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Institutional Analysis of Limitations to Climate Resilient Urban Development Planning: the Case of Udon Thani Province

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Abstract

Udon Thani is a province in northeastern Thailand which is rapidly growing and aims to become a regional hub despite being confronted with climate-related challenges. The research examines the limitation to the territory's climate resilience through the analysis of plans and policies at national, regional and local levels regarding the provincial development strategy with the focus on three sectors: land use, water supply, and wastewater management services. In doing so, this article identifies the other limitations to the mainstreaming of climate resilience into urban development planning, which includes vertical and horizontal institutional arrangement, legal framework, policy drivers. The researchers conducted. The research reveals that there are restrictions to climate mainstreaming as a result of institutional arrangements and gaps which have resulted in the lack of coordination between agencies at different levels of administration or agencies operating under different ministries. Moreover, the efficiency of the three urban services are undermined by the discrepancies of responsibility, information and financial resources allocated to the relevant actors.

Keywords: Urban resilience; Water resource management; Thailand; Urban development planning

1. Introduction

Situated in the northeast of Thailand, Udon Thani is the 11th largest province with the potential of becoming one of the country's important secondary cities. Udon Thani experienced rapid economic development in the 1960's as the base of the United States Air Force during the Vietnam War. After the departure of the US soldiers, the Udon Thani international airport and other built infrastructures enabled the province to become a regional transport hub. Indeed, this development was also supported by the central government as Udon Thani is addressed in the Office of the National Economic and Social Development Board's 2007-2011 and 2012-2016 strategic plan which propose the development of logistic systems in Udon Thani's city region. Udon Thani is in close proximity to the Laotian capital Vientiane as well as prominent Thai provinces such as Nong Khai which has Special Economic Zone, and Khon Kaen which is the location of the region's biggest university. While agriculture remains the source of income of the majority of households in the province, the socio-economic development of the region has led to urban growth and an increase in economic activities in the past decade, and this growth is expected to continue according to the province's

development objectives. Moreover, the growth of Udon Thani is expected to intensify as development of border areas become a priority of the Thai government. The development of the province is addressed in various national and regional strategies.

However, like other provinces in the Northeastern region, Udon Thani's development potential is largely threatened by the risk of flooding as a result of heavy rainfall during the monsoon season that happens often in the upper areas of Thailand. Udon Thani frequently experiences flooding in low-lying flat areas, including urban areas near the river, during the rainy season (June-October) of each year, and high-intensity floods have recently occurred in 2001, 2002, 2009 and 2011. Moreover, Udon Thani also experiences the problem of drought which occurs almost annually as a result of insufficient supply of raw water for tap water production. This often leads to farmers being told to reduce water usage for agricultural purposes in order to prioritise water supply in urban and economic areas (Udon Thani Waterworks Authority, 2015). These climate-related risks therefore undermine not only the rising urban areas but also the province's large agricultural sector.

Udon Thani was selected as the study area because it is an example of development within the context of increasingly severe and frequent climate-related risks and a freshwater ecosystem whose urban services are clearly linked to the climate. Moreover, Udon Thani is a dynamic area with high intensity and diverse land use as well as high socioeconomic importance to Thailand. This case study focuses on the institutional factors which are obstacles to mainstreaming climate change adaptation into urban management and thus exacerbate Udon Thani's vulnerability to drought and flood;his is examined via analysis of the three urban services of land use, water supply, and wastewater management. These components, which are inherently linked to the issues of flood and drought, were selected because they are essential drivers for urban growth whose management or structure provides an insight to how, if at all, the public authorities have addressed the issue of climate change and climate related risks through the spatial and environmental planning of Udon Thani. The analysis of these components also reveals institutional issues which are most likely present in other aspects of urban governance in Udon Thani province. The improvement of land use, water supply and wastewater management is necessary for Udon Thani's development and climate resilience, and the degree to which these components are able to accommodate climate related risks are indicative of the extent of the mainstreaming of water management into urban development planning.

The research area covers the urbanised area of the province, which falls under the following six local administrations: Udon Thani city municipality, Nong Samrong town municipality, Banjan subdistrict municipality, Nong Bua subdistrict municipality, Na Dee tambon administration organisation, and Banjan tambon administration organisation. The research area thus comprises of the most densely-populated and most developed urba areas of the Udon Thani province, which are all affected by the impact of seasonal flooding and drought. It should be noted that these areas fall under different boundaries of the regional and the local administrative division systems which are inconsistent, thus highlighting one of the various obstacles to the mainstreaming of climate resilience and ensuring policy coherence.

2. Research Methodology

Climate change adaptation and resilience must be integrated to development strategies in order to minimize the impact climate-related on investments and infrastructure and reduce social vulnerability of the residents. Another requirement is for mainstreaming climate resilience is to ensure that there is coherence and unity in the approach of local and national authorities, especially in the case of Thailand where central government agencies remain in control of many aspects of urban and environmental management at all levels. Climate change adaptation and resilience

in Udon Thani can be analysed using IIED's Building blocks for climate mainstreaming (Pervin *et al*., 2013) which categorizes the components of the process into three 'blocks': the enabling environment building block, the policy and planning building block, and the programmes and the project building block.

This study focuses on analyzing the enabling environment and policy planning building blocks. The research framework thus begins with the analysis plans and policies covering the period of 2002-2022, in line with the provincial development strategy, including policies at national, regional and local levels regarding the management of flood, drought, land use, water supply and wastewater management within the context of larger development aims and projects. The analysis reveals the institutional gaps present during the policy design or plan formation, the links between water management and the three urban services, and limitations for operation which includes shortcomings in organisational structure, legal authorisation, and other limitations. Policy analysis was also used to assess whether the policies included or reflected climate-related risk reduction measures and whether they are sufficient for enabling the city to cope with environmental risks. Extensive literature review was conducted of the policy and plans at multiple levels including the province's strategic development plan, development plans of the Joint Committee of Public and Private panel for Fixing Economic Problems, flood and drought management plans, environmental management plans, comprehensive urban plan, and the strategic plan of the Provincial Waterworks Authority. The research team also examined primary data and conducted multiple in-depth interviews with officials in Udon Thani, which offered a better understanding to the enabling environment upon which these policies were formulated.

The research team also conducted institutional analysis focusing on the vertical and horizontal institutional arrangements, legal framework, policy driving mechanisms and other components in order to establish an understanding of the nature and capacity of organisations which leads to policy change, as well as the obstacles and limitations to policy design and implementation. These limitations, which are the focus of this study, may be a result of internal processes and operations or relationships with other organisations. Hence, the analysis of land use, water supply and wastewater management in Udon Thani province focuses on the vertical and horizontal institutional arrangements, which refers to the coordination between public agencies of the national, regional and local levels, and the spatial coordination of public agencies at the same level of governance, respectively. Vertical coordination is essential for creating the drive for water management and urban development policies on multiple levels, while horizontal arrangement encourages coherent and effective urban growth. There is also a need for coordination between public agencies and the local government in order to incorporate climate change mitigation and water management to various aspects of urban management. (Figure 1 and 2)

A deliberative visioning workshop was a workshop conducted towards the end of the project. Findings from the institutional gap analysis conducted were presented to the relevant actors and stakeholders who expressed their agreement with the information. The research team also assessed Udon Thani's capacity to cope with the risk of flood and drought through the creation of three transient scenarios: business as usual, population increase according to the strategic plan of the Provincial Waterworks Authority, and the scenario where all of the province's envisioned development projects of the strategic plan are materialised, leading to significant urban growth. For each scenario, projections are made for the requirements that the land use, water supply and wastewater management sectors. These scenarios were then used in a visioning workshop with public officials from relevant institutions in Udon Thani to stimulate dialogue on whether or not their agency has considered the scenario and the possible limitations they will face in the case of flood or drought. The workshop was also intended to foster a more

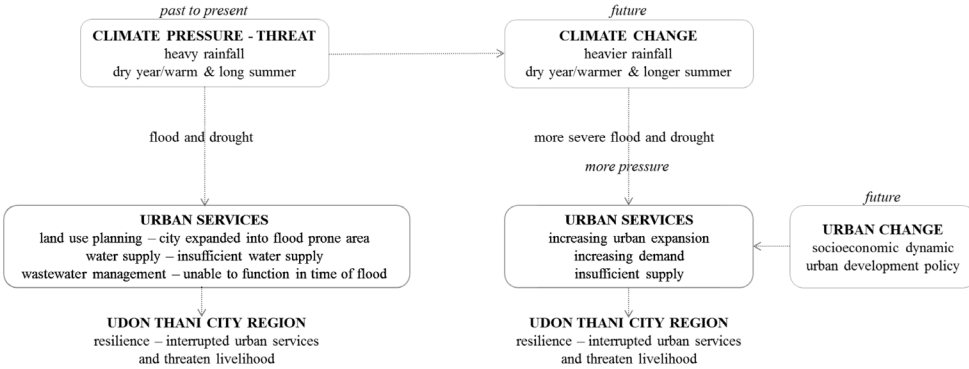

Figure 1. A diagram of research framework that shows a relationship between climate change and urban services

Figure 2. A diagram of research methodologies

holistic approach to mainstreaming climate change adaptation and to encourage participants to consider the temporal aspect of operational planning, It is worth noting that these scenarios are not predictions for the future--they are simply a tool for understanding the climate resilience of existing policies; these scenarios do not accurately reflect the reality on the ground due to limitations of the availability of data such as the number of informal residents, and two scenarios are based on plans and strategies built upon potentially inaccurate data. This is also suggested by discrepancies in estimates on the same subject such as population size by different plans. (Figure 2)

Participants of the workshop included personnel from Udon Thani Provincial Waterworks Authority, Udon Thani Province Administration Organisation, Udon Thani City Municipality, and the wastewater management agency. For each of the aforementioned scenario, the participants are asked the following questions:

1) Has your agency considered this scenario before and how? What must your organisation do in this scenario?

2) If the scenario happens, what limitations will your agency face in the case of flooding?

3) If the scenario happens, what limitations will your agency face in the case of drought?

4) Currently, are you participating with or assisting any other agencies? Do you have any expectations for cooperating with other agencies in the future and if so, with whom and on what issue?

3. Research findings

The research team has identified six key limitations to the development of Udon Thani province.

1) There is incoherence and contradiction between the provincial authority's strategic plan and the flood and drought management plan.

2) There is a lack of continuation of flood and drought management plans which are usually issued by the central government. These plans are created annually and often after an emergency event, so they are more reactive than preventive in nature and lack the essential integration of the water resource management.

3) There is limited information forecasting scenarios of future floods or droughts in the provincial strategic plan, this resulting in a plan that only addresses general environmental issues.

4) The city is growing into areas with recurring floods, and therefore poses new risks for the future.

5) there is a lack of holisticness in spatial and infrastructure management, leading to incoherence between urban policies and risk transfers to neighbouring areas.

6) There is a distinct lack of unity in the planning and development of the three urban services sectors of land use, water supply and wastewater management. These services remain vulnerable to the effects of climate risks, specifically with regards to urbanization and wastewater infrastructure location in flood-prone areas. This undermines the development capacity and climate resilience of Udon Thani urban's city region as well as the province's aim to become a regional economic hub.

For land use, there are limitations from the enabling environment that are obstacles for mainstreaming climate change adaptation. The latest provincial comprehensive plan of Udon Thani has been created using outdated information, leading to a plan that is inconsistent with existing settlements and the reality of changing city. Civil groups such as the Udon Thani Chamber of Commerce and the Industrial Committee have therefore submitted a request for the comprehensive plan to be reviewed The comprehensive plan fails to take into account flood risks, as demonstrated by how the plan designated settlements in areas with the risk of recurring flood..The shortcomings in land use planning may be a result of how there was a transfer of responsibilities from the Udon Thani department of Public Works and Town and Country Planning to the local-level organisation, the Udon Thani city municipality, to create the Udon Thani comprehensive plan. According to an interview with a city official, this transfer of responsibilities was not supported by the allocation of personnel and budget, leading to inefficiency and delays. This indicates discrepancies in vertical institutional arrangements. While local government also have the ability to manage urban planning within their jurisdictions, but few have the skilled personnel and/or resources, knowledge, and budget to do so, thus demonstrating a gap between assigned responsibilities and available capacity. In the horizontal dimension, the institution arrangement of municipalities lack cross jurisdiction coordination which is important for mitigating or preventing flood.

In the legal aspect, there are discrepancies regarding the decentralization of authority. The ultimate decision in the planning process is lies with the central authorities, and not the local government. According to the urban planning act of 1975, the final stage of the proposal of the comprehensive plan is the consideration of the urban planning committee who has the power to reject or amend the proposal. This committee is composed of representatives of central government agencies and does not include representatives of the concerned area, resulting in a lack of integration. Moreover, while land use planning has been identified as being useful for the province's development strategy, the development plan does not address tools or substantive process for urban planning and offer only vague goals such as creating livable cities.

Similarly, the water supply sector lacks integration with climate change adaptation policies. Currently, the Udon Thani provincial waterworks authority utilises only 58% of its water production capacity while covering all

areas in the Amphoe Mueang with the exception of some villages that have their own village water supply system. The Udon Thani provincial waterworks authority has the capacity to accommodate the needs of 120,000 people while the current number of service users is 69,876 persons. The main limitation for water supply in Udon Thani is the increasing demand for raw water, especially in times of flooding where the raw water sources located in areas of recurrent flooding may become contaminated. In the past, the water supply did not particularly suffer during droughts because the urban area is prioritised over the agricultural areas when water is allocated, but the conditions will change with the worsening drought and the decreasing volume of water of existing sources. Another issue that arises during the periods of drought is the contamination of pesticides and other chemicals as a result of farming in nearby areas which often gets washed into the water sources by the rain afterwards.

The Udon Thani provincial waterworks authority recognises that there is a need to find alternative water sources not only for satisfying rising demands but also to ensure that the water supply service will be less severely affected by flood and drought. The Udon Thani provincial waterworks authority is allocated 33 million cubic metres of water from the Huay Luang basin, based on a MoU between the Department of Irrigation, the Provincial Waterworks Authority, and the Udon Thani city municipality. This information is inconsistent with the projection made in the Provincial Waterworks Authority's plan stating that the demand for raw water in 2014 is 47.9 million m^3. This suggests that it is possible that there water supply is insufficient in some areas. Similarly, the assessment of the Department of Irrigation is less than actual use. In 1999, the Department predicted that in 2017 the demand for raw water will be 24.022 million cubic metres per year while the amount of water Department allocated to Udon Thani provincial waterworks authority in 2016 was 33 million m^3.

The issue of available raw water resource is further complicated by the lack of data on raw water consumption through alternative water supply service provider such as local or village water supply systems. This also includes the areas within Nadee tambon administration organisation and Banjan tambon administration organisation which are within the research perimeters. The water supply sector also faces the issue of the unsustainability of water resource and water treatment capacity which exacerbates in the event of flood. Moreover, the Udon Thani provincial waterworks authority plans to extend its service coverage to more residents in order to offer increased access to more secure and higher quality water supply, a goal which makes the need for an alternative source of water even more immediate.

Water supply in Udon Thani is a complex service that involves multiple actors with roles in the three stages of the water supply process:

1) Finding water sources and allocating and maintaining raw water resources (The Department of Irrigation, Joint Management Committee irrigation and protection of Huai Luang, Provincial Waterworks Authority, and the Department of Water Resources)

2) Water treatment and water supply systems (Provincial Waterworks Authority) and

3) Clean water distribution (Provincial Waterworks Authority, municipalities or other local administration organisations which are required to provide water supply services in the area)

The Udon Thani Office of Natural Resources and the Environment is the central government entity that oversees the environmental aspects of water supply operations. Other actors include the Provincial Electric Authority who provides electricity needed for water supply services, and the Department of Highways who enables the laying of water supply distribution systems in accordance with new roads, and the local administration organisations who owns the land used for pipe laying as well as approving operations and providing policy guidance through their development plans. Moreover, there are additional agencies who are involved in water supply and services during times of emergency, including the Udon Thani Provincial Agricultural Office, Udon Thani District Office of Groundwater Resources which

coordinates with the local administration in times of drought, and the Regional Office of Water resources who are involved with the restoration of water sources in areas afflicted by disaster.

There are multiple issues regarding the institutional arrangement of the water supply service. Vertically, the Regional Waterworks Authority is largely bound by central government authorities. However, the Regional Waterworks Authority's desire to find an alternative raw water source is not shared by the central authorities such as Subcommittee on Water Management who are more focused on addressing issues as they arise. Regarding the horizontal institutional arrangement, the Udon Thani Provincial Waterworks Authority lacks the support from and coordination with other entities in finding an alternative raw water source to accommodate rising future needs as well as for planning and operational purposes. There is also a lack of coordination between the Waterworks Authority and other relevant urban services such as power supply and urban planning. Within the financial framework, there is a lack of budgetary support from local authorities despite the fact that they are legally mandated to ensure the provision of water supply in the 1953 Municipality Act. This is because the water supply expenditure has been grouped with other services under the public utilities budget.

Wastewater management service in Udon Thani is designed to have the capacity to process up to 45,000 m^3 of wastewater, which is equivalent to the use of roughly 225,000 users. However, the volume of water being processed is around 16,000 cubic metres, equivalent to the use of 6,000 persons which is 26% of the total capacity. This limited coverage is because of the lack of a cohesive drainage system that reaches all potential service area; the wastewater management authority currently covers only an area of 8.3 km^2. The problems of wastewater management in Udon Thani demonstrate the importance of the two components of the enabling environment: knowledge information and political will. The service fees for wastewater management charged to the residents are roughly calculated due to the lack of information, resulting in these fees being viewed as unjust by some (Udon Thani Wastewater Authority, interview). Moreover, these fees fail to encourage ecologically responsible water usage. There is also a lack of political will for the development of wastewater services as suggested by its budget allocation and absence from local development plans. Moreover, the wastewater management facilities such as the water treatment plants are located in a flood-prone area outside of the urban area as designated by the City Comprehensive Plan. This is because the wastewater system was planned after the city itself has started to develop, so there was limited availability of land large enough to accommodate the system. At present, only 8.3 km^2 of the urban area in Udon Thani is connected to the wastewater system due to the limited coverage of the pipelines.

The most prominent issue in the institutional arrangement of the wastewater management service in Udon Thani is the lack of unity between the local service provider and the Regional Office of the Environment who is responsible for monitoring the water quality in the area. The wastewater management sector is more significantly affected by limitations in the legal aspect. There are inconsistencies between the 1992 act for the promotion and protection of environmental quality and the laws that were passed afterwards such as the acts on decentralisation to the local administration, which leads to unclear division of responsibilities and complications in the procurement of the budget for wastewater management. There is also a lack of legal framework granting local authorities the power to inspect wastewater management in housing estates and penalties for the failure to collect wastewater management service fees.

The output of the discussion during the deliberative visioning workshop held by the researchers demonstrates that the relevant actors have some awareness of climate related issues but find it difficult to translate these ideas into practice due to limitations in political will, authority, institutional arrangement, and budgets. Participants of the workshop

included personnel from Udon Thani Provincial Waterworks Authority, Udon Thani Province Administration Organisation, Udon Thani City Municipality (including personnel from the civil works department who is involved in urban planning and drainage), and the wastewater management agency.

Participants agree that measures such as reducing water loss through leakage and excessive usage is no longer sufficient and must be complemented by more significant measures such as to increase water procurement and production capacity. Likewise, for the case of land use planning, it is no longer sufficient to simply avoid flood prone areas but also to implement adaptive measures to ensure that built structures can withstand flood and that they will not exacerbate climate risks. Incidentally, these are also the measures recommended by UNDP-UNEP Poverty-Environment Initiative (2011) for mainstreaming climate change adaptation into development. However, the workshop also highlights limited risk assessment as well as the lack of adequate coordination between organisations. It is recognised that the impacts of climate change will exacerbate the challenges of ongoing urban development.

Participants from all sectors revealed that they have never considered the proposed scenarios (i.e. business as usual, population increase according to the strategic plan of the Provincial Waterworks Authority, and the scenario where all of the province's envisioned development projects of the strategic plan are materialized) together. In fact, preparations have been made only for the scenario based on the projections regarding water supply, but only by the Waterworks Authority without the involvement of the land use planning and wastewater management authorities. According to the participant from the Waterworks Authority, "Water supply is forecasted for the amount of water that will be used in the future. But is a forecast based only the capacity of the system and not on how population may increase. As of now, the Waterworks Authority realizes that the water supply might not be enough in the future due to the construction of condominium and the increasing amount of water users in the service area. Plus, there are also some communities that still use water sources from the village water supply or groundwater." These communities may want to be covered by Waterworks Authority in the future. A participant working on the provincial strategic plan also reveals that it is difficult to determine the direction of urban development because there is a lack of information regarding the future, especially from the climate change aspect, so the province is only able to define the urban development plan in vague terms such as making the city more livable.

Participants from all agencies were especially interested in the scenario where all existing plans are successfully implemented. This scenario highlights that the water supply and wastewater capacities are not sufficient for the accommodation of the projected urban growth. In this scenario, the water supply sector is especially affected and will need to look for alternative sources of raw water as the Huay Luang source will not be enough, even without the impact of climate change on water availability. A participant from the waterworks authority mentioned that "the agency wishes to find a new source of raw water and has submitted a proposal to the Joint Management Committee for Irrigation (JMC), which is a central organization that sets policies for each river basin. However, the JMC was not in favour of the proposal and emphasized that the water delivery system and pipes should first be improved in order to reduce water loss. So, it was not able for the waterworks authority to plan for water production in the future." Regarding land use planning, there are limitations in the direction of urban expansion. In the northern part of the city, the Nong Samrong municipality is experiencing significant growth, which includes expanding into an area with frequent flooding. This development is a result how the city has grown along the road that leads Nhong Khai province, where the regional development strategy is consolidating a border special economic zone. According to a participant from the civil works department, "the city plan must have an appropriate land use plan. If the city expands, such as in these scenarios, it is not only

the municipalities around that will be directly affected but also the water drainage capacity of Udon Thani Municipality will be affected because it is no longer possible to drain water in the lowland area in the north, because that will cause severe flooding in the area where the city is going to expand into."

In the case of drought, the participants expressed that the limitations that their agencies will face will not be significantly different to the challenges that they have in planning for floods because much of the water allocation policy comes from the central government. However, they expect that there will be an increase in conflict between the urban and rural areas regarding the water allocation policy. This is also supported by insights from a previous interview with an official of the provincial waterworks authority official which revealed that according to the data of data water consumption from Huai Luang Reservoir during the year 2003-2007, the Udon Thani Special Branch Water Supply Station is permitted to use 21 million m^3/year. Currently (2015), the Station is allowed to use 33 million cubic meters per year under a joint agreement (MoU) between the Royal Irrigation Department, Udon Thani branch Water Supply Authority, and Udon Thani Municipality. At present, the major limitations of PWA Udon Thani Branch are raw water sources that are not sufficient, thus making it necessary to procure new sources of raw water, especially considering the likelihood of drought and flooding. According to the Master Plan for Water Resources Development in the Mekong Region, Volume 16/20, PWA Udon Thani has a policy to build a pumping station that uses the Mekong River as a raw water source.

Regarding the collaboration and cooperation between the different agencies in the past, present, and future, the participants expressed that the agencies are familiar with each other so there are no major obstacles in working together. However, this has mostly been working on ad-hoc projects, and they have not had much experience in working together in long-term planning. They expect that they will be able to work together in a more systematic manner. The participant from the provincial strategic planning department said that in the past, the province has organized joint meetings for various agencies whose work is relevant to the province's territory, in order to find ways to improve basic infrastructure and urban development. Then, each locality can use the outcomes of these meetings to give direction to their development plans. However, these joint meetings are no longer organized, which may have led to a gap in collaboration or possible cooperation over some issues across different districts. Similarly, the wastewater management authority representative expressed that while the agency has created a plan for the future, it is up to each local government to develop their drainage systems in order to deliver the wastewater to the constructed provincial wastewater management system, thus highlighting the need for increased collaboration and cohesion between agencies.

5. Conclusion

Focusing on the policy and planning and the enabling environment dimensions climate mainstreaming, this study examined and demonstrated limitations to the mainstreaming of climate resilience in three important urban services (land use, water supply, and wastewater management) and urban development planning in Udon Thani province. Existing policy and plans in the national, provincial and local levels lack coherence and there is no integration of climate change adaptation and development. Consequently, the three aforementioned urban services are not adapted to immediate climate risks. Moreover, there are limitations in the institutional arrangement aspect in the vertical and horizontal dimensions: for land use, the local authorities are legally mandated to create a comprehensive plan but lack the ability to do so, thus the responsibility falls upon the central authority who does not have a thorough understanding of the area. There are also insufficient channels for coordination with the local jurisdictions and utilities service providers. Similarly, the water supply service lacks vertical coordination between entities of different levels of government as well as horizontal coordination between

relevant agencies operating under different ministries, leading to incoherent planning and strategies that are further complicated by the process of raw water allocation. Finally, the wastewater management sector is limited by the outdated legal framework which complicates the process of budget allocation. The wastewater management remains underdeveloped in terms of coverage, which highlights the failure of spatial planning of these services.

There are also significant discrepancies between development plans and the allocation of power and resources (i.e. the legal and financial frameworks) to execute certain policies which are further confounded by ineffective institutional arrangements. These policy limitations are a result of the partially decentralised government structure and how decision-makers did not perceive climate resilience as being inherently linked to development policies and the insufficiency of information services. The case of Udon Thani is not unique: it is reflective of the situation in many emerging provinces in Thailand, and, as outlined in Revi *et al*. (2014), there is an immediate need for many territories to mainstream climate change adaptation within the context of multilevel governance. This study sheds light onto how climate change adaptation can be addressed within the context of an urbanizing territory, and highlights the need for further research regarding the mainstreaming of climate resilience in urban development policies in Thailand, in order to ensure a more sustainable future.

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