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Understanding the Adaptive Capacity of Actors in Environmental Governance: The Case of Transboundary Movement of Waste Electrical and Electronic Equipment (WEEE)

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Abstract

Recent papers have highlighted the importance of adaptive ability in environmental governance. The capacity to anticipate and respond to environmental changes has been a priority for many organisations and academics studying environmental governance. While the considerable study focuses on adaptable capacity at the institutional and societal levels, little is known about the adaptive capacity of actors and how that ability might be strengthened. Additionally, a study deficit exists on the adaptive ability of essential players in environmental governance in the context of transboundary movement of waste electrical and electronic equipment (WEEE), which has tremendous negative consequences, particularly in developing countries. Thus, based on a conceptualisation of adaptive capacity and environmental governance, this paper identifies four characteristics of actors' adaptable capability in the context of the transboundary WEEE movement. The interview was a qualitative research approach to elicit data from WEEE sector players in governmental, commercial, and non-governmental organisations (NGOs). The findings illustrate the current state of WEEE in Thailand, the import and regulation of WEEE in Thailand, and a lack of knowledge and managerial capacity to address WEEE issues. Additionally, the data show that adaptive capacity consists of learning and evaluation, coordination and cooperation, responsiveness and reconfiguration, and accountability. These are essential components of environmental governance's adaptive capacity. The ideas have consequences for policymakers who wish to strengthen actors' adaptive ability via enabling elements such as training, systems, and regulations.

Key words:
Adaptive Capacity, WEEE, Transboundary, Environmental Governance

Introduction

Global environmental change imposes significant problems on which various players in the public and commercial sectors must concentrate their efforts to adjust to the external environment, a process known as adaptation. Adaptation is the capacity to alter to improve the activities of actors and cope with change. Global environmental change can provide both fresh possibilities and dangerous threats. Governments and related organisations are expected to take action during policy formulation to develop suitable governance structures for effective adaptation (Eakin et al., 2011). Promising governance solutions entail collaborative procedures, systematic learning, and multi-level interactions amongst social actors to adapt to change, all of which need adaptive ability (R. Plummer, Derek Armitage, 2010). Conservative and reactive behaviours may limit actors' ability to make decisions and fulfil their duties in response to developing environmental concerns. Additionally, environmental governance balancing environmental conservation and resource exploitation demands both governmental and non-governmental players (van der Molen, 2018). As a result, this article defines adaptive capacity as an actor's capability to respond to and adjust to external change.

Numerous studies have been conducted on the adaptive ability of environmental governance in response to environmental change (Nelson et al., 2007). These studies frequently emphasise techniques that develop institutional and community-level adaptive capacity for environmental governance (Engle et al., 2010; Keskitalo et al., 2011). Little attention has been devoted to their adaptive capacity to improve actors' adaptable capability in environmental governance. Additionally, the literature concentrating on environmental governance's adaptive ability provides significant contributions to creating and sustaining resilience for sustainable governance. However, it is often used in the context of climate change research (T. Grothmann et al., 2013), water governance study (Grecksch, 2013), forest commons research (Brockhaus et al., 2012), and renewable energy research (León-Camacho et al., 2014). Recently, a demand was made to employ the concept of adaptable capacity to improve the adaptability of players involved in the transboundary regulation of waste electrical and electronic equipment (WEEE) (Bisschop, 2016). However, adaptive capacity is currently restricted in its applicability to the transboundary movement of WEEE.

WEEE is an acronym for waste electrical and electronic equipment (EEE) or its components that have been abandoned and are no longer helpful to customers (Bovea et al., 2016). WEEE has been a source of contention for environmental regulation for decades. The usage of electrical and electronic equipment has increased in recent years, and as a result, the amount of electrical and electronic items disposed of globally is growing significantly (Reena, 2011). According to the UN's Worldwide E-waste Monitor 2020 study, around 54 million metric tonnes (Mt) of WEEE were created in 2019, and the research forecasted that global WEEE will surpass 74 Mt by 2030. (Forti et al. 2020). This means that the amount of WEEE produced worldwide is expanding at an alarming rate. The rising WEEE problem has been worsened further by WEEE's transboundary migration. Transboundary movement, as defined by the Basel Convention, is the movement of hazardous waste or other wastes from an area under a state's national jurisdiction to or via a site under the national authority of another country (Ahmed, 2019). Regardless of the multinational environmental accord or Basel Convention, hazardous waste shipments continue to pose health hazards and cause environmental harm.

Indeed, recycling and disposing of WEEE is expensive in many industrialised nations, owing to high labour costs and strict environmental rules governing hazardous waste disposal (Perkins et al., 2014). As a result, many affluent nations, such as the United States (US), the European Union, and Japan, are likely to export WEEE to developing countries in the Africa, Southeast Asia, and South America areas, where environmental legislation and regulation are little enforced (Parajuly et al., 2020). These impoverished countries have become a haven for worn and abandoned gadgets worldwide. Thailand exemplifies the worldwide WEEE flow into underdeveloped countries. Concerns have been expressed that Thailand has emerged as a new market for developed country WEEE exports

(Lefevre, 2018). Since 2014, the volume of WEEE imported into Thailand has peaked at 53,291 tonnes in 2017, more than 5.7 times the level imported in 2016. (Sasaki, 2021). WEEE is imported into Thailand from both developed nations in the west, such as the United States, the United Kingdom, France, and Germany, and growing East Asia, such as China, Japan, and Hong Kong (Roberts-Davis et al., 2019).

The transboundary movement of WEEE has provided substantial issues for environmental governance entities involved in its management and control. Governance is distinct from government. It comprises state and non-state entities such as communities, businesses, and non-governmental organisations (Agrawal et al., 2006). In the context of the WEEE transboundary movement in Thailand, environmental governance entails state and non-state actors from the public, private, and non-governmental sectors, all of whom play critical roles in regulating and managing WEEE imports and monitoring WEEE's impact on the environment and local communities. These governance actors must develop an adaptive capacity to address the environmental issues posed by WEEE transboundary migration. This research will examine the present state of WEEE in Thailand, including WEEE imports and management issues. Additionally, this research intends to investigate actors' adaptive ability and to make recommendations for enhancing the adaptive capacity of players participating in environmental governance in the setting of the transboundary WEEE movement.

Thus, this article greatly contributes to our knowledge of adaptive ability for coping with change, particularly in transboundary WEEE migration, and how adaptive capacity may be built through governance mechanisms. Developing nations, particularly Thailand, lack the power and resources necessary to address WEEE issues effectively. The transboundary migration of WEEE is anticipated to accelerate the spread of hazardous materials within countries. The ability of actors to adjust to the challenges posed by WEEE is a critical characteristic. As a result, this study identified critical components of the adaptive ability of entities involved in the transboundary flow of WEEE. This adaptive capacity framework may benefit organisations working in this subject, as there is a dearth of adaptable procedures for assessing actors' adaptive capacity. This should increase the actors' adaptive ability when confronted with a rapidly changing environment. Enhancing governance actors' adaptive ability, in particular, serves to strengthen environmental governance's resilience, enabling it to respond to environmental change in more sustainable and proactive ways.

Literature Review

Adaptive Capacity Dimensions

As the rate of global environmental change has accelerated, the ability of actors to adapt to uncertainty and change has become critical for

environmental governance to remain sustainable (Fazey et al., 2007). Numerous writers are increasingly attempting to identify the elements that enable players in governance to adjust to the complexity and uncertainty of environmental change (Bohensky et al., 2010; Wyborn, 2015). Nelson et al. and Folke quoted in Engle et al. (2010), p.4 define adaptive capacity as a fundamental human strategy for system resilience management. Engle (2011) proposes that adaptive capacity exists at both the individual and community levels, claiming that adaptive capacity is an intrinsic property of an individual or community system triggered in response to a danger or opportunity. Recently, increased emphasis has been dedicated to the institutional element as a vital component of adaptive capacity for enhancing actors' ability to deal with the repercussions of environmental change to seize opportunities or mitigate harm (R. Plummer, Derek Armitage, 2010). As, Koontz et al. (2015) explain, society requires adaptive institutions to assist social actors in maintaining or improving the desired state in the face of environmental change.

Gupta and his colleagues conduct a systematic study on adaptive capacity, proposing the Adaptive Capacity Wheel, which they define as the dimensions that encourage governance institutions to empower actors to adapt and respond flexibly to environmental change, including learning capacity, responsiveness to changing society, and collaborative ability to work with diverse actors in governance settings (J Gupta et al., 2011). Numerous studies regard governance structures as critical elements in fostering actors' adaptive ability and behaviour (Brooks et al., 2005; Eakin et al., 2006; Joyeeta Gupta et al., 2010). For instance, (Lockwood et al., 2015) explain that equitable governance, which includes legitimacy, accountability, inclusiveness and justice, leadership, coordination, and cooperation, provides the enabling environment for actors to develop adaptive capacity. Additionally, Badenoch (2002) believes that fair governance concepts such as participation, access to information, and accountability enable governance actors to address the complexities of transboundary environmental concerns more effectively. This research applies J Gupta et al. (2011)'s adaptive capacity dimension, Lockwood et al. (2015)'s adaptive capacity governance dimension, and Badenoch (2002)'s transboundary environmental governance to develop a framework for examining the adaptive capacity for environmental governance in the context of transboundary movement of WEEE.

According to prior research, adaptive capacity demands the ability to comprehend the environmental change for actors to make informed judgments and take appropriate action in response to changing circumstances. To understand changing conditions, actors must first acquire information or understanding about environmental change. As a result, they should obtain information, gain knowledge, and educate themselves about environmental changes by continually monitoring changes and the impacts of management implementation in systems (van der Molen, 2018). Then, actors must use this information in their decision-making over future actions to maintain the desired conditions (Evans et al.,

2011). The knowledge obtained by monitoring changes and the actions made as a result represents the first component of adaptive capacity for environmental governance, learning and assessment ability.

Environmental governance adaptation requires a large number of people to make decisions properly. The involvement of stakeholders is critical for adaptive processes (Huitema et al., 2009; Prehoda et al., 2019). Their cooperation and assistance are also essential for effective environmental governance. Thus, coordination and cooperation ability comprise the second component of adaptive capacity, referring to the capability to garner involvement, support, and effective coordination from stakeholders such as business and public institutions and non-governmental organisations. Participation and coordination might take the form of information exchange, direct involvement, or effective collaboration between government agencies and non-governmental organisations. Thirdly, actors must respond equitably to environmental concerns. A capability is referred to as responsive capacity. This capability enables actors to make decisions, such as reorganising internal processes and procedures in response to changing conditions (Gunderson, 2000) or adjusting existing systems to more effectively adapt to a changing environment within an acceptable timescale (UNITAR, 2017). Additionally, responsive processes or activities should be very transparent, allowing actors to adjust to the diverse requirements of society (Biermann, 2007). Transparency responses might shape information availability, accessibility, judgments, laws, or regulations.

Finally, actors should establish explicit accountability mechanisms that delegate authority to other parties (Botchway, 2000). This is referred to as responsible capability. It is a term that refers to the capacity to assign and foster acceptance of responsibility for decisions and actions (Lockwood, 2010). Accountable actors should distribute tasks/response actions equitably to adapt to environmental changes, accept responsibility, and win acceptance for dissemination. A critical component of successfully responding to environmental change is actors' capacity to assign responsibility for their decisions and actions in response to the changes. The allocated parties must comprehend and accept their responsibilities and accountability for managing them.

The four measures of adaptive capability presented are not mutually exclusive. Indeed, they can complement one another. The capacity to learn and appraise should explain environmental difficulties or changes. To respond rapidly to environmental challenges, the actors' responding capacity should be aided by their ability to comprehend the challenges. As, Olsson et al. (2004) suggest, learning, monitoring, and responding to environmental feedback are critical components in enabling governance actors to build the knowledge and understanding necessary to deal with fast changes and uncertainty in complex environmental systems. Then, actors can alter their behaviour or actions to handle the issues in real-time. Additionally, Akamani et al. (2011) suggested that adaptive capability in

conjunction with equitable environmental governance necessitates the involvement and cooperation of key stakeholders. The capacity for learning and assessment and coordination and cooperation may all contribute to the transparency of the work process. Additionally, through distributing tasks to multiple parties, the actors' capacity to be accountable should be strengthened via their awareness of events and engagement with other parties. As a result, the actors will be able to address issues publicly. While there is much study on the adaptive capacity of institutions (Berman et al., 2012; Pelling et al., 2008), there are relatively few studies on the adaptive capacity of actors. This article aims to bridge the gap between existing work on adaptive capacity and environmental governance and the development of new lenses for analysing actors' adaptive ability.

Figure 1 depicts four characteristics of environmental governance's adaptive capability. The adaptive capacity is the capability to recognise and comprehend environmental change, also known as the learning and evaluation capacity. Additionally, adaptive capacity encompasses responsiveness, or the ability to make judgments and perform actions in response to changing situations. According to the complexity of many actors involved in the environmental challenges, coordination and collaboration ability, or ability to gain support from stakeholders such as state or non-state actors, is essential to enable the adaptive capacity. Additionally, adaptive capacity includes the responsible capacity, or the capability to assign and obtain acceptance of responsibility for decisions and acts. Four factors of actors' adaptive ability are postulated to result in efficient environmental governance.

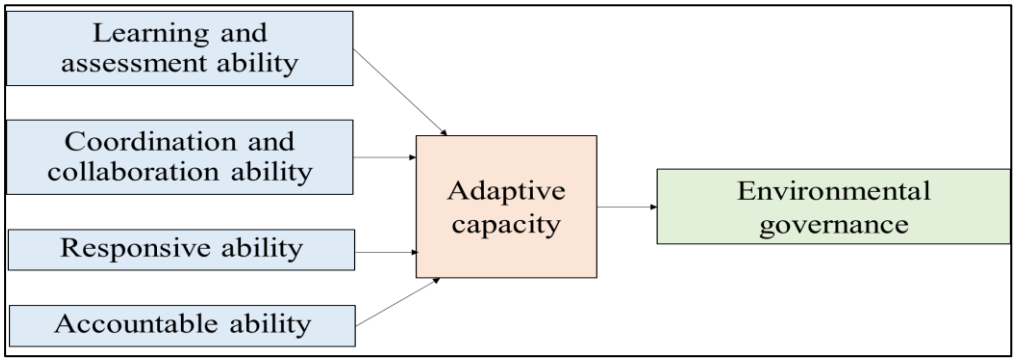

Figure 1: Adaptive Capacity Dimensions
Source: Figure created by the author

Research Methodology

Qualitative research is primarily concerned with elucidating human lives' meanings, relationships, and experiences within social contexts (Fossey et al., 2002). The emphasis of this study is on the extent to which informants offer detailed descriptions of research concerns about the participants, which is accomplished through semi-structured interviews (Eyisi, 2016). Qualitative interviews were undertaken to get a thorough knowledge of the present state of WEEE in Thailand and essential features of actors' adaptive

ability in environmental governance. This research approach enables the researcher to examine and analyse actors' adaptive capacity within the context of environmental governance. Thus, semi-structured interviews with informants from government agencies, the corporate sector, and non-governmental organisations were employed to collect data to address the study goals. The participants were recruited through their organisations and came from various areas within the WEEE industry to acquire a range of viewpoints on the transboundary movement of WEEE in Thailand. Participants were tasked with elucidating the essential elements of actors' adaptable ability and highlighting the potential for actors' adaptive capacity to be strengthened in environmental governance. The purpose of data collecting is to accomplish the following research goals: 1) examining the existing state of WEEE in Thailand, and 2) examining the adaptive potential of players in environmental governance and suggesting measures to strengthen their adaptive capacity. According to the rapid expansion of the electrical and electronic equipment market, mass manufacturing of electrical and electronic equipment has increased, and nearly 50 million tonnes of garbage are generated each year. Most waste electrical and electronic equipment (WEEE) is exported to impoverished nations in Asia and Africa (Vidal, 2013). WEEE is regarded as the world's fastest increasing waste stream, posing an impending threat to environmental governance (Hossain et al., 2015).

The transportation and transfer from industrialised to developing nations pose enormous risks, particularly in emerging countries. Additionally, a shorter life cycle for electrical and electronic equipment leads to increased trash deposited in developing nations. As a result, people involved in environmental governance are confronted with novel and evolving environmental concerns. This demands adaptive capacity, or the ability to adapt to and manage changes in the environment. Enhancing actors' adaptive ability should actively respond to changes to build and sustain environmental governance successfully. As such, the current study aims to provide light on the adaptive capacity for ecologically responsible governance in the transboundary movement of WEEE. The interviews were done in Thailand using open-ended questions based on the prior literature's aims and conceptualisations of adaptive ability. The interview guide included basic questions about the present state of WEEE in Thailand, as well as the transboundary flow of WEEE in Thailand. Additionally, the handbook offers questions for answering the study objectives, which are adaptive capacity-related questions developed from prior studies, and recommendations for enhancing adaptive capacity for environmental governance. The process of creating an interview guide is depicted in Figure 2, as is the relationship between research objectives and interview questions.

The interviews were performed with important actors in Thailand's WEEE management and regulation, including government officials, private firm employees, waste management consultants, and environmental non-governmental organisation workers.

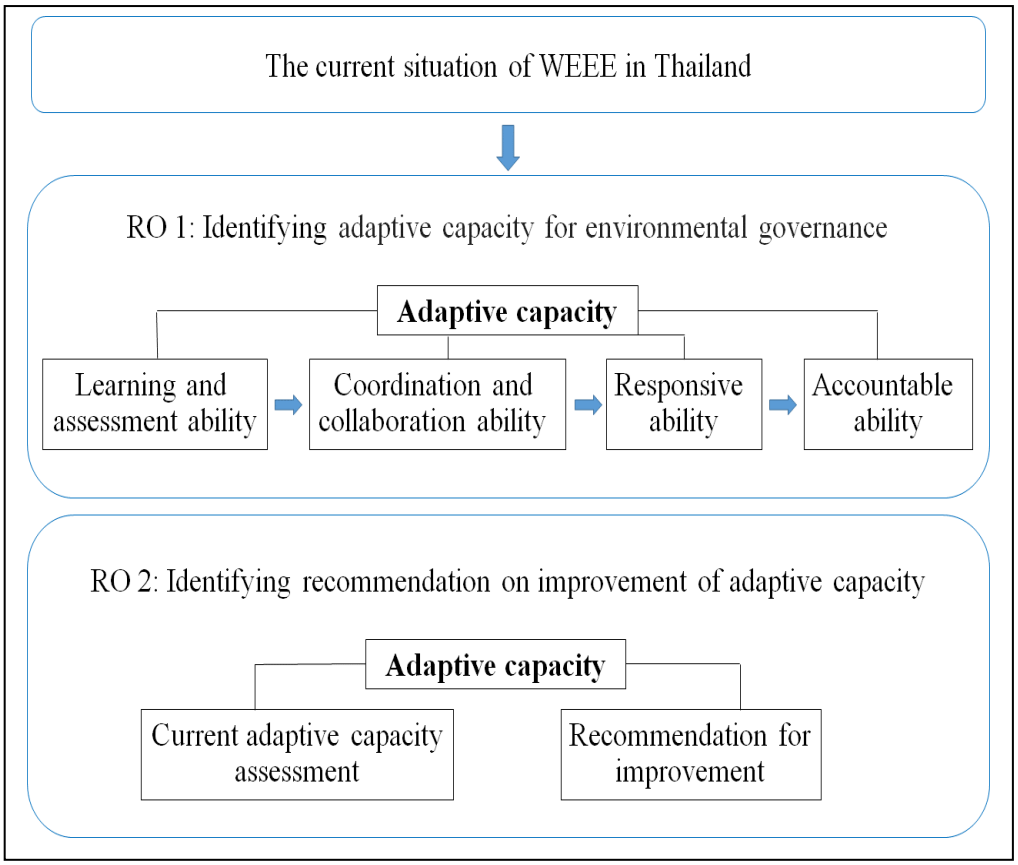

Figure 2: Research Objectives and Interview Questions

Due to the researcher's inability to acquire information on the principal actors in WEEE governance in Thailand, the sampled organisations were requested to select possible respondents following the research goals. Each organisation was called to arrange a meeting and interview with one responder. Then, using snowball sampling, instances of interest were identified from the initial sample of participants (Patton, 1990). Twelve interviews were performed in all. These are listed in detail in Table 1.

Audio recordings of the interviews were made for further analysis. Interviews lasted about an hour. Twelve interviews were deemed adequate for data saturation since no additional data were created from the material (O'Reilly et al., 2013; Walker, 2012). Braun and Clarke's theme analysis technique was used to analyse the data (2012). The analytical method began with generating initial codes from the transcription of interview material. The data was then transformed from codes to themes following the study goals. The prospective themes were examined to correspond to the codes and data set. Finally, particular names were assigned to the probable topics.

The examination of interview data about the current state of WEEE in Thailand resulted in the formation of five themes. The five categories that resulted from this study were subsumed under a more significant category about Thailand's present WEEE issue (Table 2).

Table 1: Details of Interviews

Participant Code	Organisations	Duration of interviews (minutes)
P1	Pollution Control Department, Ministry of Natural Resources and Environment	52
P2	Pollution Control Department, Ministry of Natural Resources and Environment	60
O1	Thai Customs Department, Ministry of Finance	109
O2	Thai Customs Department, Ministry of Finance	70
D1	Department of Industrial Works, Ministry of Industry	55
D2	Department of Industrial Works, Ministry of Industry	58
G1	Environmental NGO	106
G2	Environmental NGO	73
T1	Waste Management Consultant	55
T2	Waste Management Consultant	65
W1	Waste Management Company	50
W2	Waste Management Company	55

Results

Current Situation of WEEE in Thailand

The first code represents the current state of electrical and electronic equipment (EEE) and wastes electrical and electronic equipment (WEEE) (WEEE). According to the sources, EEE growth has expanded in Thailand, causing waste problems and trash management. Numerous items have been introduced into the market due to technological advancements, increasing waste at the same rate as their expansion. According to the sources, the amount of garbage or WEEE generated may surpass the country's capabilities to manage it. They stated that a control mechanism, such as licences, may help decrease waste, improving the environment.

The second code relates to WEEE importation into Thailand. According to the interviews, Thailand imported WEEE till last year. The import of WEEE created environmental difficulties in the country, including private sector legal violations. The respondents expressed worry about the challenges associated with the importation of WEEE. The third code deals with the prohibition of WEEE imports into Thailand and the significance of WEEE laws. The interviewees discussed the reasons for the import restriction and the issues due to the ban. Despite the prohibition on WEEE imports, there are instances of unauthorised infringement.

Additionally, they emphasised the difficulties associated with law enforcement. The fourth code relates to WEEE disposal and recycling. The respondents responded that because WEEE disposal results in pollution, proper disposal management is critical to resolving the issue. Additionally, this code indicates that respondents believe that recycling innovation may generate value from WEEE and convert the garbage into ecologically sufficient resources. The last code relates to WEEE understanding and management to improve the waste's value. The respondents stated that they lack the necessary expertise and managerial capabilities to manage WEEE properly. They must possess the knowledge and practical management abilities to reap the benefits of trash management.

The initial five codes of the current situation of WEEE in Thailand were shaped from codes to be three themes: the current status of EEE and WEEE, the Import of WEEE in Thailand and regulations, and management of WEEE disposal and recycling, as shown in Table 3.

Adaptive Capacity for Environmental Governance

The data on the present state of WEEE in Thailand helps develop our knowledge of the origins of issues, the consequences of WEEE imports, and the effects of WEEE import bans. Following that, to address research objectives, participants were questioned about their adaptive ability for environmental governance in the context of the WEEE transboundary movement in Thailand. Five types of adaptive capability were identified through the analysis: data collection and organisation, collaboration, reaction, responsibility, and reorganisation (Table 4). The first code is a capability for data collecting and organisation. According to the data, this capability entails the capacity to watch, screen, and continuously update data about the change or movement of WEEE. Although Thailand has prohibited the import of WEEE, used or second-hand EEE may be imported. Thus, the players involved in WEEE administration in Thailand, whether public or private, should monitor and comprehend the situation.

Additionally, they should forecast uncertainties, dangers, and impending changes. As a result, these actors can assess events and choose the appropriate course of action to follow to resolve issues or manage crises. One respondent stated that actors should acquire new knowledge and integrate it into their prior or current expertise to better their regular work. The second code is titled capacity to collaborate. The data demonstrate that functioning in the WEEE industry, particularly with transboundary transfers, entails many stakeholders. Actors should be able to collaborate with members of diverse communities. Specifically, interviewees stressed the need for effective communication and collaboration among all governance parties.

Table 2: Five Codes of the Current Situation of WEEE in Thailand

Current status of WEEE in Thailand				
Current situation of EEE and WEEE	**The Import of WEEE in Thailand**	**Import banning of WEEE in Thailand and WEEE's regulations**	**WEEE disposal and recycling processes**	**Knowledge and management of WEEE to increase the value of the wastes**
EEE in Thailand tends to increase to the point that it exceeds our capacity to handle the waste. People buy new products very often. They have a short lifespan. We (Thailand) have a considerable amount of WEEE – about a thousand tons generated every year. (T2) We need to control the amount of WEEE to reduce the negative impact on the environment. According to law, factories must follow the process and get a licence. Different types of waste require additional licences. (W2)	The import of WEEE into Thailand causes severe pollution in our country. (P2) There was a big issue in 2018 that we found illegal hazardous wastes in factories. This means that some entrepreneurs violated the regulations. We investigated further and found that many cases violated the regulation. …they imported those hazardous wastes from aboard. (O1) Violation of regulation conditions of many factories raise concerns about WEEE import and management. ……The government needs to have the ability to deal with the situation to prevent harm and loss caused by the waste. (G1)	(WEEE import) It was banned now… We need to have specific laws or regulations for WEEE. … vulnerability of law enforcement is another concern. Organisations responsible for WEEE need to be alerted and prepared for the illegal import of WEEE. (G1) Yes, (WEEE) was already banned. ….Thailand used to allow WEEE to be imported to the country, but unauthorised factories illegally bought and recycled WEEE. Those factories were withdrawn their certification. However, some of them change the factories' names and still run the new ones. (D1) Entrepreneurs who used to have import licenses now cannot import WEEE. …there is an exception under section 152 of the customs act that allows specific WEEE import. (O1)	WEEE in Thailand previously can be divided into two groups: WEEE produced in the country and imported from aboard. …there are benefits gained from this waste… …need a proper process to transfer them to be something valued. (W1) The restriction of the use of certain hazardous substances in electrical and electronic equipment should help to improve the pollution problems and disposal practice of the waste. ….should be aware of the effects of pollution caused by WEEE to keep using the products a bit longer… … suitable methods of disposal and recycling with good campaigns can bring about innovative results in friendly waste to the environment. (G2) …it is not about stopping using the products… …the right way to take care of WEEE… …reuse and recycle the WEEE mainly extracts the value material from the WEEE. (T1)	We have a limited number of factories to recycle and sort out WEEE. There is a lack of knowledge to manage WEEE. (P1) Shortly, we will need to improve the effectiveness of WEEE management to the next level. We need advanced technology to extract high-value materials. (O2) …need to know how to manage and extract value metal from WEEE and take advantage of them. (D2)

Table 3: Themes of Current Situation of WEEE in Thailand

Current situation of WEEE in Thailand	
Initial codes	**Themes**
Current situation of EEE and WEEE	The current situation of EEE and WEEE
The Import of WEEE in Thailand	The Import of WEEE in Thailand and regulations
Import banning of WEEE in Thailand and WEEE's regulations	
WEEE disposal and recycling processes	Management of WEEE disposal and recycling
Knowledge and management of WEEE to increase the value of the wastes	

Additionally, an appreciation of each party's distinctions or variety is necessary for gaining collaboration and engagement from other parties. According to one interviewee, it was critical for performers to visualise themselves in the shoes of other parties. This should result in increased cooperation amongst all parties.

The third code is reaction capability, which refers to acting or responding to changes. According to the informants, actors should adapt to shifting WEEE scenarios. They said as an example that if new choices or announcements about the import of WEEE are made, the actors must be able to execute them properly. Additionally, the informants stated that performers should sometimes alter their everyday work. Otherwise, it will not take appropriate action in response to new duties or conditions. To take transparent measures, informants agreed that conveying information about the working process, its state, or the accountable teams or employees is crucial for change reactions. This can instil confidence in all key stakeholders over the project's implementation of collaboration, resulting in mutual trust or a long-term relationship.

The fourth code is the capacity for accountability. According to respondents, performers should do their jobs or duties efficiently. They classified actors into two categories: executive and subordinate. These players have varying levels of authority or job titles, which means their tasks should be unique to deal with change. While actors with more authority should be able to make judgments and assign duties clearly and equitably to get approval for their command, subordinate actors should carry out assigned tasks to deal with changing events effectively. The evidence established that subordinate actors lack executive power and can make final judgments. Thus, they must grasp and embrace their jobs and responsibilities to manage them efficiently. However, respondents noted that subordinate actors might suggest how the working team should adapt to changes. Thus, subordinate actors should carry out their responsibilities, organise tasks, communicate with other parties, and initiate needed actions. The respondents noted that the transboundary flow of WEEE is a complicated scenario, particularly in light of the current WEEE import prohibition. Actors having executive authority should make sound

judgments in response to changes in time. Then, subordinate actors should understand their duties and support the new policy to deal with the changes. According to one responder, "they [subordinate actors] serve as implementers and facilitators."

The last code is the capacity to reorganise. This code that emerges from the data refers to the ability to be adaptable and innovative to amend present decisions, policies, or conditions in response to changing circumstances. As a result, actors with this capability might provide alternative ideas, approaches, or solutions for managing the changes. The informants recognised that it is challenging to implement changes in work processes, work teams, rules, or laws in response to changes. They had not anticipated actors influencing the progress of WEEE management. Indeed, because the transboundary flow of WEEE remains a significant concern following the import prohibition, players must demonstrate flexibility and ingenuity to deal with the situation more effectively.

The initial five codes of adaptive ability for environmental regulation in Thailand's transboundary movement of waste electrical and electronic equipment were sculpted into four themes. The capacity to gather and organise data is the learning and assessment ability. The second theme is coordination and collaboration capability, which is derived from the code for co-working capability. Following that, the capacity to respond and reorganise is bundled together and dubbed responsive and reconfiguration ability. Finally, as shown in Table 5, accountability ability is the accountable ability theme.

Recommendation

One of the study goals is to give policymakers recommendations on strengthening actors' adaptive capacity for environmental governance. According to the findings, there are three primary recommendations for increasing actors' adaptive capacity: ability enhancement via training, the system and institutional support, its enhancement through policy. To begin, actors do not always possess all four aspects of adaptive capability: learning and evaluation, coordination and collaboration, responsiveness and reconfiguration, and accountability. Additionally, they may have adaptive potential yet may lack other aspects. The responders recommended that training programmes may be used to enhance actors' adaptive ability. There are numerous doubts surrounding the WEEE import ban's implications. Opportunities for recycling and the import of EEE are new issues that may result in changes to WEEE management. Different nations have enacted or enacted various acts or legislation to regulate WEEE. WEEE management includes trash collection and disposal systems and waste recycling technology. Waste is composed of both valuable and dangerous items.

Table 4: Five Codes of Adaptive Capacity for Environmental Governance

Adaptive capacity for environmental governance: Transboundary movement of WEEE in Thailand				
Data collection and arranging ability	Co-working ability	Reaction ability	Responsibility ability	Reorganising ability
…be able to check the information and assess how serious are the WEEE situations… (O2) Typically, staff in the working team should be able to monitor situations… …evaluate conditions and report to the head… (D1) The ability to anticipate changes is essential, as many uncertain things are. …They need to sense the problems… …the significance of the issues…what they need to do… (G1)	Our team has been working very hard on PR (public relations). We make announcements of all information officially. …asking for stakeholders' opinions is not easy …put many efforts … We send information to different departments. (P1) …All relevant parties should work together… Coordination among all related parties is a crucial success factor. …Yes, you need to have good skills to manage this job. …participation of all groups is a suitable method for gaining consent and cooperation from people. (G2) The process involves many parties…from foreign countries to Thailand…working with many people, departments, or organisations. …be able to deal with people very well… (P2)	Many things are uncontrollable, unstable, and uncertain. We have to be prepared…very active to take decisions, actions… …check all related regulations, and follow all requirements… …it affects all of us considerably. We have planned and set everything already, but we had to change it. (T1) There are still many things to do even though there were restrictions… the protocol, the documents, etc. …can do it if they can take the actions in time. Once we contact them, we want the information and want them to handle it right away. We have a straightforward procedure that they need to follow. …it's realistic, reliable and the process can be tracked. …very active to work with all of them. …those kinds of skills and abilities are crucial to getting things done. (W1) It is an ability to be ready …be prepared… implement and manage those tasks. You need to know what you ought to do. (W2)	We have a clear division of responsibilities. [It is] very transparent. …very clear of the chain of command to allocate tasks. …who makes decisions and takes responsibility. Then, the job is assigned to the subordinates. …they do have the skills and abilities to do so. (O1) Often, there are many people involved in the assignments. We have meetings and consult with the experts. …they do need to have the ability to do it very well. They know that it is their job…their responsibility. …the roles are evident and reasonable…you've been working for years. So you got to be very good doing your jobs. …of course, this requires the ability to assign tasks to their subordinate correctly to deal with the situations… (P2) Put the right man on the right job …you need to have the skill to do so. …it seems like something relatively routine, but yes, they must have the skill, however. Mainly, there is a working team. So the distribution should be fair. That's right… [someone] needs to take the responsibilities. (G2)	...requires the ability to be flexible to create or invent something new to cope with the situations. It is not a fantasy, you know. [It is] just a bit of change; slightly adjust it, but you can handle it better. (T2) Sometimes, it takes time. There are protocols and processes that we need to follow… well, possibly… they can finally manage the tasks successfully. It would be great to be flexible and inventive to find a way. (O2) There is no need for a significant change. This would need just adaptation or adjustment. It is an essential ability to be flexible and innovative so that you can tackle all obstacles, right? (G1)

Table 5: Themes of Adaptive Capacity for Environmental Governance

Adaptive capacity for environmental governance: Transboundary movement of WEEE in Thailand	
Initial codes	**Themes**
Data collection and arranging ability	Learning and assessment ability
Co-working ability	Coordination and collaboration ability
Reaction ability	Responsive and reconfiguration ability
Reorganising ability	
Responsibility ability	Accountable ability

While a successful recycling system may recover valuable materials from garbage and repurpose them economically, it can also segregate harmful elements from waste for subsequent disposal. Additionally, EEE and WEEE management impact import and export firms. Nowadays, the lifespan of EEE products is quite limited due to the acceleration of rapid change in customer behaviour. Two interviewees agreed that it is presently impossible to obtain adequate data collection to analyse Thailand's WEEE issue. There is no database for the supply of quantitative data on WEEE. As a result, respondents felt that the training programme might assist actors in improving their capacity for learning and assessment. The actors should develop the ability to screen and track information, maintain well-organised records, prioritise and categorise data for decision-making, and analyse data to forecast future changes.

The second piece of advice for policymakers is for institutions to assist actors through the provision of systems. According to the respondents, the system might shape information accessibility, transparent work processes, and technical equipment. They noted that an effective strategy should enable actors to monitor and analyse changes by providing relevant information across departments or organisational boundaries. Two respondents stated the system that allows communication between government agencies, private businesses, and various segments of the public. This should also result in a greater degree of coordination between multiple parties. The results established that stakeholders in WEEE should be equipped with hazardous waste identification knowledge and equipment. Diverse sorts of trash demand distinct management strategies. This might aid actors in distinguishing between different kinds of the garbage while also preventing them from coming into touch. A sound system is also crucial for responding appropriately to changes, assigning the appropriate responsible responsibilities, and cooperating with the proper departments or organisations. One respondent noted that actors do not know whom to call when a particular instance of WEEE arises.

The last conclusion is that policy can help actors improve their adaptive capacity. According to the informants, actors' adaptive potential may be ultimately productive guidelines in carrying out their duties. They advocated that supporting policies for WEEE be created at several levels, including organisational, national, and transboundary, due to the presence

of governance actors at each of those levels. One responder emphasised the need for policies that help actors provide them with a variety of alternative options or solutions for coping with environmental changes. Additionally, the data indicated that rules should provide for flexibility in routine adjustments, autonomous actions or job changes, decision-making recommendations, and involvement in formulating new laws or regulations. However, most respondents thought that lower-level actors have little ability to influence or affect policy decisions. As a result, actors with adaptive capacity cannot adjust to changes. While the import restriction on WEEE has had a positive effect on the environment in Thailand, respondents expressed worry that second-hand EEE may pose a significant new difficulty. As a result, new regulations concentrating on this category of items or trash should enable actors to monitor, examine, and govern their movement correctly.

Discussion

Environmental changes necessitate a transition of environmental governance to avoid failures caused by rapid technological advancement, changing consumer behaviour, changing legal and regulatory frameworks, and globalisation. Nonetheless, the intended reforms in environmental governance cannot maintain pace with reality. As a result, adaptive capacity garners significant interest in the research and among policymakers. Adaptive capacity refers to comprehending environmental change, making judgments, and acting to maintain a desirable system under changing conditions (Evans et al., 2011). This is consistent with Engle (2011)'s definition of adaptive capacity as the ability to adapt to unanticipated challenges and unpredictable fluctuations to learn and modify in the face of constraints. Regions and nations respond differently to environmental change, depending on their location, resources, the responsiveness of players, and their capacity to handle environmental problems and adapt to changing conditions (Ivey et al., 2004). Historically, adaptive capacity analyses have concentrated on a system's capacity feature, particularly in climate change research (Malone et al., 2011; Park et al., 2012; Posey, 2009).

Nonetheless, the purpose of this study is to ascertain an actor's adaptive potential for environmental governance. Four dimensions of adaptive capacity are proposed based on the environmental governance framework: learning and assessment capability, coordination and collaboration capability, responsive and reconfiguration capability, and accountable capability for advancements in the application of adaptive capacity. The transboundary transmission of WEEE utilises all four aspects of adaptive capability (Figure 3).

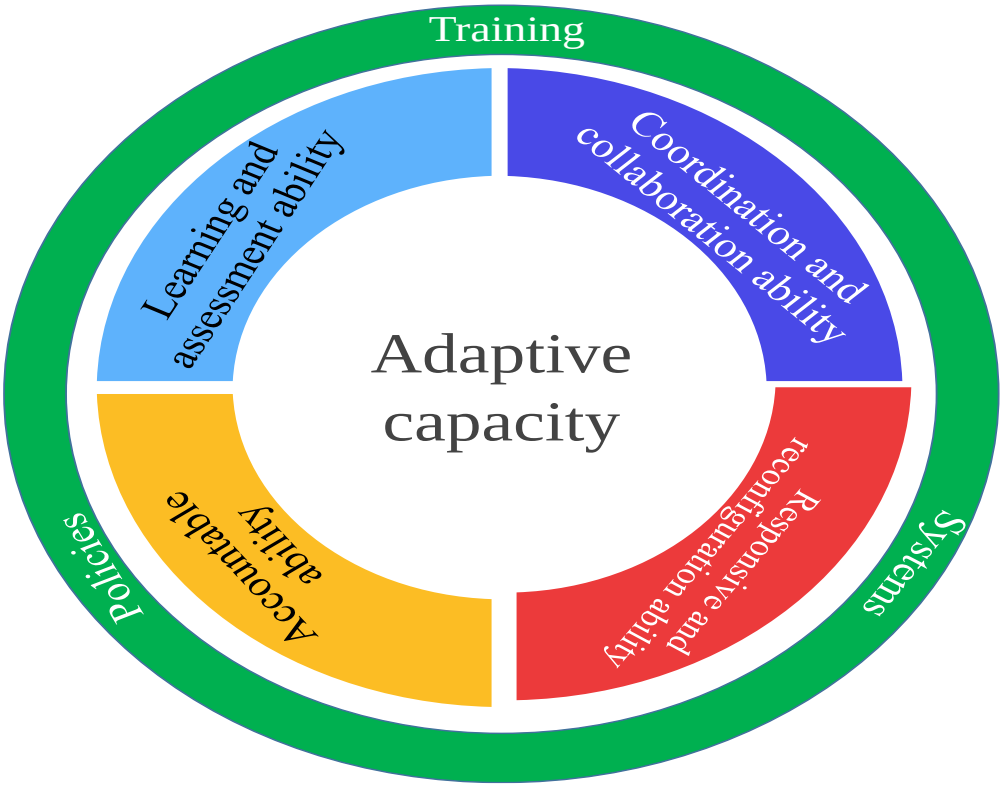

Figure 3: Four dimensions of adaptive capacity and supporting factors

The first dimension of adaptive capacity is the capacity for learning and evaluation, which refers to gathering data and learning about environmental changes via monitoring them to make decisions to maintain desired states (Evans et al., 2011). The actors with the capacity for learning and assessment should be able to monitor environmental data over time and analyse it to apply it for decision-making. Regarding the research findings, the ability to collect and screen data on WEEE changing concerning the import issue falls under learning and assessment. The results broaden the breadth of the ability to learn and analyse by including the capacity to anticipate future changes and integrate new and current information. Thus, the ability to gather and filter data, obtain information, integrate new and existing knowledge, appraise the data, and anticipate future changes should be the first dimension of adaptive capacity in the context of the transboundary movement of WEEE. This description is compatible with Hackmann (2016)'s assertion that agents may acquire knowledge about environmental concerns and develop the necessary attitudes, behaviours, and skills to solve environmental challenges successfully. While Folke et al. (2005) and Reed et al. (2009) claimed that actors might acquire knowledge about the environmental setting and use it to address environmental issues, this research indicates that this capacity does not assist actors to solve problems enough. According to the current study, actors must aggregate all four aspects of adaptive ability to deal with environmental changes or difficulties.

Given that actors operate at various levels and design adaptation strategies (R. Plummer, 2013), they should possess the coordination and cooperation

ability, the second dimension of adaptive capacity, to collaborate with other actors across levels and organisations. Additionally, Folke et al. (2003) imply that environmental governance is operationalised through collaboration among diverse players. This is consistent with study findings indicating that actors' ability to coordinate and collaborate is crucial for securing the participation of all key stakeholders in the transboundary management of WEEE. Indeed, the results go beyond the ability itself by demonstrating other modes of coordination and collaboration, such as information sharing, inter-actor communication, and working group involvement. Thus, coordination and cooperation in the transboundary realm of WEEE can take various forms.

To adapt to environmental changes, actors must possess the capacity to learn and appraise and the ability to respond and carry out adaptation decisions, referred to as the response and reconfiguration ability. Additionally, this capability includes reorganising processes and procedures in response to changing situations (Gunderson, 2000) and responding transparently. As an element in governance, transparency can help increase adaptive ability (Brockhaus et al., 2012). As such, our research suggests that it is a component of responsiveness and reconfiguration capacity. When the idea was applied to changes in WEEE, particularly the transboundary movement, the results indicated that actors should be capable of responding to changes in WEEE, even if there was an import restriction on WEEE from other countries. While the import restriction has eased the environmental situation, the actors must continue to address additional concerns, as the prohibition does not cover all WEEE goods. Additionally, they deal with discarded EEE, which can create environmental difficulties. The findings revealed the central dimension of adaptive capacity to be responsive and reconfigurable. The capability entails adjusting to changing WEEE situations, making adaptive judgments or plans, and modifying work techniques or procedures. Additionally, the research findings suggested that transparency might take the form of information sharing, job progression, and team information.

Accountability is a critical sign of good governance when increasing the capacity for adaptation to environmental changes (Brooks et al., 2005). According to (Ensor et al., 2015), accountability refers to the ability of impacted communities to hold power holders accountable for their decisions or acts. This article considers accountability as one of the elements of adaptive capacity, which is the capability to establish transparent accountability processes, allocate duties to various parties, and secure acceptance of judgments. The findings indicated that players should be capable of making unambiguous decisions, assigning tasks, and appointing accountable implementers when the transboundary conditions for WEEE become dynamic. Additionally, two distinct kinds of players with varying degrees of accountability are deduced from the results: executive actors and subordinate actors. The administrative actors should make sound judgments in response to changes and gain approval for their choices and work assignments.

On the contrary, subordinate actors lacking decision-making capacity should assume ownership of adaptation execution. Their commitment to the adaptation choice or effort is critical to its success or failure. Additionally, the studies revealed that a high degree of accountability capability is reflected in equitable task assignment and responsibility.
Hurlbert et al. (2013) argue that adaptive governance should provide a fair allocation of risks, rewards, and costs, including the definition of accountable risks.
Institutions can either increase or hinder adaptive capability (Kelly et al., 2000). As a result, the recommendations made by respondents include three components: institutional or organisational assistance through training, processes, and policies. For years, research into the factors of adaptive ability has been accelerating. Additionally, a more significant emphasis has been placed on the adaptive capacity wheel's use in a variety of scenarios (T. Grothmann et al., 2013; Phillips, 2015). It was initially believed that financial resources might enhance adaptive ability (IPCC, 2001; Vincent, 2007). Apart from financial help, actors' adaptive capacity to deal with and adjust to changes in the transboundary flow of WEEE can be strengthened by other variables. The interviews indicate that training can help actors develop their adaptive capacity, particularly their capacity for learning and assessment and their ability for responsiveness and reconfiguration. They should be equipped with an up-to-date understanding of hazardous wastes and the information necessary to analyse WEEE import circumstances. This is supported by Abdul-Razak et al. (2017) and Caretta (2014), who demonstrate that training is the primary determinant of adaptive capacity and the critical factor in its improvement.

Additionally, actors require systems to enhance their adaptive ability because adaptive capacity is strongly impacted by governance, management, and institutional factors (Engle, 2011). Transnational difficulties emphasise the importance of answers, decision-making processes, and collaboration that transcend the boundaries of individual players. The issues need the development of administrative structures or system designs that work on several levels to promote sustainability (Badenoch, 2002). The findings indicate that solutions that can help actors improve their adaptive ability include an information management system and a waste detection system. The information system can assist actors by providing critical information on WEEE's current state, the applicable law or regulation, or the cross-border movement of WEEE. When actors need to communicate with government or non-government entities, the information system should list important persons accountable for the issue. Due to the variety of WEEE, the waste identification system should assist them in distinguishing unlawful and hazardous trash from recyclable waste with expert assistance. Institutional change (Birkmann et al. 2009), structural change, functional change, and organisational system change are required to develop adaptive capacity for long-term activities (Eriksen et al., 2005; Kelly et al., 2000). The adaptive capacity has handled actual and

anticipated changes (IPCC, 2001, 2007). As such, supporting mechanisms will be required to enhance the adaptive ability of the actors.

The third guideline for policymakers is to ensure that policies support actors' adaptive capabilities. The policy may be defined as laws, legal rules, formal rules, and informal norms that regulate actor behaviour and interaction (Yamin et al., 2019). To maximise actors' adaptive capability, it is necessary to have a diversity of solutions arising from the availability of a diverse range of policy alternatives for addressing an issue (J Gupta et al., 2011). Complex challenges, such as WEEE in a transboundary environment involving various players and levels of government, need a range of strategies to stimulate flexibility and adaptability among the parties. Additionally, regulations should enable actors to make autonomous adjustments to their decisions, plans, or actions (Polsky et al., 2007). This can enhance actors' adaptive capacity to devise customised solutions, modify existing situations, and deal with expected and unforeseen changes.

Conclusion

The purpose of this research is to elaborate on determining the adaptive ability of players involved in the transboundary movement of WEEE. The theory presented in this research identifies four components of adaptive capacity: the ability to learn and analyse, the ability to coordinate and collaborate, the ability to respond and reconfigure, and the ability to be accountable. Additionally, while promoting these four aspects of actors' adaptive capacity, policymakers should prioritise supporting variables such as training, systems, and regulations. The methodology presented in this article is beneficial for establishing and sustaining actors' adaptive ability when confronted with changes in the context of transboundary movement. Thus, the study addresses a concern raised by academics in environmental governance: a disproportionate amount of research on adaptive capacity is focused on climate change (Torsten Grothmann et al., 2005; Smit et al., 2006). Additionally, while other long-term dangers, such as WEEE, have garnered considerable attention in social scientific research, none of these studies considers adaptive capability in the international movement of WEEE.

As a result, this study contributes to our understanding of adaptive capacity in WEEE, where four characteristics of actors' adaptive ability are critical for adapting to change. While the literature strongly supports the approach described in this research, the data is collected from a small number of examples and a narrow range of circumstances. The model used in this work serves as a good reference for future empirical investigations on the adaptive capability of hazardous waste and waste transfer across borders. Additionally, critical topics about future research requirements in this subject include establishing evaluations of actors' adaptable ability in the transboundary domain and studying the relationships between the four dimensions of actors' adaptive capacity and the three proposed supporting elements. Perhaps the findings brought new knowledge from a

more extensive range of governance situations, increasing the potential for the adaptive capacity literature and practises to advance.

Further research is needed to determine how the suggested framework may be adapted to the transboundary movement of WEEE in a manner comparable to the Thailand scenario. A quantitative survey with a high sample size would give empirical evidence confirming the correlations between the adaptive capacity components. Comparing actors' adaptation ability across companies may be accomplished by using various statistical analytic approaches.

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