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Analysis of Climate Change Adaptation Policies in Asia

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Abstract

The article addresses the issue of adaptation policies by comparing two regions in Asia: Southeast Asia and Northeast Asia. The aim is to highlight the directions and the degree of progress of the policies implemented, as well as their determinants. The methodology included an analysis of bibliographic materials and available data. As a result, it was possible to establish that the scope of carrying out adaptation policies varies depending on the country, and it is not possible to speak of a common continental policy or even a common regional policy. The degree of a country's development determines the sophistication of the policy pursued.

Keywords: adaptation policy, climate change, Southeast Asia, Northeast Asia

JEL: O44, O57

Introduction

Progressive climate change has consequences for humans, economies, and the environment. Knowledge of the causes and consequences of climate change should result in concrete measures of adaptation on the one hand and mitigation on the other. Countries implement specific adaptation policies into the practice of socio-economic life. Due to a number of regionally determined factors, adaptation policies implemented by individual countries differ.

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The literature addresses adaptation policies in Asia and the Pacific very broadly. Studies have investigated parts of regions (Agarwal et al. 2021), vulnerability to climate change (World Bank 2009, pp. 41–56), climate change, climate resilience, and water security (Sawhney and Perkins 2015, pp. 56–84), challenges, policy tools, programs and adaptation measures in different areas (Anbumozhi et al. 2012; McKinsey Global Institute 2020), the economic costs and benefits of unilateral and regional actions on climate change in Bangladesh, Bhutan, India, the Maldives, Nepal and Sri Lanka (Ahmed and Suphachol 2014), and the social aspects related to migration due to climate change (United Nations, Economic and Social Commission for Asia and the Pacific 2017). They have also investigated climate change adaptation assessment (USAID 2010) and good practices (Roome 2022). The articles deal with adaptation measures taken by individual countries, for example, South Korea, Singapore, China, Bangladesh, and India (Vachani and Usmani 2014). There are publications that deal with activities implemented in various sectors, most often in agriculture (Nor Diana et al. 2022), including the problem of crop insurance (Sawhney and Perkins 2015, pp. 36–55), but also in urban, energy, and transport sectors (World Bank 2009, pp. 153–184). There is also the comprehensive publication entitled "The Economics of Climate Change in the Asia-Pacific Region" by the United Nations, Economic and Social Commission for Asia and Pacific (2016).

The paper presents the results of analyzing adaptation policies implemented in Asia. To better understand the issue, Asia was divided into two regions, which were then compared with each other to find commonalities and differences. This also serves to ascertain whether, like Europe, we can speak of a common adaptive continental policy. The methodology includes analyzing bibliographic materials and available data.

Climate change in selected regions of the world

The first step in designing climate change adaptation measures is to identify the risks of climate change in a given region and the priority areas. Table 1 shows the main characteristics of selected regions of the world and the potential risks and consequences of progressive climate change.

Climate change will affect agriculture the most. Based on projections for the sector through 2050, there is a general trend of a northward shift in agricultural productivity. However, studies point to a 3% decline in the output of world agriculture by 2080, a decline that will be felt most in poor and developing countries. Thus, in China and Japan, for example, agricultural productivity is expected to decrease significantly due to lower profitability of wheat, rice and corn production. Meanwhile, in India, agricultural yields are expected to decrease 5.4%, while population density is increasing. This will significantly reduce food security and increase poverty

in the country (the percentage of extremely poor people will increase from 4 to 6%) (World Bank 2010, pp. 40–41).

Table 1. Threats and consequences of climate change by world region

Sub-Saharan Africa	East Asia and the Pacific	South Asia	East Europe and Central Asia	Latin America and the Caribbean	Middle East and North Africa
The region is prone to droughts and floods. Its economy depends on natural resources. Biomass provides 80% of energy. Agriculture accounts for 23% of GDP and employs 70% of residents. Poor infrastructure can hinder adaptation efforts. Problems: limited drinking water and malaria.	There is a large population living on the coast. The region's profitability depends heavily on agriculture. Problems: rapid urbanization and industrialization, environmental degradation, loss of marine resources (coral reefs). Expected changes: a more intense rainy season and the dry season extended by two months.	High levels of poverty, high population density, threat of lack of potable water supply, loss of ecosystems: melting glaciers, sea levels rising to flood levels, shrinking coastlines, loss of agriculture.	Ineffective environmental management (Russia) and poor state of infrastructure; low resilience to the impact of floods, storms and heat waves. Accelerated melting of Central Asian glaciers.	Very high threat to ecosystems, melting of tropical Andes glaciers, reduced drinking water supplies, warming and acidification of the oceans, threat to coral reefs, damage to the Gulf of Mexico, and a threat to the Amazon rainforest. Threats: more frequent and intense hurricanes.	The region most vulnerable to drinking water shortages (a 50% decline, even without climate change), a decline in agricultural profitability, threat to regional food security, high population density, resource scarcity, and socio-political conflicts.

Source: own work based on the World Bank (2010).

The main challenge for climate change prevention efforts is to reduce carbon emissions. The largest sources of CO_2 emissions are, in turn, energy production (26%), industry (19%), land use change and forestry (17%), agriculture (14%), transportation (13%), buildings (8%), and waste and wastewater management (2%) (World Bank 2010, pp. 190–196). What negatively impacts efforts to reduce emissions is the increasing wealth of societies. Higher incomes accelerate urbanization and the growth of the construction industry, increase consumption, and increase the number of travelers and the number of cars (abandonment of public transport), with increased transportation contributing to increased carbon dioxide emissions. Table 2 presents data on planned CO_2 reductions, the share of Renewable Energy Sources (RES), energy efficiency improvements and changes in the transport industry in selected countries. Table 3 shows the percentage distribution of carbon dioxide emissions by industry and income of countries.

Table 2. Planned preventive measures in selected countries

	U.S.	Canada	Australia	China	India	Mexico	Brazil
Planned reduction of CO_2	80% of 1990 levels by 2050.	20% of 2006 levels by 2020.	15% of 2006 levels by 2020.	Established a group of experts on climate protection and CO_2 emissions reduction, overseen by the prime minister.	National Action Plan on Climate Change – not to exceed emissions above the levels of developed countries.	50% of 2002 levels by 2050.	70% of 1990 levels by 2018.
Planned use of RES participation	25% by 2025	nd	nd	15% by 2020.	23 gigawatts by 2012.	8% by 2012.	10% by 2030.
Energy efficiency	nd	nd	nd	Reduce energy intensity by 20% from 2005 to 2100.	A reduction of 10 gigawatts by 2012.	nd	nd
Transport	Reduce fuel consumption by a gallon per 35 miles by 2016.	nd	nd	Achieve the goal of reducing fuel consumption by a gallon per 35 miles. Plans to be a leader in the use of electric vehicles and underground bulk transportation	Increased investment in public transport.	Increased investment in public transport	World leader in ethanol production.

Note: nd = no data.
Source: own work based on World Bank (2010, p. 192).

Table 3. CO_2 emissions by industry and country income (ppm part per million, based on World Bank classification)

	World	High-income countries	Middle-income countries	Low-income countries
Energy	26	36	26	5
Industry	19	17	16	7
Transport	13	23	7	4
Land management and forestry	17	–	23	50
Agriculture	14	8	14	20
waste management	3	–	–	–
Buildings	8	–	–	–
Others	–	18	14	14

Source: own work based on World Bank (2010, pp. 190–196).

For global warming to stop at 2˚C, a maximum CO_2 emission of 450 ppm is required. For this, action is needed to reduce emissions in power generation by 71%, construction by 41%, transportation by 30%, and industry by 21% (50% in total) by 2050 (World Bank 2010, p. 200). To achieve this, energy efficiency must be increased, and total energy demand must fall. To achieve this goal, reductions in oil and coal consumption, and increased use of RES and carbon detection and storage technologies are required. Unfortunately, these technologies are not without flaws and problems. In the case of wind, hydropower, and geothermal power, the main problem is the limited number of available sites. Biomass is limited by competition from agricultural and forestry production, while solar energy production is still expensive. Nuclear energy raises concerns about the development of the weapons market, waste management, and the danger from reactors. Carbon storage and storage technologies are in the testing stages of commercialization and may be limited by space availability and high costs. However, studies show that investing $1 in increasing energy efficiency avoids more than $2 in the cost of producing new energy and further promotes countries' development (World Bank 2010, p. 209). A summary of priority climate change prevention measures by country income level is shown in Table 4.

Table 4. Priority prevention activities by income

High-income countries	Middle-income countries	Low-income countries
– increase access to on-grid and off-grid energy, – increase energy efficiency and use of RES, – remove mines, – fuel subsidies.	– improve energy efficiency and use of RES, – adaptive urbanization orientation, – develop low-carbon urban transportation, – remove mines and reduce coal consumption, – fuel subsidies, – invest in R&D of new technologies.	– reduce the carbon footprint of single households, – lifestyle changes, – remove mines, – fuel subsidies, – invest in R&D of new technologies, – fund the transition away from coal energy in developing countries.

Source: own work based on World Bank (2010, p. 204).

Water management and drinking water shortages could be the biggest challenge posed by climate change, experts point out. Humidity around the world is increasing, higher temperatures will lead to evaporation and more frequent droughts, and there will be an increase in rainfall and rain-free periods. The solutions used so far may not be enough, and the pace of change will be too fast to find new solutions (this has occurred in Peru, where farmers have abandoned previously cultivated crops due to a lack of water). In the case of the water resource, as with food security, rising demand[1] meets falling supply, exacerbating the water deficit.

As the UN points out, a small number of countries have knowledge of the quantity and quality of the available water supply and estimates of how much water can be withdrawn without upsetting the environmental balance. This is due to the high complexity of monitoring the water resource and the lack of uniform international standards. Other problems include treating water as a public good with an infinite amount – there is a lack of standards for using the water resource and a lack of adequate regulations to enforce fees for the water resource used (e.g., in forestry). Many experts believe that the best solution for reducing the water deficit is appropriate technologies to increase water productivity (including groundwater, such as groundwater pumps and mulching) and enabling the use of rainwater (stormwater), seawater desalination, recycling, and water storage (World Bank 2010, p. 137).

Climate change also affects fisheries. Even without climate change, through overexploitation of marine ecosystems, it is estimated that productivity will decline by 25 to 30 percent, with no chance of returning to baseline levels. The worldwide cost of mismanaging marine ecosystem resources is estimated at about $50 billion a year. Fish and shellfish protein provides 8% of the world's animal protein needs. With the world's

1 A single person's daily consumption is 2 to 5 liters of water, with 2,000–5,000 liters of water used in food production.

population growing by about 78 million people per year, it makes it imperative that fish production should grow by about 2.2% a year, maintaining the current 29 kilograms per person per year (World Bank 2010, p. 157).

Experts stress that only a sustainable fishing policy can save the industry from a total loss of productivity. New coastal management solutions are needed (including reducing stress on marine ecosystems, such as coral reefs), the introduction of marine protected areas, fishing restrictions, coastal enforcement policies, fishing technology, and licensing. High hopes are pinned on aquaculture, or the raising, breeding, and cultivation of aquatic organisms (plants or animals). Such activities are carried out in either a controlled or specially selected aquatic environment. In 2006, it accounted for 46% of the world's fish supply, with an estimated 7% average annual growth. A major challenge for aquaculture is the quality of fish; in 2010, 40% of aquaculture depended on industrial feeds. The emphasis is on herbivorous or omnivorous cultures, as carnivorous ones are less efficient, e.g., 2.5–5 kilograms of wild fish are needed to produce a kilogram of salmon or shrimp. A major cost of aquaculture is the burden on the environment; by 2010, it was responsible for the loss of 20 to 50% of mangroves (World Bank 2010, p. 157)[2].

The global market will see a shortage of crops, rising food prices, and price volatility due to rising demand. There will also be more difficult growing conditions (higher costs associated with adaptation measures, such as the use of new technologies), declining water resources, and higher energy prices as a result of climate policy. Estimates indicate a 60–97% increase in the price of rice, corn, soybeans and wheat, and a 31–39% increase in the price of beef, pork, and poultry between 2000 and 2050. These increases will be felt most severely in poor regions, where the population spends 80% of its income on food purchases. Despite differences in estimates of the percentage changes in prices, there is a consensus on the threat to global food security and an increase in the problem of hunger, primarily in South Asia and Africa (World Bank 2010, p. 168).

A major threat posed by climate change is the spread of diseases and more cases of known diseases, e.g., malaria. It kills nearly one million people a year, and by 2050 will increase by an estimated 14% in Africa alone and globally by 30 to 60% by 2070. New strains will emerge, and with them, there will be problems with treatment due to the lack of adequate drugs. The problem is particularly acute in poor countries. It is estimated that the number of deaths due to climate impacts will increase by 150,000 per year and more, and indirect effects, such as the spread of diseases (mainly those related to diarrhea disrupting cognitive function and learning ability, especially among children), will negatively affect productivity in the long term (losses in productivity).

2 Mangroves, mangrove forests – evergreen, pioneer plant formation of sea coasts in almost the entire intertropical zone. They generally occur in the intertidal area and are therefore sometimes called tidal forests. However, this term is not accurate, as the tides are not always clear in the areas where mangroves occur.

The spread of diseases requires the state to take appropriate, often costly, measures, i.e., early epidemic containment systems, adequate medical security, investment in research, designing diagnostic tools, developing information (communication) and monitoring techniques, developing sanitation and water management systems, preventing the breeding of disease-spreading insects, and providing training systems for health care personnel. Only well-functioning adaptation systems, set up by the government and supported by the private sector, can reduce deaths and keep losses to a minimum (World Bank 2010, pp. 90–92).

Another increasing problem is heatwaves and the formation of "heat islands" in cities, where the perceptible temperature is 3.5–4.5°C higher. The seriousness of the problem is underscored by data on the 2003 heat wave, which caused a total of 70,000 deaths in the following countries: Italy (20,089 deaths), France (19,490), Spain (15,090), Germany (9255), Portugal (2696), Belgium (1175), Switzerland (1039), the Netherlands (965), Croatia (788), England (301), Slovenia (289), and Luxembourg (166) (World Bank 2010, pp. 93–96).

Identifying climate change adaptation actions in Asia

In the Asia-Pacific region, the consequences of climate change are being felt by nations and communities in many different sectors. Rising sea levels, intensifying winters, long droughts, and increased risk of flooding are just some of the impacts of climate change in the region. Faced with a changing environmental context, governments are struggling to achieve and maintain water, food, and energy security, while the continent's people are trying to adapt to the new climate reality. As the struggle for access to natural resources intensifies, the need for transboundary and regional resource management is also expected to increase.

Efforts to adapt to progressive climate change on the continent are regionally diverse. Many stakeholders, such as governments, the public, and the international community, are engaged in multi-level adaptation activities (at international, national, and local levels). Through cross-regional cooperation, the Asia-Pacific Adaptation Network (APAN) conducts knowledge management activities and supports governments and other organizations that work on climate change adaptation. By sharing knowledge and expertise from across the region, APAN seeks to increase the decision-makers' access to technologies and funding, and design and implement adaptation initiatives (Sawhney and Perkins 2015, pp. 2–6).

The first adaptation program in the Pacific region was Capacity Building for the Development of Adaptation Measures in Pacific Island Countries (CBDAMPIC). It addressed the long-term risks of climate change in development and resource management planning, and improved adaptive capacity and livelihoods through integration. The project included the following three stages of adaptation: Stage I – Planning,

researching the possible impacts of climate change to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building; Stage II – Actions that can be taken to prepare for adaptation as envisioned in Stage I ; Stage III – Activities to facilitate appropriate adaptation, including insurance and other adaptation measures envisioned in Stage I . Most of the climate change projects introduced in the Pacific fall into the Stage I and II categories, while the CBDAMPIC project is the first step to Stage III (Nakalevu 2016, pp. 44–51).

The CBDAMPIC project recommended a climate change adaptation approach based on two "downstream" and "upstream" levels and "learning by doing." The project promotes adaptation activities that empower residents to initiate action in response to the adverse effects of climate change using a participatory approach. While the global and regional community provides solutions to common problems, local solutions should be the basis for long-term climate change adaptation. The project was piloted in 16 communities in four countries (the Cook Islands, Fiji, Samoa, and Vanuatu), and important lessons were learned for future adaptation work (Nakalevu 2016, pp. 44–51).

Pacific Adaptation to Climate Change (PACC), on the other hand, is a regional project involving 14 Pacific countries. PACC's goal is to "enhance the capacity of participating countries to adapt to climate change, in selected key development sectors." The project's outputs include increased adaptive capacity in key economic sectors such as the coastal sector (in the Cook Islands, Micronesia, Samoa, and Vanuatu), agriculture and food, the security sector (in Fiji, Palau, Papua New Guinea, and the Solomon Islands), and the water sector (in the Marshall Islands, Nauru, Niue, Tokelau, Tonga and Tuvalu). The project has helped integrate climate change adaptation measures into national policies and programs in the economic sectors above. It also promoted regional cooperation among participating countries, sharing experiences, innovating and including adaptation measures in national development goals, plans, strategies, and programs (Nakalevu 2016, pp. 44–51).

In Central Asia, the Central Asia Regional Economic Cooperation (CAREC) has produced a report entitled "Adapting Technology to the Needs of Central Asia's Water Industry and Agriculture." The report recommends the following measures (including disaster preparedness): afforestation and forest restoration (preservation of ecosystems), using irrigation technologies in agriculture, constructing necessary infrastructure for access to groundwater, reconstructing irrigation systems, water resources (supply and storage), supporting breeding programs to develop drought-resistant crop varieties, introducing advanced agricultural technologies (soil and moisture conservation technologies), crop diversification and rotation, developing modern systems for early warning and the prevention of natural anomalies (including effective weather forecasting methods), and breeding programs to diversify crop and livestock varieties and develop varieties and species resistant to expected changes in climatic conditions (Regional Environmental Center for Central Asia (CAREC) 2012).

The United Nations Environment Programme (UNEP) launched the Asia-Pacific Adaptation Network, which was followed by the Global Adaptation Network. The task of these networks is to strengthen national scientific and policy dialogues. The networks bring together universities and institutions to address the need for better interaction and communication of policy and science on climate change issues, particularly adaptation (http).

As presented in the Climate Change Action (CCA) conducted for South Asia (countries such as India, Bangladesh, Afghanistan, the Maldives, Pakistan, and Nepal), the main gaps in the adaptation process relate to the fact that the national development strategies of South Asian countries continue to focus on GDP growth rates. This is problematic for two reasons. First, it is based on the assumption that economic growth will automatically result in more jobs, thereby increasing prosperity and reducing vulnerability. However, there is no empirical support for this assumption for this region. Second, the focus on GDP growth ignores the important determinant of climate change mitigation of achieving production increases in a sustainable and climate-resilient manner (Mehta and Vashist 2015, pp. 7–17).

In the context of achieving greater overall efficiency, all South Asian countries' national plans and strategies have identified better governance as a priority, as well as the more efficient management of natural resources. Three main aspects have been identified for improvement. First, there should be increased awareness of the need for adaptation activities by administrative officials and governments at all levels with tangible results in concrete adaptation plans and their implementation. The second aspect is the continuous monitoring and auditing of these programs. Social audits, in particular, are a very useful tool for assessing program effectiveness, as they directly involve beneficiaries in the auditing and monitoring processes. Third, improved coordination of institutional climate change cooperation is required within and between countries (Mehta and Vashist 2015, pp. 7–17). As a lack of sources of funding for adaptation activities is a major problem in South Asian countries, Mehta and Vashist (2015, pp. 7–17) pointed out that it is necessary to raise funds both domestically and from international organizations.

In the South Asian region, there is a positive trend of small-scale climate change adaptation initiatives undertaken by local communities or NGOs. Regionally, these initiatives have not produced tangible results, but they provide a good basis for further action at both the national and regional levels. An issue that requires rapid intervention is the existing water-sharing agreements between various countries in South Asia, which ignore the issue of climate change (Mehta and Vashist 2015, pp. 7–17).

In the South Asia region, it is necessary to shift the focus of adaptation efforts from disaster response to effective weather risk management, including a focus on preparedness and countermeasures, improving flood and drought forecasting, establishing early warning systems, and improving information flow. It is recommended that comprehensive action plans include technical plans and guidelines, disaster preparedness policies

with allocated resources, decentralized coordination mechanisms, implementation of gender policies, and access for women and children to all interventions to achieve integrated flood and drought management (Mehta and Vashist 2015, pp. 7–17).

Despite the vast water resources available, the lack of agreement among states in the region generates conflicts. Conducting integrated policies at the state level is an important factor that influences adaptation initiatives at the regional level (Mehta and Vashist 2015, pp. 7–17). The jointly adopted "Integrated water resources management" (IWRM) initiative, and acts and plans in individual countries (e.g., Bangladesh – National Water Policy 1999 and National Water Management Plan 2004; Bhutan – Water Act 2011; India – Draft National Water Policy 2012; Nepal – National Water Plan 2002), have so far failed to produce tangible results. The main reason is the lack of institutional establishment or policy implementation mechanisms. No country in the region has a mechanism or institutional framework for allocating or distributing resources. Institution building is especially needed at the community level. The regulatory framework needs to be revised in light of integrated water resources management at the river basin level, incorporating an ecosystem approach. Estimating the economic value of water should take into account decisions regarding the allocation of water resources and the pricing of water services (Mehta and Vashist 2015, pp. 7–17).

Southeast Asia

Southeast Asian countries increasingly act towards addressing climate change. All countries in the region have adopted the UNFCCC (United Nations Framework Convention on Climate Change), signifying their recognition of "common but differentiated responsibilities" and a commitment to responding to the challenges of climate change in terms of mitigation and adaptation. Many of these countries have formal institutions responsible for climate change, which were established either as independent entities that report directly to the head of state (president, prime minister) or as special divisions within the Ministry of the Environment (Diomampo 2015, pp. 181–221).

Most countries in the region are integrating climate change into their development plans, as well as developing their climate change action plans. In Indonesia and the Philippines, in addition to general climate change plans, they have developed climate change strategies/detail plans – National Climate Change Action (CCA) plans. However, there are also some that have not yet developed CCA plans, let alone implemented them. For example, Brunei and Myanmar must first conduct a vulnerability/impact assessment to formulate their climate change plans/strategies (Diomampo 2015, pp. 181–221).

The region's priority CCA sectors are agriculture, water resources, coastal/sea resources, forestry, biodiversity, and health. The three most common priorities for Southeast

Asian countries (with the exception of Brunei) are cross-sectoral approaches to climate change, water resources, and health. Agriculture and water resources remain important sectors for both livelihoods and food security, thus becoming a CCA priority for most countries in the region. This is especially true for countries with a high percentage (more than 50 percent) of their labor force engaged in agricultural activities, such as Timor Leste, Cambodia, Laos and Vietnam. As expected, the CCA priority sectors reflect the characteristics and gaps in each country. For example, agriculture and forestry are not priority sectors for Singapore, a highly urbanized country. Instead, the Urban Heat Island effect was identified as a priority due to its high population density and energy-intensive manufacturing-based economy (Table 5) (Diomampo 2015, pp. 181–221).

Table 5. Southeast Asia's key sectors of adaptation

Country	Key sectors for adaptation
Brunei	Forestry and biodiversity
Indonesia	Agriculture, water management, coastal resources, forestry and biodiversity, health care
Lao PDR	Agriculture, water management, coastal resources, forestry and biodiversity, health care
Malaysia	Agriculture, water management, coastal resources, forestry and biodiversity, health care, energy, industry and transport
Myanmar	Agriculture, water management, coastal resources, forestry and biodiversity, health care, energy, industry and transportation
Philippines	Agriculture, water management, coastal resources, forestry and biodiversity, health care
Singapore	Water management, coastal resources, health care, Urban heat island
Thailand	Agriculture, water management, coastal resources, forestry and biodiversity, health care
Timor Leste	Agriculture, water management, coastal resources, forestry and biodiversity, health care, energy, industry and transportation, infrastructure
Vietnam	Agriculture, water management, coastal resources, forestry and biodiversity, health care, energy, industry and transportation

Source: own work based on Diomampo (2015, pp. 181–221).

In almost all key sectors for CCAs in each country, activities are assumed to improve infrastructure. Other common features of the plans/strategies are the assumption of changing practices, developing planning systems, raising awareness and establishing monitoring/warning systems (Diomampo 2015, pp. 181–221).

One of Southeast Asia's key industries is agriculture, so available studies (e.g., APAN and The South-East Asian Regional Center for Graduate Study and Research in Agriculture –SEARCA) indicate that the region's climate change adaptation efforts should focus specifically on agriculture. To date, climate change adaptation efforts in the agricultural

sector in Southeast Asia have been sporadic and inconsistent. The adaptation action initiatives that do occur are mainly on small farms, without external support (which may provide a basis for using the concept of climate-smart agriculture, CSA, in this region) (APAN-SEARCA 2013).

The challenge for the region is for the government to put in place the correct policy and infrastructure mechanisms in line with the principles of sustainable agriculture. In addition, effective adaptation measures for the region should be based on close cooperation between local governments and private organizations to share costs and improve implementation and management. Examples of good practices of adaptation measures for this region of Asia include the introduction of decision-support systems for farmers, investment in agriculture, financial incentives for farmers (e.g., crop insurance), raising farmers' awareness of climate impacts and hedging options, and the free flow of technological knowledge to enable the introduction of sound agricultural practices (Ancog and Ticsay 2015, pp. 18–31).

Table 6. Adaptation policies of Southeast Asian countries

Country	Adaptation policy	Institution responsible	Regional distribution of funds for adaptation measures
Brunei	None	None	0%
Cambodia	Cambodia's Climate Change Strategic Plan 2014–2023 (The National Climate Change Framework)	The Climate Change Department, which is under the Ministry of the Environment	31%
Indonesia	National Climate Change Action Plan in preparation	Indonesia's National Council on Climate Change, Geophysical and Climatological Agency (under the Ministry of Environment)	14%
Lao PDR	*The National Climate Change Strategy*	Lack of a single responsible institution, all ministries are required to take climate change into account in their activities	4%
Malaysia	Climate change adaptation plan project phase	Unable to identify the institution responsible	0%
Myanmar	Climate change adaptation plan project phase	Unable to identify the institution responsible	1%
Philippines	*The National Climate Change Action Plan*, NCCAP, 2011–2028	*The Climate Change Commission*	26%
Singapore	*The National Climate Change Strategy 2013*	*The National Climate Change Secretariat*	0%

Country	Adaptation policy	Institution responsible	Regional distribution of funds for adaptation measures
Thailand	*The Thailand Climate Change Master Plan* (2012–2050)	Unable to identify the institution responsible	1%
Timor Leste	Climate change adaptation plan project phase	Unable to identify the institution responsible	2%
Vietnam	National Climate Change Action Plan in preparation	*The Department of Meteorology, Hydrology and Climate Change*	21%

Source: own work based on Diomampo (2015, pp. 181–221).

In assessing the sophistication of climate change adaptation efforts in the Southeast Asian region, it can be seen that while there are countries with high levels of sophistication, there are still countries such as Timor Leste, Myanmar and Brunei, for example, which are in the preliminary stages of implementation. These countries still lack institutional and legal frameworks and even have a limited assessment of climate change impacts. The level of implementation in Brunei, despite its financial resources, is much lower than in other countries in the region. Countries with relatively more experience in implementing CCA initiatives have the right institutions, plans and policies in place. A problem in the region is a lack of coordination and integration, which is important given that climate change issues affect many sectors and involve different levels of government. Other challenges include fragmented or sometimes overlapping responsibilities between different institutions, such as the environment ministry and autonomous climate change offices. In addition, most countries lack sufficient knowledge and skills (e.g., indicator development, assessment), technology, and human, financial and methodological resources.

Despite the existence of CCA initiatives at the local level, it is important to further increase education, capacity building, and the involvement of local governments and the public in climate change issues. It is also important to improve coordination between national and local institutions. Other problems identified include unrealistic action plans, incomplete or inconsistent policies/legal documents (e.g., lack of risk assessments), low awareness, capacity and expertise in CCA monitoring from central to local levels, a lack of availability or lack of baseline data, a lack of vulnerability assessment studies, political barriers (e.g., changing views of politicians or policymakers), and difficulties in measuring the effectiveness of ongoing activities due to varying definitions, and uncertainty of climate change and future developments (Diomampo 2015, pp. 181–221).

Four countries account for 92 percent of CCA funding in the region. The majority of adaptation funding in the region comes from public sources, so it is understandable that systems for monitoring adaptation activities in countries that receive more funding are better developed, matching the reporting requirements of funding agencies (Diomampo 2015, pp. 181–221).

Northeast Asia (China, Japan, Korea, Mongolia)

China, Japan and Korea play an important role in the region's economy, as well as the world's. China, due to the vastness and diversity of its terrain, is characterized by varying impacts of climate change. The Tibetan Plateau is experiencing the consequences of climate change in the form of changes in river flows and melting glaciers. Conversely, northwestern China is threatened by worsening desertification caused by lower rainfall and higher evaporation rates. Northern and northeastern China are affected by water shortages, while parts of the east and southeast are affected by frequent storms and long-term flooding. Since 2012, China has suffered from more frequent extreme weather, with the National Development and Reform Commission (NDRC) pointing out that many areas in southern China have experienced very high temperatures, flooding, and mountainous landslides and mudslides (National Development and Reform Commission (NDRC) People's Republic of China 2013).

In Japan, an archipelago of islands, temperatures have risen by 1.15˚C in the last century. The most serious consequences of climate change are the increasingly severe effects of heat on society, declining agricultural production, health problems, and weather anomalies (Japanise Ministry of the Environment 2009).

Korea has seen a temperature rise of 1.7˚C and a sea level rise of about 22 centimeters over the past 100 years. The negative dimensions of climate change in the region are mainly heat waves, which pose a threat to public health, and extreme weather events (The Government of the Republic of Korea 2003).

Mongolia's average temperature has increased by 1.9˚C since the 1940s. A major problem for Mongolian agriculture is dwindling water resources, especially in naturally dry regions. A consequence of climate change in this area is extreme weather phenomena, which worsen the country's already difficult economic and social situation. Intense snowfall, dust storms, hailstorms, and floods are common occurrences in the country. Every year, about 2.4% of the animal population dies as a result of severe weather conditions (Dagvadorj et al. 2009). Disasters, called "dzud," have caused massive loss of livestock and direct damage to nomads and their way of life (Yan, Oba, and Balt 2015, pp. 199–205).

On the path of rapid urbanization and economic development, China is trying to find a balance point for economic growth and reduce the negative effects of climate change. In China, the plan for climate change adaptation is to integrate the problem of climate change into socio-economic processes, enhance the adaptive capacity of key sectors of the economy and society, and introduce a Chinese development plan that considers the ability to cope with the negative consequences of climate change and is based on the paradigm of sustainable development. The goal of adaptation activities is to improve the ability to reduce the negative consequences of disasters, increase irrigation efficiency, and recover 50% of desert land. Achieving these goals should take into account

the balance of global and national development needs. There should also be simultaneous prevention and adaptation activities, increased technological and institutional innovation, and cooperation between society and government (National Development and Reform Commission (NDRC) People's Republic of China 2013).

Japan's adaptation plan aims to make the country more resilient to extreme weather events. The main goals are to avoid or adapt to risks, reduce negative impacts, and take advantage of benefits. The goals will be achieved with all possible mitigation and adaptation measures (Basic Act for National Resilience 2013).

Korea aims to create a climate-resilient society and support green growth. The main goals are to be ranked seventh on the list of green economy leaders by 2020, and fifth by 2050. To this end, the National Climate Change Action Plan (NCCAMP) was enacted, and the National Adaptation Committee (NGAC) and the National Climate Adaptation Center (KACCC) were established (The Government of the Republic of Korea 2012).

Mongolia's stated goal is to create a sustainable environment for development through its ability to adapt to climate change. This will be done by promoting its ability to adapt to climate change, reducing risks, and facilitating adaptation at the local community level. These activities will be possible by analyzing the impact vulnerability of the environment and economic sectors to climate change and adapting socio-economic development policies to the results (relevant legal acts required) (Ministry of Environment and Green Development 2013).

All the countries in question are considering climate change mitigation and adaptation to create a favorable relationship with the environment and social development that is consistent with sustainable development. The key sectors for adaptation activities are presented in Table 7.

Table 7. Northeast Asia's key sectors for adaptation

Country	Key sectors
China	Agriculture and forestry, soil desertification, water management, coastal protection, biodiversity, health care, energy production, critical infrastructure, monitoring and warning systems.
Japan	Agriculture and forestry, water management, coastal protection, health care, critical infrastructure, community.
Korea	Agriculture and forestry, water management, coastal protection, health care, energy production, critical infrastructure, monitoring and warning, education.
Mongolia	Agriculture, cattle ranching, soil desertification water management, biodiversity, critical infrastructure.

Source: own work based on Japanise Ministry of the Environment (2010; 2012); The Government of the Republic of Korea (2012); National Development and Reform Commission (NDRC) People's Republic of China (2013); Mongolia's Initial National Communication (n.d.).

Table 8 presents the range of adaptation policies of Northeast Asian countries.

Table 8. Northeast Asia's adaptation policies

Country	Adaptation policy	Responsible institution	Supportive institutions
China	No unified regulations on climate change adaptation measures. They are not included in legislation or regulations. Developed National Adaptation Strategy and Adaptation Action Plan.	*National Development and Reform Commission*, NDRC	*National Leading Group to Address Climate Change*, NLGACC
Japan	Law to promote the prevention of global warming (1998, amended 2002). In 2012, a law to combat global warming was rejected.	Ministry of Environment	*The Climate Change Commission*
Korea	National Climate Change Adaptation Plan (2009–2030). Law on low-carbon, green growth (2009–2050). National Strategic Plan for Adaptation to Climatic Change (2011–2015).	Ministry of Environment	*National Government Adaptation Committee*, NGAC
Mongolia	Climate change adaptation measures are not included in laws and statutes (only a few mentions in sectoral regulations, without implementation). National Adaptation Strategy and Adaptation Action Plan developed.	Ministry of Environment and Green Development	*The National Agency for Meteorology, Hydrology and Environment Monitoring*, NAMHEM

Source: own work based on Barbi (2016, pp. 324–339); National Development and Reform Commission (NDRC) People's Republic of China (n.d.); Ministry of Environment (n.d.); Ministry of the Environment, Government of Japan (n.d.); *Climate Change Adaptation…* (n.d.); World Meteorological Organization (n.d.).

Table 9 summarizes the above analysis of adaptation policies in the Southeast and Northeast Asia regions. It shows a feature that is common to all countries on the continent – recognizing the problem of climate change and the urgent need for adaptation policies, especially in agriculture and forestry, water management, and coastal protection. All the countries analyzed indicate the importance of raising public awareness of adaptation. However, the scope of carrying out adaptation policies varies from country to country, and it is not possible to speak of a common continental policy, or even a common regional policy.

Table 9. Comparison of selected CCA indicators by region

Indicator	Southeast Asia	Northeast Asia
CCA common priority sectors	Agriculture, water resources, coastal/sea resources, forestry, biodiversity and health	Agriculture and forestry, water management, coastal protection, critical infrastructure
CCA joint priority activities	Cross-sectoral approach to climate change, water resources and health	increase public awareness of CCA
CCA consistency across countries	Consistency is about recognizing the need to develop planning systems, raise awareness, and create monitoring/warning systems	
CCA's main concern	Lack of coordination and integration of individual policies, fragmented or sometimes overlapping responsibilities between institutions, lack of sufficient knowledge and skills (e.g., indicator development, evaluation), technology, and human, financial and methodological resources	Lack of cooperation within the region, mainly in terms of information/knowledge flow and facilitating learning processes
CCA policy advancement	There are countries with high levels of progress; still, countries such as Timor Leste, Myanmar and Brunei are in the preliminary stages of implementation. They still lack institutional and legal frameworks, and even have limited climate change impact assessments	The sophistication of the CCA is closely related to a country's stage of development: Japan (top development country) – the adaptation vision is largely focused on maintaining advanced socio-economic development that is conducive to change. Korea (highly developed country) – the vision of adaptation is to strengthen the economy and maintain a state of advanced development in a sustainable manner until 2050. China (developing country) – adaptation efforts are part of a national strategy to achieve developed country status by 2050. Mongolia (least developed country in the region) – adaptation vision is set to achieve the Millennium Development Goals by 2050

Source: own work.

Conclusion

An important conclusion drawn from the analysis of the results is that a country's development level determines the sophistication of its CCA policy. Therefore, it can be concluded that adaptation solutions are sought only when other problems have already been solved and when society reaches a satisfactory level of development

followed by a sufficient degree of prosperity. At this point, it is worth mentioning the other side of the issue – one of the main effects of economic development is progressive climate change with its consequences. So, we pose a question for further research and consideration: Shouldn't a climate change adaptation policy be an integral part of the development policy of each country/region/continent, so that it goes hand in hand with that policy, rather than being a necessity? It may be too late to introduce such a scheme of action, but an affirmative answer indicates the need to work intensively on advancing adaptation policies to make the most of the negative consequences of the economic development to which humanity so doggedly aspires.

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Analiza polityki adaptacyjnej do zmiany klimatu w Azji

Artykuł podejmuje zagadnienie polityk adaptacyjnych w oparciu o porównanie dwóch regionów Azji: Azji Południowo-Wschodniej oraz Azji Północno-Wschodniej. Celem jest zwrócenie uwagi na kierunki, stopień zaawansowania realizowanych polityk, a także ich uwarunkowań. Zastosowano metodę analizy materiałów bibliograficznych oraz dostępnych danych. W wyniku przeprowadzonej analizy udało się ustalić, że zakres prowadzenia polityki adaptacyjnej jest różny w zależności od analizowanego regionu, nie można mówić tutaj o wspólnej polityce kontynentu, a nawet wspólnej polityce regionalnej. Stopień rozwoju danego kraju warunkuje stopień zaawansowanie prowadzonej polityki.

Słowa kluczowe: polityka adaptacyjna, zmiany klimatu, Azja Północno-Wschodnia, Azja Południowo-Wschodnia