



Dynamic Governance in Agricultural Sector Development During Climate Change Era for Food Security in North Aceh

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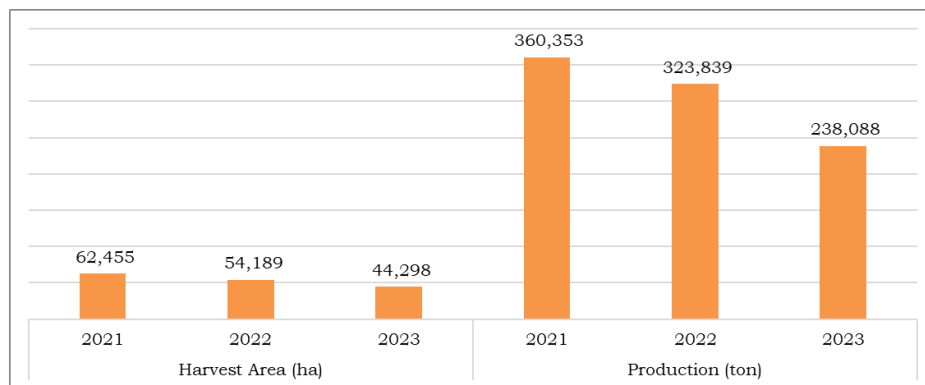
ABSTRACT

Climate change poses serious challenges to the agricultural sector in North Aceh through drought, flooding, and irrigation damage that reduce productivity and threaten food security. This study aims to analyze agricultural stakeholder governance using a dynamic governance (DG) approach to assess the implementation of the principles of thinking ahead, thinking again, and thinking across in responding to climate impacts. The method used is qualitative through in-depth interviews with six key informants: Bappeda, BMKG, the Agriculture and Food Service, practitioners/academics, farmers, and farmer groups. Findings show that farmers tend to rely on pragmatic adaptation strategies such as the use of water pumps, crop diversification, and simple mechanization. Meanwhile, the government focuses on macro policies, including Climate-Smart Agriculture, land expansion, and agricultural input assistance. BMKG plays a role by providing climate information and Climate Field Schools. From a DG perspective, thinking ahead is reflected in development planning, thinking again through the evaluation of farmer adaptation, but thinking across is still weak due to minimal cross-sector coordination, for example, the rehabilitation of the Krueng Pasee irrigation system, which has not been addressed. Recommendations include improving irrigation, increasing farmers' adaptation capacity, strengthening the climate information system, and establishing regular cross-sector forums to achieve adaptive and sustainable governance.

INTRODUCTION

Climate change causes various problems in the agricultural sector, ranging from land degradation, water scarcity, disasters, pollution, environmental damage, high rainfall to the loss of biodiversity, which has a negative impact on food production levels ((Abdullah Kasim et al., 2023; Gwambene et al., 2023). However, the agricultural sector plays a key role in achieving sustainable development, making the strengthening of the agricultural sector a top priority (Abobatta & Hussai, 2024). In Indonesia, climate change has caused various serious problems in the agricultural sector, such as crop failure, a decline in crop quality and quantity, and an increase in production costs (50 percent) (Kusumasari, 2016). These various problems have a domino effect that undermines efforts to achieve food security, reduces farmers' welfare, and increases poverty (Suranny et al., 2022). Therefore, climate change must be taken into account in achieving food security (Harini et al., 2023). Based on statistical reports, in recent years Indonesia has experienced a decline in the area of rice fields as a major food commodity, from 10.41 million hectares in 2021 to 10.04 million hectares in 2024, which has also reduced the amount of rice production, from 54.4 million tons in 2021 to 53.1 million tons in 2024 (BPS Indonesia, 2025). This is happening at a time when Indonesia's population is growing.

Aceh Province, ranked eighth with the highest agricultural production in 2024 (1.65 million tons), clearly faces similar challenges. As of 2021, the area of rice fields in Aceh reached 297 thousand hectares, a decrease of 14.47% in 2023. Production has also declined, from 1.63 million tons (2021) to only 1.39 million tons (2023). In fact, as the largest rice-producing district in Aceh in recent years, North Aceh has also experienced a significant decline in terms of land area, productivity, and harvest production, as shown in Figure 1:



Source: (BPS Aceh, 2024)

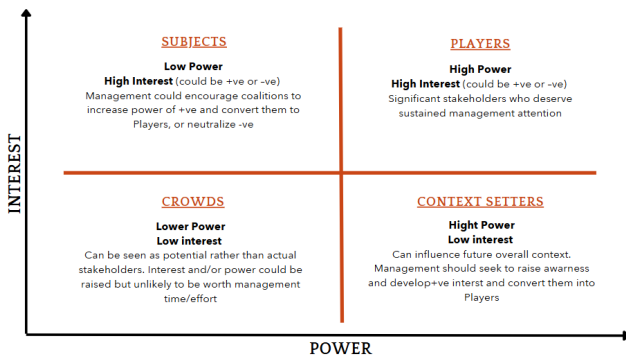
Figure 1. Harvest Area and Production in North Aceh 2021-2023

According to BPS data, rice harvest productivity (kg/ha) in North Aceh has declined dramatically from 59.76 (2022) to 53.75 (2023). This was influenced by a decrease in land area and production, as shown in Figure 1. As clear evidence of the impact of climate change on the agricultural sector, flooding has increasingly inundated 4,900 hectares of rice fields in North Aceh (Zulkarnaini, 2024). This has caused damage to the Krueng Pase Dam, a central irrigation system, resulting in thousands of farmers in North Aceh with 8,900 hectares of land being unable to cultivate their fields optimally since 2020-2024. This has caused an estimated loss of 311.5 billion rupiah and poses a threat of a food crisis (Zulkarnaini, 2023). This poses a serious threat to food security in North Aceh, putting the government's role under increasing scrutiny (Jafaruddin, 2024).

Responding to the urgent need to achieve food security, starting at the local level, the Indonesian government issued Law No. 3 of 2024 on Villages, which then gave rise to Permendes No. 2 of 2024 on Operational Guidelines for the Focus of Village Fund Use in 2025, so that villages have eight main focuses for fund use. Of these eight priorities, two are related to food security programs and adaptation to climate change. These two priorities are closely linked in efforts to achieve sustainable agriculture. However, there are challenges in achieving food security in North Aceh, ranging from the suboptimal functioning of the North Aceh Agriculture and Food Security Agency in the areas of regulation, empowerment, and the provision of goods and services to support food security (Zulfikar & Sari, 2024). These challenges include limited access to agricultural costs and technology, limited human resources and infrastructure, and low awareness and participation due to limited institutional capacity and weak governance systems between agencies and stakeholders (Nurmasyahyati et al., 2024). Addressing the complexity of agricultural issues in North Aceh requires an adaptive and dynamic governance approach from relevant stakeholders. Where dynamic governance has not yet been the focus of various studies on climate change and agriculture.

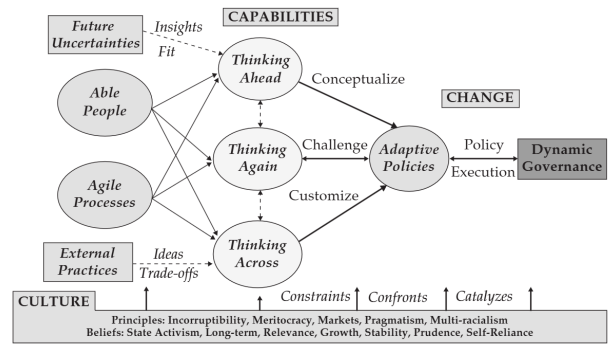
Various studies have instead highlighted the impact of climate change on agricultural productivity (Ahmed et al., 2023; Mallappa et al., 2021; Shehzad et al., 2023), seeking to implement CSA (climate smart agriculture) as an adaptation and mitigation effort for the agricultural sector in response to climate change (Gardezi et al., 2022; Nurmasyahyati et al., 2024; Pasaribu et al., 2024; Zhao et al., 2023), examining measures to address climate change in a global context and involving interactions between countries (Ajibade et al., 2019; Qazi & Al-Mhdawi, 2024). Furthermore, various studies related to governance in the agricultural sector have so far been more focused on efforts to achieve food security through governance at the global level (Upadhyaya et al., 2022), focusing on irrigation sector governance (Salmoral et al., 2020; Upton & Nielsen-Pincus, 2021), institutional governance among traditional farmers at the regional level (Abeldaño Zuñiga et al., 2021), and family-based (Gervazio et al., 2025). Although emphasizing the importance of governance and institutions to address food security issues (Al-Muqdadadi et al., 2024; Delina et al., 2025), these studies have not fully explained what form of governance is most needed for the agricultural sector in the era of climate change.

Therefore, this study aims to examine the reality of the governance process among stakeholders in the agricultural sector in North Aceh using a dynamic governance (DG) approach in an effort to achieve food security in the era of climate change. The concept of DG is an approach to developing the adaptive capacity of villages in North Aceh in achieving food security in the era of climate change. According to Neo and Chen (2007), DG is a concept that combines elements of new ideas, rapid response, flexible adaptation, and sustainable innovation in policy processes and management to face the challenges of rapid change. Research on adaptive governance has not yet focused much on strengthening collaboration and stakeholder mapping to be more effective (Raciti et al., 2025; Schoon et al., 2017). However, there is a need for an integrated policy framework that considers integration between sectors (Hurlbert & Gupta, 2016). To support these objectives, this study uses stakeholder mapping (Figure 2) to analyze the roles and interactions of actors and assess their capacity through the DG framework (Figure 3).



Source: Created by the author from (Ackermann & Eden, 2011)

Figure 2. Stakeholder Power-Interest Grid



Source: (Neo & Chen, 2007, p. 13)

Figure 3. Framework for Dynamic Governance System

As described in Figure 3. DG is an outcome that can be achieved if existing policies are adaptive (proactive) by implementing various innovations, contextual adjustments, and implementation based on national/local cultural values. There are three dynamic capabilities integrated into this concept, namely. 1) Thinking ahead: the ability to analyze future conditions by considering external environmental conditions and threats; 2) Thinking again: the ability to evaluate existing policies to redesign them in order to achieve better results; 3) Thinking across: the ability to think of new ideas through collaboration and integration of knowledge that can be adopted to achieve goals optimally by learning from experience.

Thus, this study has several unique aspects in the development of DG studies. First, it expands the application of the concept of dynamic governance, which has been commonly used in policy and administration studies, to the context of agriculture and food security in the era of climate change. Second, it elaborates on the concept of DG with mapping stakeholders, thereby clarifying the relationships, interests, and capacities between actors. Third, it contextualizes DG at the village level, particularly in areas with special autonomy characteristics in North Aceh. Thus, this research offers a new empirical perspective on how DG operates in local governance as an implication of DG studies.

METHODS

The research method is qualitative with a case study approach. The case study approach emphasizes the unique context of the case and the existence of empirical facts balanced by theoretical aspects as the most important elements (Gammelgaard, 2017). The case study in question is an effort to achieve food security in the era of climate change in North Aceh. Data collection techniques will include observation, interviews (data collection techniques in the form of purposive and snowball sampling), and documentation (Creswell & Creswell, 2023, p. 229). The research location will be in North Aceh Regency, as it is the regency with the largest production and agricultural land area, and has experienced various complex problems in the agricultural sector due to climate change (Jafaruddin, 2024; Zulkarnaini, 2023, 2024).

The research will be conducted from June to August 2025. The informants sought are those identified in the stakeholder mapping, including the North Aceh District Agriculture Office, the Development Planning Agency (Bappeda), the Malikussaleh Meteorology, Climatology, and Geophysics Agency, farmer groups, farmers, and practitioners/academics. Direct observation of the research location will also be conducted in North Aceh Regency. Specifically, in Syamtalira Aron District and Muara Batu District, which are areas with the

largest agricultural land and most affected by climate change issues in the agricultural sector in the form of flooding and drought. This will be followed by literature collection as secondary data. To ensure the validity and reliability of the data, this study uses data triangulation from three different data collection sources (observation, interviews with various informants, and documentation) (Schlunegger et al., 2024). The analysis of the research data also used the Nvivo12 software tool with analysis stages consisting of data import, preparing case nodes, coding the findings, and querying and visualization (Suripto, 2022). The research data analysis technique included several stages in accordance with the data analysis stages (Creswell John & David, 2023, p. 239), with the realization: organizing and preparing data; reading all data; coding data that leads to DG dimensions; identifying themes and elaborating them with the main DG dimensions as a lens for analyzing coding results; developing interpretations by referring to how DG dimensions are operationalized in agricultural governance practices; further analyzing data (elaboration of stakeholder mapping and DG); and presenting and interpreting the data in the form of qualitative narratives.

RESULT AND DISCUSSIONS

The Reality of Agricultural Conditions in North Aceh

The agricultural potential of North Aceh is actually quite large, with a total area of 38,417 hectares of rice fields, divided into irrigated and non-irrigated fields, as reported by the Regional Development Planning Agency (Bappeda). However, since 2020, agricultural production, especially rice, has declined significantly due to damage to the Krueng Pasee irrigation system. This damage has directly affected 8,920 hectares of rice fields in six sub-districts, namely Syamtalira Bayu, Samudera, Meurah Mulia, Syamtalira Aron, Tanah Pasir, and Nibong. As a result, many of these fields have become rain-fed, making them vulnerable to drought and difficult to maintain productivity.

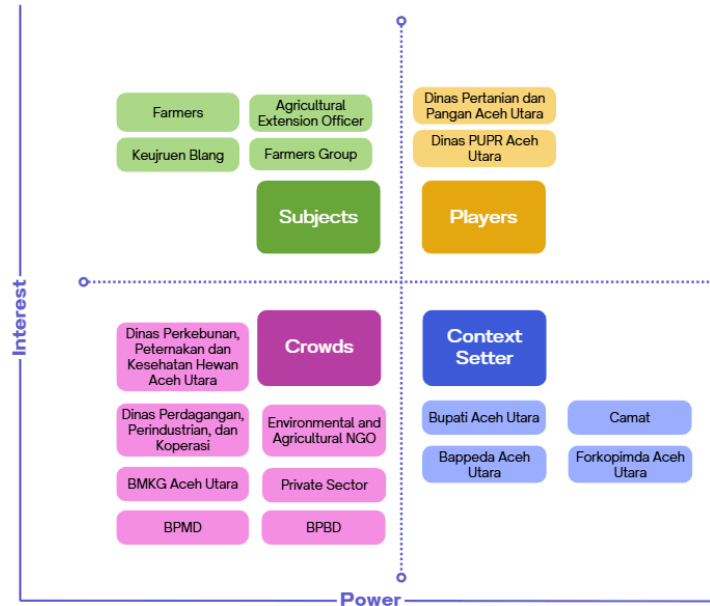
In addition to drought, flooding is also a recurring problem in North Aceh. Sixteen sub-districts have been classified as flood-prone, especially in the areas of Lhoksukon, Meurah Mulia, Paya Bakong, Matang Kuli, Tanah Luas, Pirak Timur, and Geudong. The district is crossed by four major rivers, namely Krung Keureuto, Krueng Pase, Krueng Sawang, and DAS Krueng Geukuh. With the Keureuto Reservoir becoming operational in 2025, flooding is claimed to be reduced by up to 30 percent, but this has shifted the main problem in agriculture from the threat of flooding to drought. The El Nino and La Niña phenomena have worsened the situation for farmers in North Aceh with shifting rainfall patterns, rising temperatures, and extreme weather. Government assistance in the form of water pumps remains limited and has not fully repaired irrigation damage. Although food security is a priority, the “Bangkit, Beudeh, Beusare” vision has not fully addressed the needs of farmers.. Macroeconomically, North Aceh still holds the status of Aceh's main food basket, with more than 307,320 of its 614,640 residents being farmer (Zulkarnaini, 2023). According to the Regional Development Planning Agency (Bappeda), North Aceh Regency contributes 20-30% of the province's grain production, with a rice surplus of 300-400 thousand tons per year. Productive rice fields that are planted twice a year produce around 70 thousand hectares of rice harvest. However, this surplus is at risk of declining if climate issues and infrastructure damage are not immediately addressed. Inadequate infrastructure can hamper economic development activities and, of course, cause inefficiency (Dangui & Jia, 2022).

Bappeda emphasized that the government has launched adaptation programs, such as providing water pumps during droughts, distributing seeds during floods, and implementing agricultural insurance schemes. CSA concept is also promoted to sustain productivity while reducing emissions. Meanwhile, the regent’s priority programs, including free plowing and

agricultural downstreaming, are projected to strengthen food security. BMKG contributes through information and education, with the Climate Field School (SLI) and climate calendar guiding farmers in adjusting planting times. From a technical perspective, the Secretary of the Agriculture Office encourages crop diversification, advising farmers with damaged irrigation systems to switch to commodities other than rice. The office also provides pumps, pesticides, replacement seeds, and promotes the Additional Planting Area program to meet national food self-sufficiency targets. A free rice field plowing program (2025–2026) is further expected to improve resilience. These initiatives show that agricultural vulnerability in North Aceh arises from ecological (climate, flooding, drought), structural (irrigation damage), and institutional (policy) factors. Farmers’ pragmatic micro-adaptations, such as pumps and diversification, address immediate needs but not structural issues. In contrast, government programs remain partial, highlighting a gap between farmers’ adaptive capacity and broader food security policies, underscoring the importance of governance (Cui, 2020). Therefore, local capacity must be contextual and vary between regions, so that institutional capacity, knowledge, innovation, and governance structures need to be improved for effective climate adaptation (Cid & Lerner, 2023).

Mapping of Agricultural Sector Governance Stakeholders

Stakeholder mapping is an important step in understanding agricultural governance in North Aceh, especially in the context of facing increasingly complex climate change. Figure 4 and Table 1 show the various actors involved, ranging from government and private entities to local farmer groups.



Source: Processed by author (2025)

Figure 4. Mapping of Agricultural Governance Actors in the Era of Climate Change in North Aceh

Table 1. Stakeholder Mapping of Agricultural Programs in the Era of Climate Change in North Aceh

Actor	Role	Position	Reason
Government			
Bupati Aceh Utara	Establishing vision & priorities agriculture in the District Medium-Term Development Plan.	Context setter	Determining direction and amp; vision for development, but execution is carried out by technical agencies.
Bappeda Aceh Utara	Development planning, integration of food issues in the RPJM.	Context setter	Determining the direction of development planning, not technical executors.
Camat	Policy coordination at the sub-district level, liaison between the district government and villages.	Context Setter	Forming the implementation framework at the sub- district level, the District Government is not the implementing agency directly.
Dinas Pertanian dan Pangan Aceh Utara	Formulator and implementer of regional agricultural policy.	Player	Actor in in the formulation and implementation of agricultural policy.
Agricultural Extension Officer	Providing technical and adaptive planting	Subject	Directly involved in policy implementation at the farmer level (field implementers)
BMKG Aceh Utara	Climate data and weather forecasts for planting patterns	Crowd	Data and information providers, but not agricultural policy implementers
Forum Koordinasi Pimpinan Daerah Aceh Utara	Cross-sector coordination (security, order, synergy).	Context Setter	Establishes regulatory frameworks and stability, but does not execute technical aspects.
Dinas Pekerjaan Umum dan Penataan Ruang (PUPR) Aceh Utara	Irrigation infrastructure, farm roads, supporting facilities	Player	Executor of agricultural infrastructure development policies (irrigation)
Dinas Perkebunan, Peternakan, dan Kesehatan Hewan Aceh Utara	Manage plantation/livestock sub-sectors, food diversification.	Crowd	Implementing technical policies for non-rice subsectors
Dinas Perdagangan, Perindustrian, dan Koperasi Aceh Utara	Distribution of agricultural products, MSMEs, cooperatives.	Crowd	Playing a role in the post-production value chain, influencing the agricultural produce market.
BPMD (Badan Pemberdayaan Masyarakat dan Pemerintahan Desa)	Community & village empowerment, integration of agricultural programs.	Growd	Providing support from the village institutional side, not as a major actor in agricultural policy
BPBD (Badan Penanggulangan Bencana Daerah)	Flood, drought, and disasters management.	Crowd	Working during disasters, providing support to the agricultural sector.
Non-Government			
Keujruen Blang	Traditional irrigation management, water distribution, local wisdom.	Subject	Has real authority in local agricultural governance.
Private sector	Production facilities provision, digital market access	Crowd	Supports agriculture, not main decision maker.
Environmental and Agricultural NGO	Advocacy, education, climate adaptation assistance.	Crowd	Acts as support, not formal authority
Farmers Group	Farmer organizations, access to assistance, distribution of facilities, capital.	Subject	Collectively strengthens bargaining and program access.
Farmers	Key actors in agricultural production activities.	Subject	Directly affected by policy and climate impacts, but has no formal authority.

Source: Analyzed by author (2025)

This mapping shows varying actor roles, from policy makers to field implementers. At the local level, the regent, Bappeda, sub-district head, and Forkopimda act as context setters, shaping vision, regulations, and coordination frameworks without directly executing policies. Technical actors such as the Agriculture and Food Service and the Public Works and Housing Service serve as executors through program design, irrigation development, and facility provision. At the field level, extension workers, farmer groups, keujruen blang, and farmers are subjects who both implement and hold local knowledge. Supporting roles are played by BMKG, Trade Office, NGOs, and private actors, providing data, advocacy, and market access. With this configuration, agricultural governance in North Aceh cannot be understood solely in terms of the hierarchical relationship between the government and farmers, but rather as a multi-actor ecosystem.

The context of development vision, technical policy execution, local knowledge, and institutional and market support are interconnected, forming a network that determines the region's adaptive capacity in facing the challenges of climate change and food crises. Based on a review of the reality of governance and elaboration of stakeholder mapping, it can be said that agricultural sector governance in the era of climate change in North Aceh shows a top-down governance pattern, with farmer involvement still limited to being recipients of policy. This reflects the limitations of a participatory pattern that is still symbolic in nature, so that policy effectiveness is highly dependent on bureaucratic capacity. This is in line with research (Athaya et al., 2024), which found that low participation and effectiveness in development planning will greatly determine the success of village development governance. Therefore, collaboration between the government, the private sector, and the community is very important in development planning, even at the village level (Athaya et al., 2024). Therefore, this mapping is important not only to identify who is involved but also to assess the extent to which the principles of dynamic governance: thinking ahead, thinking again, and thinking across can be realized in the agricultural governance of North Aceh.

Dynamic Governance Practices in the Agricultural Sector Facing Climate Change

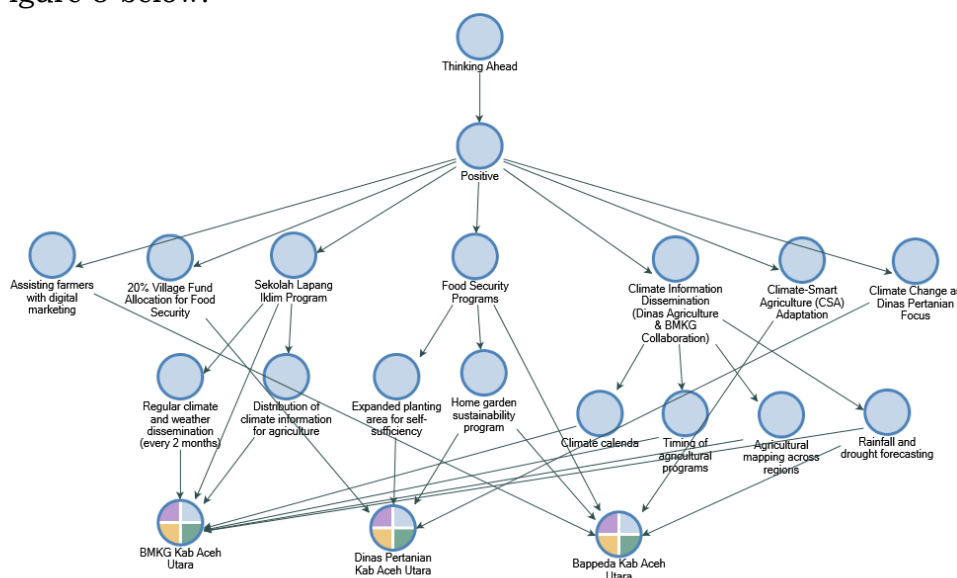
Agricultural governance practices in response to climate change in North Aceh reveal multi-actor dynamics. However, farmers describe agricultural governance at the local level as ineffective. The assistance provided is often in the form of emergency food supplies, while structural solutions such as improvements to the Krueng Pasee irrigation system have not been addressed because they are considered to be the responsibility of the provincial and central governments. This shows that there is a coordination gap between levels of government that is felt directly by farmers. This gap can cause policies to not be fully implemented or even to conflict with each other, which has a direct impact on farmers (Schütze, 2025). Bappeda explained that agricultural governance and climate disaster management are based on disaster scale mechanisms. If the scale is still at the district level, the regent is responsible, but if it is wider, it is handled by the province or the national government. Agricultural data is collected from the Agriculture Office and BMKG, then reported to Bappeda as a basis for planning. This system reinforces the layered bureaucracy that sometimes hinders a quick response.

BMKG notes that climate information is shared through the Agriculture Office and local government, yet its effectiveness depends on local dissemination. To address this, the Agriculture and Food Service stresses cross-sector coordination, requiring closer collaboration with the Public Works and Housing Service and Bappeda, while extension workers act as direct liaisons with farmers. Agricultural governance already involves multiple actors, but technical implementation challenges, particularly irrigation, persist. Coordination across levels and timely responses remain weak, as success depends on synergy rather than

dominance. This context highlights the relevance of dynamic governance principles thinking ahead, again, and across (Lukat et al., 2023).

Anticipatory capacity (Thinking Ahead) in Agricultural Governance in North Aceh

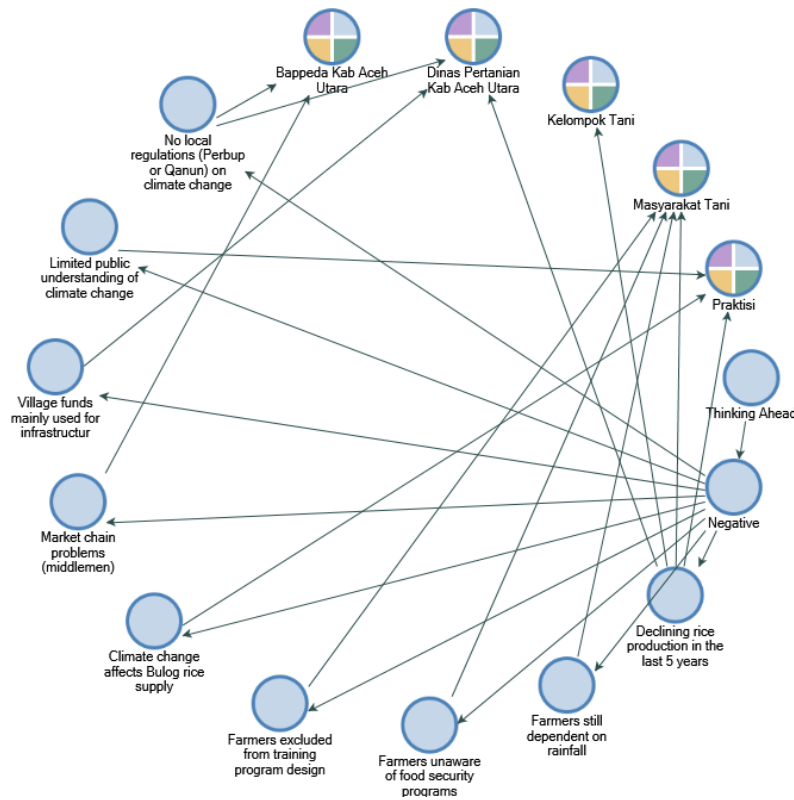
Thinking ahead refers to the ability to analyze future conditions by considering external environmental conditions and threats (Neo & Chen, 2007). Reflection on the previous actor mapping shows that agricultural governance in North Aceh operates within a multi-level and multi-actor framework. Each actor plays a different role, ranging from policy makers, technical implementers, liaisons, to ecosystem supporters, but they are all interrelated in determining the adaptive capacity of the agricultural sector. In the context of dynamic governance, the ability to think ahead is important, because only with a forward-looking perspective can cross-actor initiatives be integrated and produce policies that are responsive to climate change and farmers' needs. On the positive side, thinking ahead in North Aceh's agricultural governance can be seen in various cross-institutional initiatives. This is illustrated in Figure 5 below:



Source: Data processing by Nvivo (2025)

Figure 5. Thinking Ahead Activities in Agricultural Governance

It is evident that Bappeda emphasizes the macro vision through the RPJM and the regent's vision and mission, which place agriculture as a leading sector, as well as an instrument of food self-sufficiency and downstreaming. This orientation illustrates systematic long-term planning. BMKG plays a technical-informative role through climate and weather projections, including climate calendar programs and Climate Field Schools, so that farmers can adjust their planting patterns to weather forecasts. Meanwhile, the Department of Agriculture takes a more practical approach by encouraging crop diversification, distribution of production inputs, provision of pesticides and seeds, and utilization of 20% of village funds for food security. These efforts are also reinforced by food security and sustainable home gardening programs. All of these initiatives show that thinking ahead is not only interpreted as climate adaptation, but also as a collaborative strategy across actors to strengthen long-term food security. However, there are negative aspects that do not support thinking ahead due to a number of structural challenges, as shown in the visualization in Figure 6:



Source: Data processing by Nvivo (2025)

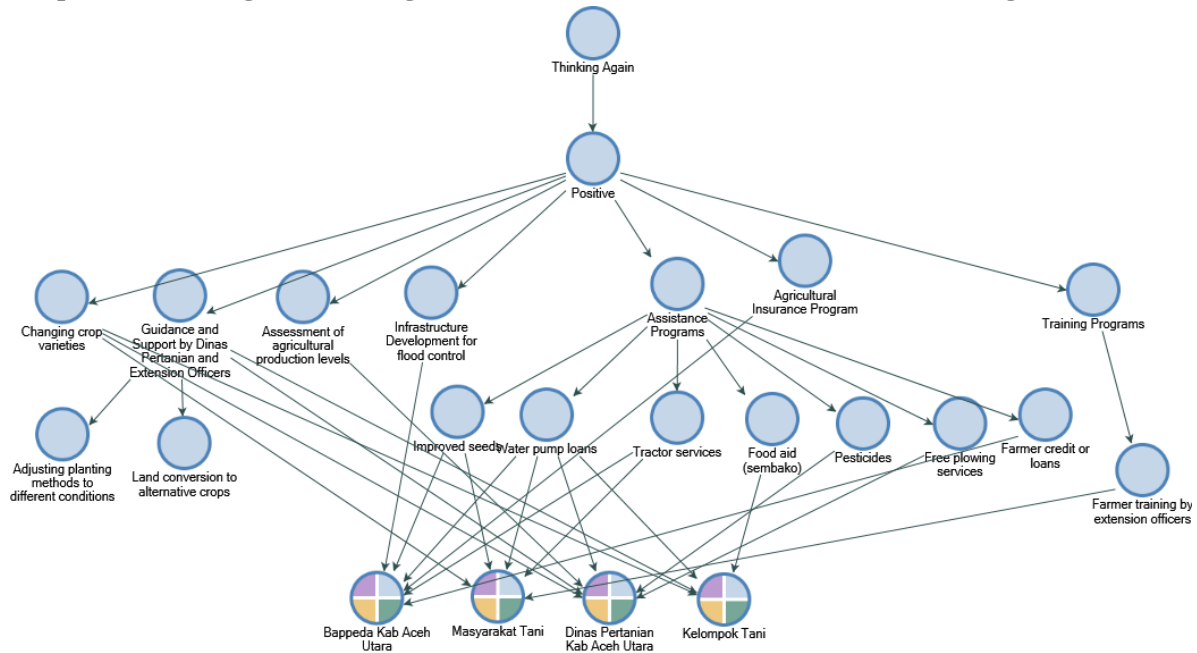
Figure 6. Activities that Hinder Thinking Ahead in Agricultural Governance

It can be said that farmers themselves have a simple but concrete vision: improving the Krueng Pasee irrigation system as the main solution to restoring agricultural production. For them, infrastructure needs are more urgent than macro adaptation strategies. On the other hand, various obstacles have also emerged, such as declining rice production in the last five years, farmers' dependence on rainfall, weak public understanding of climate change, and the absence of local regulations (Perbup/Qanun) that specifically regulate climate issues. In addition, the market chain is still dominated by middlemen, village funds are mostly allocated to non-agricultural infrastructure, and farmers' limited access to training and information on food security programs further deepens the gap. These conditions reveal a disconnect between the micro aspirations of farmers and the macro orientation of local governments. Therefore, policy integration is needed to facilitate cooperation between various actors at different levels (Park et al., 2021), followed by the implementation of a collaborative governance model (Cheema, 2020). This indicates the need for an integrative mechanism so that future anticipatory efforts can be more synchronized between practical needs at the local level and strategic agendas at the policy level (Park et al., 2021), followed by the implementation of a collaborative governance model (Cheema, 2020). This indicates the need for an integrative mechanism so that future anticipatory efforts can be more synchronized between practical needs at the local level and strategic agendas at the policy level.

Thinking Again as a Mechanism for Evaluating and Adjusting Agricultural Policy

In addition to the ability to *think ahead*, agricultural management also requires space for reflection and review. Environmental dynamics, especially climate uncertainty, mean that policies and technical practices do not always go according to plan. Therefore, the process of *thinking again* is crucial for reassessing existing strategies, learning from experience, and adjusting direction to remain relevant to field conditions. *Thinking again* is the ability to

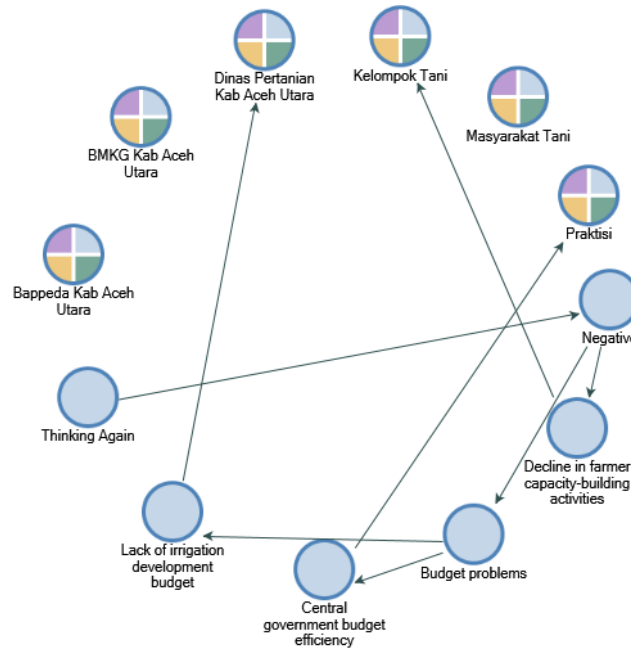
evaluate existing policies in order to redesign them to achieve better results (Neo & Chen, 2007). Based on the research findings, the evaluation process or *thinking again* produced positive patterns in agricultural governance in North Aceh. As shown in Figure 7:



Source: Data processing by Nvivo (2025)

Figure 7. Thinking Again Activities in Agricultural Management

At the farmer level, evaluations arise from daily practical experiences, such as changing crop varieties, switching to corn cultivation, or using water pumps during droughts. These adaptations are pragmatic, based on trial and error, but respond quickly to climate change. Local governments conduct formal evaluations through agricultural insurance policies, seed and pesticide assistance, and flood control infrastructure, despite limited budgets and a tendency to be reactive. Meanwhile, the BMKG measures the effectiveness of Climate Field Schools (SLI), which have been proven to accelerate harvests and improve farmers' anticipation of floods and droughts. These three mechanisms present a positive pattern of thinking again, although their integration is not yet optimal.



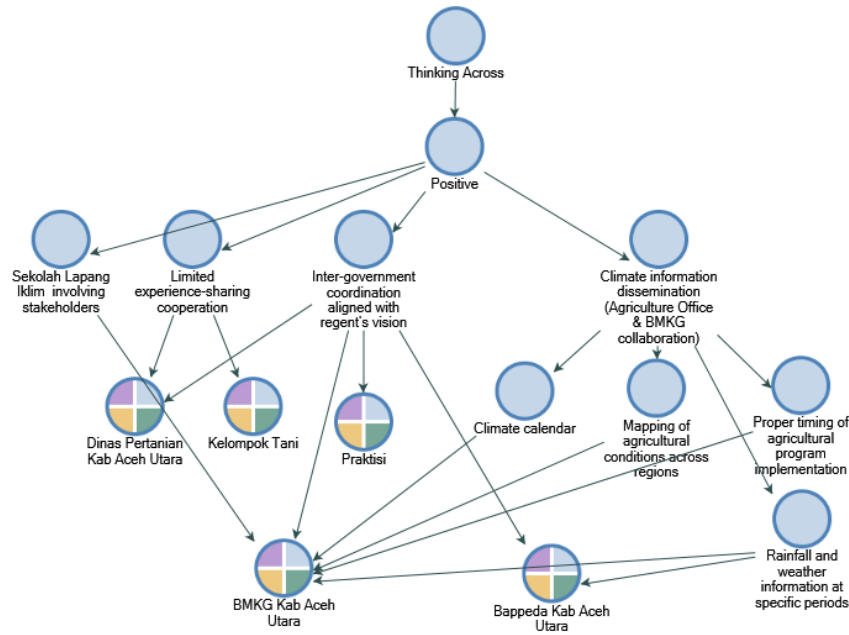
Source: Data processing by Nvivo (2025)

Figure 8. Inhibitory Thinking Again Activities in Agricultural Management

This negative aspect certainly poses a challenge in realizing dynamic governance. This is represented by evaluations that are hampered by structural limitations. One of the main obstacles is the budget issue: limited irrigation funds, the efficiency of the central government budget, and allocation problems at the regional level. As a result, farmer capacity building programs often decline, while field assistance is not always sustainable. In this context, the evaluations conducted by the government are more administrative in nature and are stuck on technical financial issues, thus failing to respond quickly to farmers' needs. This condition also affects farmer groups and communities, who ultimately have to bear the risk of production failure with limited resources. Practitioners and academics also highlight how evaluations lose their transformative power when they focus too much on budget constraints rather than adaptive learning. Thus, Figure 5 illustrates that thinking again does not always bring improvement. It can actually create a cycle of stagnation if evaluations are not accompanied by the courage to build bridges between the practical logic of farmers and the formal logic of the government. As a result, their responses are quick but pragmatic and do not always result in long-term food security improvements. A similar phenomenon is also noted in research (Mughtar et al., 2024) where government programs often lack a long-term perspective.

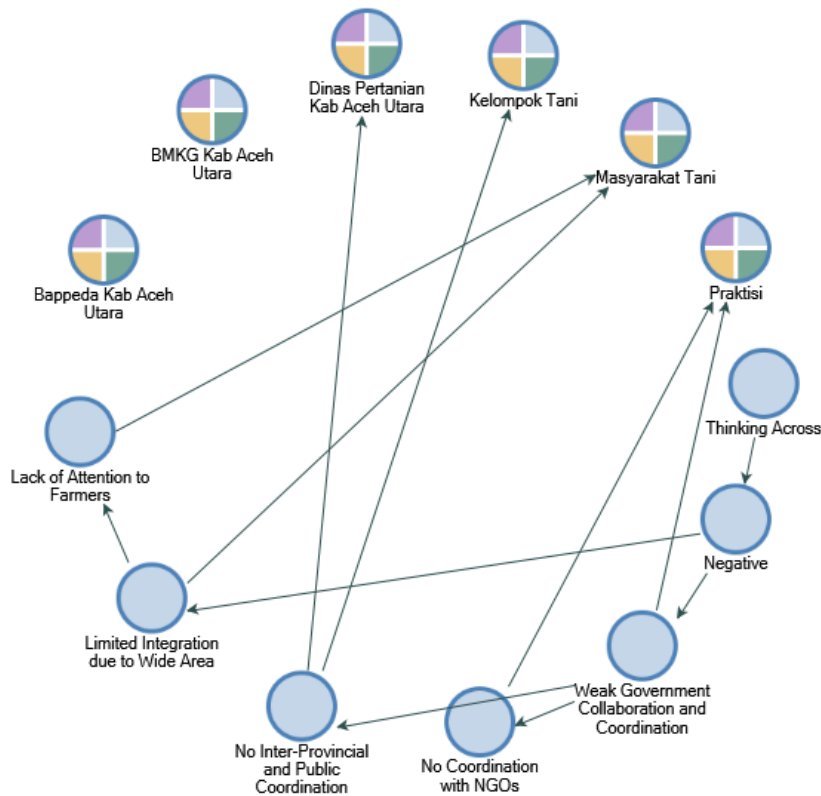
Thinking Across: The Reality of Collaboration Among Stakeholders in the Agricultural Sector

If thinking ahead emphasizes forward vision, and thinking again provides space for reflection on experience, then another dimension that is no less important is the ability to build bridges between actors. In the context of agricultural governance, the challenges of climate change cannot be addressed partially, but require synergy across institutions, local communities, and external supporters. This confirms the importance of thinking across as the foundation for multi-level collaboration and coordination. Thinking across is the ability to think of new ideas that can be adopted and adapted to achieve optimal goals by learning from experience (Neo & Chen, 2007). Based on research data, the implementation of agricultural policies in the era of climate change shows positive dynamics in Figure 9 and negative dynamics in Figure 10:



Source: Data processing by Nvivo (2025)

Figure 9. Thinking Across Activities in Agricultural Governance



Source: Data processing by Nvivo (2025)

Figure 10. Activities that Inhibit Thinking Across in Agricultural Governance

On the positive side, thinking across has led to cross-actor collaboration in agricultural governance in North Aceh. BMKG has become the main hub for climate information dissemination through climate calendars, agricultural maps, and the Climate Field School forum, which involves the Agriculture Office, Bappeda, and farmer groups. The local government emphasizes that collaboration is carried out through marketing digitalization

(IPEDEMIK), the use of village funds for P2L (Pekarangan Pangan Lestari), and the role of extension workers and kejrueu blang. However, Figure 10 shows the negative side in the form of weak cross-sector coordination, limited cooperation with other villages, NGOs, and the private sector, as well as minimal integration between regions, so that collaboration has not yet been institutionalized. This confirms that adaptation networks at the grassroots level are still very limited. Therefore, multi-stakeholder collaboration is needed so that policies can be more adaptive (Kriswibowo et al., 2020).

Limitations of Agricultural Governance in North Aceh from a Dynamic Governance Perspective

Based on the analysis of the findings, it can be said that the agricultural sector in North Aceh in the era of climate change is vulnerable due to a combination of natural and structural factors. Climate change in the form of drought and flooding, coupled with damage to the Krueng Pasee irrigation system, has caused a significant decline in production, especially rice (Zulkarnaini, 2023). Farmers have resorted to pragmatic adaptation measures such as the use of water pumps, crop diversification, and simple mechanization, but these solutions are only short-term. Meanwhile, the local government, through Bappeda and the Agriculture Office, is trying to address the problem with structural policies such as Climate-Smart Agriculture, the Luas Tambah Tanam program, agricultural input assistance, and a free rice field plowing plan. The BMKG also plays a role as a provider of climate information through Sekolah Lapang Iklim and climate calendars, which have proven to help some farmers anticipate the planting season.

However, governance among stakeholders still shows a dominant top-down pattern, in which the Agriculture Office is the main actor, the regent and local government act as context setters, while farmers remain positioned as subjects. In fact, a top-down governance structure can reduce the quality of participation and cause inefficiency in resource distribution (Zhou et al., 2025). From the perspective of dynamic governance, the dimension of thinking ahead is already evident in the government's macro planning (RPJM, regional head vision, CSA) and climate projections by BMKG, but it has not been integrated with the micro needs of farmers, particularly basic infrastructure and production certainty. The dimension of thinking again is evident in the form of formal monitoring by the government and direct adaptation by farmers. However, these evaluations are still administrative in nature and hampered by limited budgets and bureaucracy. As a result, the evaluations fail to produce transformative policy lessons. Meanwhile, the dimension of thinking across appears to be the weakest. It is characterized by a lack of cross-sector coordination, weak collaboration between government and non-government actors, and the absence of a cross-sector forum that bridges the logic of government policy with the field experience of farmers. Therefore, it can be said that agricultural governance in North Aceh is still dominated by a top-down approach, with minimal farmer participation and their placement as mere recipients of policy rather than adaptation partners. This highlights the gap between the government's macro strategies and farmers' micro needs in maintaining food security in the era of climate change.

Institutionalization of Dynamic Governance principles in local policy

Based on the review of the results and discussions, it appears that DG principles have strong potential to be institutionalized in local agricultural policy in North Aceh. Institutionalization can be understood as the process of integrating values, strategic objectives, and formal policies into the culture and structure of an organization to ensure stability and sustainability (translation of macro policies into micro practices) (Junaid et al.,

2015). This can be done by strengthening more structured institutional mechanisms in formal and informal mechanisms. In the dimension of thinking ahead, institutionalization can be carried out through the integration of BMKG climate data, flood-drought vulnerability maps, and farmer needs data into regional and village planning documents (e.g., RPJMD and RPJMDes).

Therefore, agricultural development planning should not only focus on increasing production targets, but also consider climate risks and the specific needs of each affected region. The dimension of thinking again is also institutionalized through an adaptive learning-based policy evaluation system, which not only assesses success in terms of budget absorption and program output but also the impact of policies on farmers' adaptive capacity. This evaluation can involve various parties, ranging from extension workers, farmer groups, and local actors such as Keujruen Blang, so that farmers' practical experiences also become part of the agricultural policy improvement process. Then, the dimension of thinking across requires cross-sector collaboration through the establishment of an agricultural and climate coordination-collaboration forum that connects the Agriculture Office, Bappeda, PUPR, BMKG, village governments, farmer groups, and non-governmental actors. The existence of this forum is important to ensure that agricultural adaptation is not partial, but integrated between policies, infrastructure, climate information, and local practices.

CONCLUSION

This study concludes that agricultural governance in North Aceh still faces a real gap between government macro policies and the micro needs of farmers in responding to climate change. Farmers place greater emphasis on practical solutions such as water pumps, crop diversification, and simple mechanization, while local governments focus on macro programs such as Climate-Smart Agriculture, Additional Planting Area, and agricultural input assistance, and BMKG strengthens climate information dissemination through Climate Field Schools. From a dynamic governance perspective, the dimensions of thinking ahead and thinking again have been implemented, but have not addressed urgent needs such as the repair of the Krueng Pasee irrigation system, while thinking across remains weak because cross-actor collaboration has not had a significant impact on farmers. The novelty of this research lies in the application of the concept of dynamic governance in the study of agriculture and climate change, which has rarely been touched upon, the contextualization of this concept at the local-village level by showing the dynamics of farmer adaptation that differ from formal policies, and the presentation of a case study of North Aceh as a special autonomous region that expands the scope of application of this theory in Indonesia. Short-term recommendations proposed from this study include accelerating irrigation infrastructure improvements, increasing farmers' adaptive capacity CSA training, and strengthening more accessible local climate information systems. Long-term recommendations include institutionalizing the DG concept in governance improvements, integrating micro-level needs into the RPJM, and establishing a cross-sector forum to make governance more collaborative, participatory, and sustainable in achieving food security in the agricultural sector in the era of climate change.

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