviews the literatures on 2 issues: 1. conceptual framework for environmental management planning and future climate change 2. laws and regulations related to environmental management of local government organizations and transfer of missions.

1. Conceptual framework for environmental management planning and future climate change

Global Circumstance

The world has experienced a long-term increase in average temperatures since the Industrial Revolution period in the 18th century due to fossil fuel usage. By 2030, the global average temperature is predicted to rise by more than 1.5 degrees Celsius compared to the pre-industrial era (Climate Center, 2022). This rapid temperature rise can have severe consequences, including more extreme natural disasters and rapidly rising sea levels due to the melting polar ice.

The continuous global warming, caused by the concentration of greenhouse gases, leads to severe and rapid changes in the Earth's climate. According to the Intergovernmental Panel on Climate Change (IPCC) report in 2022, global temperatures have already risen by 1.1 degrees Celsius, with projections indicating a potential increase to 1.5 degrees Celsius. If temperatures continue to rise beyond 1.7-1.8 degrees Celsius, it is estimated that half of the global population may face severe heat and humidity that threatens their livelihoods (Levin, Boehm & Carter, 2022).

To prevent the consequences, international agreements like the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement have been established to limit global warming to below 2 degrees Celsius, with an ambitious target of 1.5 degrees Celsius. The latest COP27 in Sharm El-Sheikh, Egypt, in November 2022, emphasized global efforts to achieve these goals (Lienard, 2022).

Thailand’s National Circumstances and Efforts

As a developing country, Thailand was ranked 9th globally in the "extreme risk" category, as a country with high vulnerability to future climate change impacts over the next three decades. Despite, Thailand's greenhouse gas (GHG) emissions amount are less than 1% of global emissions and lower than the global average (Office of Natural Resources and

Environmental Policy and Planning, 2018). Notably, the energy sector stands as the primary contributor to Thailand's GHG emissions, making up 69.06% of the total emissions in 2018. Thus, the country adopt the global goal in international agreements like the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement in direction to limit global temperature with an ambitious target of 1.5 degrees Celsius (Office of Natural Resources and Environmental Policy and Planning, 2018).

Since 2007, Thailand has integrated climate change into its national economic and social development strategies. Climate change is now outlined in the National Strategy (2018-2037), ensuring its sustained importance alongside other economic and social factors such as poverty reduction. The Climate Change Master Plan 2015-2050 encompasses strategies for addressing climate change, encompassing mitigation, adaptation, capacity building, and interconnected issues.

2. Laws and regulations related to environmental management of local government organizations and transfer of missions

The primary role of local government organizations is mainly related to the provision of public services for the benefit of the local population. These local government entities can also establish ordinances or regulations at the local level for urban environmental management, in accordance with the overarching legal framework (Royal Thai Government Gazette, 1999).

Important laws related to environmental management of local government organizations are as follows:

1. Provisions regarding the environment of the 2017 Constitution
2. Law establishing local government organizations:
   2.1 Municipality Act 1953
   2.2 Subdistrict Council and Subdistrict Administrative Organization Act B.E. 1994
   2.3 Provincial Administrative Organization Act 1997
   2.4 Bangkok Metropolitan Administration Act, B.E. 1985
   2.5 Pattaya City Administrative Regulations Act, B.E. 1999

These 5 establishing local government organization laws specify local environmental management duties related to: managing waste and wastewater, maintaining the cleanliness of the city, public health, managing natural resources and the environment, maintaining public places and local culture, and urban planning and construction control.

3. Specific laws that empower local government organizations to manage the environment such as National Environmental Quality Promotion and Preservation Act, 1992

4. The law gives local authorities authority to manage natural resources such as Mineral Act 2017, Water Resources Act 2018,

5. Local decentralization law

The decentralization of power to local government organizations not only involves the enactment of relevant laws but also includes power decentralization plans and operational decentralization plans for local government organizations. This constitutes the distribution of tasks in both central and regional government to local government organizations.

The distribution of tasks from the national decentralization plan, the transferred missions of local government organizations are usually missions that have some overlapped subtasks to the missions of central government agencies. Also, the local government organizations in different size have to accept equally large missions. Environmental missions are important missions that must be carried out according to specified laws. Therefore, environmental decentralization requires holistic consideration of the structure of relationships between other missions (Jarusombat, 2021).

Research Framework

Figure 1 Research Framework

Research Methodology

This mixed-method research examines the roles, responsibilities, and capacities of local government concerning environmental management, in relation to addressing climate change conditions. We studied the related documents and surveys of the local government organizations across Thailand with a structured questionnaire that addressed three dimensions: adaptation, mitigation, and capacity-building, all of which are linked to climate change conditions.

In this research study, the researchers collected data from the questionnaire, "The Role of Local Government Organizations in Environmental Management to Support Climate Change Adaptation" nationwide. A total of 2,149 local government organizations responded to the questionnaire out of a total of 7,850 local government organizations across the country.

Research Sample

The number of sample groups in this study was determined by using stratified sampling based on the proportion of local government organizations nationwide, which totaled 7,840 (excluding 2 special-format local government organizations). The sample size was determined to have a maximum sampling error of not more than 2% at a 95% confidence level.

$$\text{Finite population: } n' = \frac{n}{1+\frac{z^2 \times \hat{p}(1-\hat{p})}{\varepsilon^2 N}}$$

z = z score

ε = margin of error

N = population proportion

p̂ = population proportion

confidence level 95%
margin of error 2%
population proportion 50%
population proportion 7,850 คน

Therefore, the number of samples classified by type of local government organization is as follows.

Table 1 The Number of Samples Classified by Type of Local Government Organization

Type of the Local Government Organizations	Total Number of Local Government Organizations	Number of Local Government Organization Sample	Number of Actual Data Collection
(1) Provincial Administrative Organization (PAO)	76	18	18
(2) City Municipality	30	7	11
(3) Town Municipality	195	46	49
(4) Subdistrict Municipality	2,247	527	773
(5) Subdistrict Administrative Organization (SAO)	5,300	1,242	1,296
(6) Special Local Government Organizations: Bangkok Metropolitan Administration and Pattaya City (100% collected)	2	2	2
Total	7,850	1,842	2,149

The research process is divided into three stages:

Stage 1 Data Collection:

Survey questionnaires are used to gather data about the roles of local government organizations in environmental management to address climate change-related challenges. The questionnaire consists of two parts:

Part 1: General information about the local government organization, including demographics, organization's location, income, and local government organization executives.

Part 2: The capabilities, roles, and preparedness of local government organizations to adapt to climate change. This includes assessing the environmental management practices of the local government organization at the grassroots and specific levels. It covers three dimensions: adaptation, mitigation, and building capacity to support climate change initiatives.

Stage 2 Data Analysis:

Statistical analysis using the SPSS software is conducted to analyze the data. Descriptive statistics are employed to determine the frequency, data distribution, average values, and standard deviations of independent variables, such as the type of local government organizations.

Relationships between variables are explored to identify correlations between independent variables and the roles of local government organizations in environmental management.

Stage 3 Presentation of Research Findings:

The research findings are presented at a national level, covering various aspects, including: The types of local government organizations. The locations of local government organizations based on geographical regions. The size of local government organizations in terms of population. The income of local government organizations is categorized by types. Tenure of local leadership positions, classified by the type of local government organization involved.

Research Findings

1. The overall environmental management situation of local government organizations:

1.1 Environmental management is not a top priority for most local government organizations in Thailand. An assessment of data related to environmental projects, budgets, systems and personnel shows that, local government organizations are not actively engaged in environmental management to support climate change adaptation. However, some organizations have future plans to address the issues.

Local government organizations (LGOs) acknowledge the importance of environmental management, and they are preparing to enhance their environmental management capabilities. Currently, nearly half of LGOs (45.28%) have declared policies for environmental management to support climate change adaptation. Around 42.79% have formulated clear plans for environmental management to address climate change. However, within their local regulations, many LGOs (approximately 70%) have not issued ordinances or regulations related to environmental management for climate change adaptation. Additionally, they have not conducted training to develop local personnel for climate change adaptation, although over 50% have enacted ordinances or regulations related to environmental management and have carried out activities within their responsibilities.

1.2 The sources of environmental projects included in the operational plans of local government organizations primarily originate from issues and demands raised by the local community in the area. The study found that the proportion of project sources related to the environment within local government organizations, when compared among the public sector, government sector, and academia, is as follows:

59.10% of project sources come from local issues or public demands.

30.90% of project sources come from central government policies.

10% of project sources come from experts or scholars.

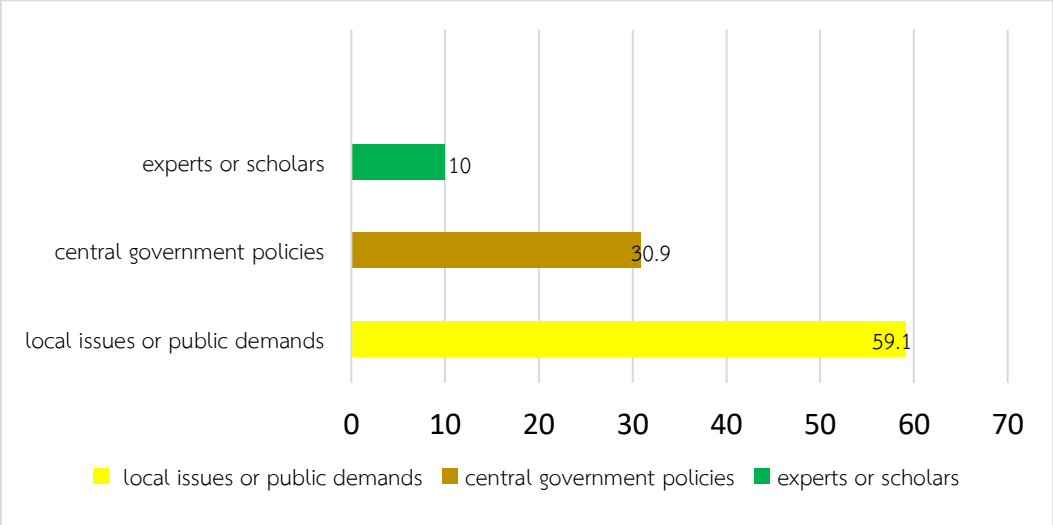

Figure 2 The Proportion of Sources of Environmental Projects in Local Government Organizations

This demonstrates that the majority of environmental projects are initiated by the local community demands, with a smaller proportion being influenced by national policies or expert opinions.

1.3 Small-sized local government organizations tend to allocate a higher proportion of their budgets to environmental expenses comparing to larger local government organizations. The smaller local government organizations tend to allocate a higher proportion of their budgets to environmental expenses comparing to larger ones. This indicates a greater emphasis on environmental initiatives in smaller local government organizations.

1.4 The top environmental issue that local government organizations prioritize is waste management. According to survey data collection on the local government duties and responsibilities, it was found that these organizations collect and utilize waste-related data the most. The data includes the water quality data and the data on hazardous environmental establishments, all of which are directly related to the quality of life for the public in terms of public health and welfare.

The local government organization also ranked the most urgent environmental problems that need immediate attention within local government areas, the top four issues are as follows:

1. Waste management and disposal.
2. Air pollution, such as toxic air and exceeding dust standards.
3. Water pollution, such as contaminated or polluted water with chemicals.
4. Sudden flooding.
5. Air pollution is the second most urgent issue in several areas. However, the survey revealed that many local government organizations in various regions do not collect air quality data.

2. The Role of Local Government in Thailand in Environmental Management for Climate Change Adaptation.

Adaptation:

In the dimension of adaptation, a general knowledge assessment of climate change/global warming and greenhouse gas emissions revealed that the target local governments answered questions correctly at a rate of 75.34%. Moreover, 85.70% of the target local government recognized the associated challenges, including impacts on health and the growth of agricultural produce, which significantly affect the well-being of the population. At present, approximately 38.43% of local government organizations have undertaken adaptation activities to address changing climatic conditions. These activities commonly encompass policy-driven measures, agricultural remedies, or assistance to vulnerable groups in public health. Moreover, from the survey it was found that the local green spaces cover less than 20% of the whole land in the country.

Mitigation:

In the dimension of greenhouse gases mitigation, it was found that 36.82% of the local governments, who took the survey, have been carrying out activities to reduce greenhouse gases. These are usually the main activities according to Local Administration Act, such as

waste management operations and building controls. Also, it was found that the waste management is not sufficient for up to 47.15% of the surveyed area.

Capacity Building and Driving Efforts:

When examining the dimension of capacity building and driving efforts to support climate change adaptation, it was found that 60.66% of local government organizations still lack activities related to data development, research, and technology concerning climate change adaptation. Moreover, there has been a survey on opinions regarding the approach to addressing climate change through decentralizing power to local government organizations. The findings indicate that the majority of local government organizations, at 70.40%, agree with the proposal to allow local governments to declare emergencies themselves. This would enable them to use their authority and budget to promptly address disaster issues. Following this, 63.70% of respondents support increasing the budget for local areas to develop and enhance water sources in their regions. Additionally, 55.80% expressed the desire for central authorities to support local budgets for the development of sustainable green cities.

Recommendations

1. Enhancing Environmental Management Awareness and Legislation:

1.1 Introduce mandatory training programs and workshops for local government organization (LGO) staffs to elevate their understanding of environmental management and climate change adaptation.

1.2 Encourage LGOs to establish comprehensive ordinances and regulations specifically focusing on environmental management for climate change adaptation, considering local circumstances.

1.3 Allocate resources to support the development of local personnel by organizing specialized training sessions, workshops, and capacity-building programs centered on climate change adaptation and environmental management.

1.4 Encourage larger LGOs to collaborate with smaller ones, fostering mentorship programs where larger entities guide smaller ones in efficient budget allocation strategies for environmental purposes.

2. Strengthening Community Engagement and Collaboration:

2.1 Create platforms or committees that involve community representatives in decision-making processes regarding environmental projects. This engagement can enhance the relevance and success of initiatives.

2.2 Establish partnerships and collaborations between LGOs, academic institutions, and experts in the field of environmental management to foster knowledge exchange and guidance for impactful initiatives.

2.3 Encourage the formulation of joint projects between LGOs and local communities to address specific environmental issues, ensuring inclusive and community-centric solutions.

3. Increasing Budget Allocation for Environmental Initiatives:

3.1 Advocate for a structured budget allocation system within LGOs that prioritizes environmental initiatives, especially targeting waste management, air pollution control, and water quality improvement.

3.2 Provide incentives or financial support schemes for smaller LGOs that demonstrate exceptional commitment to environmental management, encouraging larger organizations to follow suit.

4. Improving Data Collection and Utilization:

4.1 Develop evaluation frameworks that measure the effectiveness and impact of budget allocation for environmental projects in both smaller and larger LGOs. This would provide tangible evidence of the benefits and encourage further investment.

4.2 Utilize performance metrics as a criterion for accessing additional grants or resources, motivating larger LGOs to allocate more of their budgets towards environmental initiatives to achieve positive outcomes.

4.3 Institute a comprehensive data collection system across all LGOs, particularly focusing on air quality monitoring and analysis, to provide accurate information for decision-making.

4.4 Foster the utilization of collected data by creating platforms or tools that enable LGOs to effectively interpret and implement policies based on environmental data analysis and findings.

4.5 Facilitate partnerships between larger LGOs and external organizations, such as NGOs, private enterprises, or research institutions, to jointly fund and implement large-scale environmental projects, leveraging resources and expertise.

5. Supporting Green Infrastructure and Sustainable Development:

5.1 Advocate for central government support and funding mechanisms to aid LGOs in the creation and maintenance of green spaces, aiming to cover a more significant percentage of land area, enhancing environmental quality.

5.2 Implement policies incentivizing sustainable practices within urban planning and construction, ensuring green city initiatives are prioritized and supported by both local and central authorities.

These recommendations aim to address the identified gaps in environmental management and climate change adaptation at the local government level in Thailand. Emphasizing capacity building, community engagement, legislative reinforcement, and resource allocation can significantly enhance the effectiveness of environmental initiatives and foster resilience against climate change impacts.

References

Bervia, Mark. (2009). *Key Concepts in Governance*. SAGE Publications.

Climate Center. (2022). *Greenhouse effect*. http://climate.tmd.go.th/content/article/10

Department of Environmental Quality Promotion. (2023). *Policies and plans at the international and national levels related to urban management supervision and promotion*. Urban environmental management. Environmental sustainability assessment guide for local government organizations. Department of Environmental Quality Promotion.

Department of Environmental Quality Promotion. (2023). *Origins and importance of environmentally sustainable city assessment*. Guide to sustainable environmental assessment for local administrative organizations. Department of Environmental Quality Promotion.

Hambleton, Robin Savitch, Hank V. and Stewart, Murray. (2002). *Globalism and Local Democracy*. In Hambleton, Robin Savitch, Hank V. and Stewart, Murray (Ed.), Globalism and Local Democracy: Challenge and Change in Europe and North America (pp. 1-19). Hampshire: Palgrave, p. 12.

Jarusombat, S. (2021). Potential of Local Government Organizations in Environmental Management. *Journal of the King Prajadhipok's Institute*, 9(1), 5-35.

Levin, K., Boehm, S., & Carter, R. (2022). *6 Big Findings from the IPCC 2022 Report on Climate Impacts, Adaptation and Vulnerability*. https://www.wri.org/insights/ipcc-report-2022-climate-impacts-adaptation-vulnerability.

Lienard, C. (2022). *COP27 in Egypt*. https://www.bic-rhr.com/sites/default/files/inline-files/BIC%20Special%20Publication%2C%20COP27%20-%20Clementine%20Lienard-1.pdf.

National Development Research Institute. (2006). *Assessment of social risk and vulnerability: Measuring poverty and social vulnerability into practical guidelines in Thailand.* https://tdri.or.th/wpcontent/uploads/2012/12/h103.pdf

Office of Natural Resources and Environmental Policy and Planning. (2018). *Introduction, Definitions, and Principles for Preparing Plans to Adapt to Change*. Ministry of Natural Resources and Environment.

Office of Natural Resources and Environmental Policy and Planning. (2021). *Environmental Protected Areas*. https://www.onep.go.th/

Royal Thai Government Gazette, Vol. 116, Pt. 114. *Decentralization Plan and Procedures for Local Government Organizations*, (Special Issue), 11st November B.E. 2542 (A.D.1999), pp.53-55

Royal Thai Government Gazette, Vol. 139, Special Section 253. *Solid Waste Management*, (No. 2), 11st October B.E. 2565 (A.D.2022), pp.5-6

Thai Environment Institute. (2005). *Environmental Governance Indicators of public participation 2005*. Thai Environment Institute.

Turner, Mark. (1999). *Central-Local Relations: Themes and Issues*. In Turner, mark (Ed.), Central-local relations in Asia-Pacific: Convergence or divergence? (pp. 1-18). Hampshire: Palgrave, p. 4.