

THEORETICAL LEGAL ISSUES ON THE DEVELOPMENT OF THE PRIVATE ECONOMIC SECTOR FOR THE WEATHER FORECAST INFORMATION AND DATA MARKET IN VIETNAM

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ABSTRACT

Vietnam, a nation acutely vulnerable to the impacts of climate change, faces a critical juncture where the accuracy and accessibility of hydrometeorological information are paramount to its economic stability and sustainable development. This paper offers a comprehensive legal analysis of the framework governing private-sector participation in Vietnam's weather forecasting and data market. It examines the interplay between the Law on Investment 2020 and the sector-specific Law on Hydrometeorology 2015, revealing a nascent but complex regulatory environment. The analysis contextualizes the state's policy of "socialization" – a strategic imperative to modernize this public service sector by mobilizing private investment and innovation. Key legal ambiguities and barriers are identified, including a lack of coherence between general and sectoral laws, no formal open-data policy, and an undefined competitive interface between the national meteorological agency and private firms. Drawing on successful public-private models in the United States and Europe, the paper proposes concrete reforms to harmonize the legal framework: establishing a tiered data-access policy, ensuring a level playing field, and providing investment incentives. The conclusion emphasizes that targeted legal reforms are essential to transforming the current framework into a robust ecosystem, thereby unlocking the full potential of the private weather market as a crucial component of Vietnam's climate resilience strategy.

Keyword: : Private sector development; Weather forecasting market; Information and data; Hydrometeorology.

1. INTRODUCTION

1.1. The economic vulnerability of Vietnam to hydrometeorological events

Vietnam's rapid economic ascent is shadowed by its profound vulnerability to hydrometeorological events, a susceptibility that is being amplified by the accelerating impacts of global climate change. The nation's extensive coastline, coupled with its geographic location in a tropical storm belt, exposes it to a high frequency of severe weather phenomena, including typhoons, floods, droughts, and landslides [13]. This inherent risk poses a direct and substantial threat to the country's socio-economic development, national security, and the livelihoods of millions.

The economic stakes are immense. A 2022 report by the World Bank Group starkly quantifies this vulnerability, estimating that climate change impacts cost Vietnam approximately \$10 billion in 2020 alone, a figure equivalent to 3.2% of its GDP.

The report further projects that without the implementation of robust adaptation and mitigation measures, climate change could cost the nation between 12% and 14.5% of its GDP annually by 2050 and risk pushing up to one million people into extreme poverty by 2030 [17]. This economic reality transforms weather from a mere environmental concern into a core issue of national economic policy.

The agricultural sector, a cornerstone of the Vietnamese economy and a primary source of employment, is particularly susceptible. Climate change manifests in reduced arable land, increased frequency and intensity of droughts, and the proliferation of pest infestations, creating immense pressure on crop cultivation. Scientific projections indicate alarming future scenarios, with forecasts suggesting that by 2050, rice and maize yields could decrease by as much as 15.06% and 32.9%, respectively. The fisheries and aquaculture sectors face parallel threats from

saltwater intrusion and rising sea levels, with projected annual economic damages in the tens of billions of Vietnamese Dong [9]. These climate-induced pressures are not abstract future risks but present-day realities that directly impact food security, rural incomes, and national export revenues [3]. The pervasive impact of adverse weather extends across virtually all key economic sectors identified as needing specialized hydrometeorological information, including transportation, energy, construction, tourism, and insurance [18]. Consequently, the demand for accurate, timely, and increasingly specialized weather information and data is no longer a niche requirement but a fundamental necessity for risk management, strategic planning, and sustainable growth across the entire economy.

1.2. The state's policy of “socialization” and the imperative for modernization

In response to these escalating challenges, the Vietnamese state has adopted a strategic policy known as “socialization”. This policy represents a fundamental shift away from a purely state-centric model of public service provision. The government has explicitly identified the socialization of hydrometeorological activities as an inevitable and necessary trend for the nation's development. At its core, the policy is a pragmatic recognition that the state budget alone is insufficient to fund the massive capital investments required to modernize the national hydrometeorological infrastructure and services to meet contemporary demands.

Academic analysis of the term “socialization” in the context of post-reform Vietnam reveals a complex and multifaceted concept. While historically rooted in socialist collectivization, in its modern application, it often implies the privatization of public goods and the transfer of responsibilities from the state to society and individuals, driven largely by fiscal constraints. The policy encourages the mobilization of resources from non-state actors - including private enterprises, civil society, and individuals - to supplement public investment and enhance the quality and diversity of services. This approach is not unique to meteorology but has been applied across various public sectors, such as education and healthcare, to cope with decreasing state budgets while maintaining the state's central role in ensuring public welfare [8].

In the hydrometeorology sector, this policy is inextricably linked to the national agenda for modernization. Official government decisions, such as the plan to modernize the sector by 2025-2030, underscore the need to improve forecasting quality through the application of advanced technology and the development of a more diverse range of services [12]. The state has acknowledged that the traditional focus of the national weather service - primarily on providing general warnings for disaster prevention - is no longer sufficient [14]. The modern economy, with its sophisticated sectors like renewable energy, precision agriculture, logistics, and financial services, requires highly specialized, value-added data products that the state apparatus is not structured or resourced to provide at scale [18].

Therefore, the push for private sector involvement is not merely an exercise in economic liberalization or a simple cost-saving measure. It is a core component of Vietnam's national climate resilience and security strategy. The state is, in effect, strategically delegating a portion of the responsibility for innovation and specialized service delivery to the private sector. This delegation is intended to fill critical data and service gaps, thereby building broader economic resilience by outsourcing the agility and market-responsiveness needed to serve a modern, climate-vulnerable economy.

1.3. Research objectives and structure

While Vietnam has established a foundational legal framework to facilitate this private participation, significant ambiguities and structural barriers remain that hinder the development of a vibrant, competitive, and innovative private weather market. The central thesis of this paper is that targeted legal and policy reforms are necessary to address these gaps and unlock the full potential of the private sector in contributing to national climate resilience.

This paper aims to critically analyze the existing legal framework, identify its strengths and weaknesses, and propose concrete reforms informed by international best practices. The analysis will proceed in four subsequent sections. Section 2 will examine the dual nature of weather information as both a public good and a commercial commodity, a central tension that the legal framework must navigate. Section 3 will provide a detailed dissection of the current legal

framework, analyzing the provisions of the Law on Investment 2020, the Law on Hydrometeorology 2015, and their implementing decrees, with a focus on market entry conditions and the public-private interface. Section 4 will present a series of specific recommendations for legal and policy reform, drawing lessons from the successful public-private meteorological ecosystems in the United States and Europe. Finally, Section 5 will offer a concluding synthesis of the analysis and reiterate the case for creating a more robust and enabling legal environment for private sector development in this critical field.

2. THE DUAL NATURE OF WEATHER FORECAST INFORMATION AND DATA

The legal and economic character of weather information is inherently dualistic. It functions simultaneously as a quintessential public good, essential for the safety and well-being of the populace, and as a valuable raw material for a burgeoning commercial market. The effectiveness of any legal framework governing the sector hinges on its ability to manage the delicate balance between these two functions.

2.1. Legal definitions under the Law on Hydrometeorology 2015

The primary legislative instrument governing the sector, Law No. 90/2015/QH13 on Hydrometeorology (hereinafter “Law on Hydrometeorology”), provides the foundational definitions that delineate the scope of regulated activities. Understanding these definitions is crucial for identifying the legal objects over which the state exerts control and for which private entities must seek authorization.

According to Article 3 of the Law on Hydrometeorology 2015, “Hydrometeorology” is defined as a comprehensive term encompassing meteorology, hydrology, and oceanography. The Law defines core activities with legal precision. “Hydro-meteorological monitoring” refers to the systematic observation and measurement of atmospheric and water conditions. “Hydro-meteorological forecasts and warnings” are the products derived from the analysis of this monitoring data, intended to predict future conditions. The Law also defines the physical and informational infrastructure of the national system, including “hydro-meteorological stations” as the sites for data collection and the “national hydro-meteorological database” as the central

repository for this information. These definitions are not merely technical; they establish the boundaries of the activities that fall under the licensing regime and shape the structure of the market.

2.2. A public good and a commercial commodity

The Vietnamese legal framework explicitly recognizes and institutionalizes the dual nature of weather data. The Law on Hydrometeorology firmly establishes the “public good” dimension of hydrometeorological activities. Article 4 of the Law on Hydrometeorology 2015 stipulates that these activities are a fundamental responsibility of the state, primarily serving “socio-economic development, national security and defense, natural disaster prevention and combat”. The state guarantees resources for the construction and operation of the national station network and the provision of essential forecasts and warnings to the public. This public service mandate is the bedrock of the system, ensuring that all citizens have access to the critical information needed for safety and security.

Simultaneously, the Law carves out a distinct space for the “commercial commodity” aspect. It explicitly provides for “hydro-meteorological services”, which are defined as activities performed to meet the specific demands of organizations and individuals, distinct from the state's general public duties. Clause 1 Article 25 of the Law on Hydrometeorology 2015 opens the door for private participation, stating that organizations and individuals are permitted to engage in forecasting and warning activities, provided they meet certain conditions.

This legal bifurcation is reflected in the emerging market reality. A domestic private sector is taking root, with companies like WeatherPlus Corp. offering tailored, business-to-business (B2B) services to climate-sensitive industries such as hydropower, renewable energy, agriculture, and logistics. Furthermore, international firms are entering the market through high-level collaborations. The partnership between Japan's Weathernews Inc. (WNI) and Vietnam's National Center for Hydrometeorological Forecasting to provide advanced, AI-based forecast information for typhoons and heavy rain exemplifies a sophisticated public-private partnership model aimed at leveraging private sector technology to

enhance public safety and risk management [15]. These examples confirm that a commercial market for specialized weather data and services is not just a legal possibility but an operational reality in Vietnam.

The legal framework, by defining both a public duty and a commercial service, implicitly creates a two-tiered market structure. However, it critically fails to explicitly delineate the boundary between the two. The law establishes the state's primary role in providing the "base layer" of free, essential warnings for public safety, which constitutes the public good. It concurrently allows private entities to build value-added, commercial services upon this base layer. The crucial missing element is a clear and transparent data policy. The law does not specify which data from the national network is a free public good, accessible to all for innovation, and which data the state agency itself can commercialize, and under what terms.

This ambiguity creates significant market uncertainty and a potential for distortion that could deter private investment. If the national meteorological agency, which is funded by taxpayers, can compete directly with private firms by selling value-added services without a clear commercial mandate or a transparent, cost-based pricing structure, it creates an unlevel playing field. This situation contrasts sharply with more mature regulatory environments. The United States model, for instance, is built on a policy of free and open access to most raw government data, which has been the catalyst for a massive private weather industry [7]. The European ECOMET framework, while often based on cost-recovery, aims to create transparent and fair rules of access for all market participants. The absence of such a clear boundary in Vietnamese law represents a significant legal and policy gap that could inadvertently stifle the very "socialization" it is designed to promote.

3. THE LEGAL FRAMEWORK FOR PRIVATE SECTOR PARTICIPATION IN HYDROMETEOROLOGICAL SERVICES

The legal architecture enabling private investment in Vietnam's weather sector is constructed from two primary pillars: the general framework established by the Law on Investment, which governs all business activities, and the specific, more stringent regulations laid out in the Law on Hydrometeorology. Navigating this dual structure

is essential for any private entity seeking to enter the market.

3.1. The general right to Invest: The Law on Investment 2020

The Law on Investment No. 61/2020/QH14 (hereinafter "Law on Investment 2020") serves as the foundational statute for all investment activities in Vietnam. It embodies the state's policy of encouraging economic development by establishing a clear and liberalized investment environment. A core principle, articulated in Clause 1 Article 5 of The Law on Investment 2020, is that investors are entitled to carry out business activities in any sector or trade that is not explicitly banned by the law.

3.2. Sector-specific regulation: The Law on Hydrometeorology and implementing decrees

The business of providing hydrometeorological forecasting and warning services is a conditional business line under the Law on Investment 2020. Hydrometeorological forecasting is, in fact, a highly regulated activity. This is due to the principle in Vietnamese law where a specific, specialized law takes precedence over a general law in matters pertaining to its specific domain. The Law on Hydrometeorology 2015 acts as this specialized statute.

Clause 1 Article 25 of the Law on Hydrometeorology 2015 explicitly permits organizations and individuals, including foreign ones, to participate in forecast and warning activities. However, this permission is not unconditional. The same article mandates that any such entity must meet specific conditions related to professional capacity, qualifications, and physical-technical infrastructure. Crucially, it requires them to obtain a license from the competent state authority before commencing operations. This provision effectively establishes hydrometeorological forecasting as a conditional business line through sectoral legislation, irrespective of its status under the Law on Investment 2020 (Appendix IV of The Law on Investment 2020).

The detailed procedures, requirements, and conditions for this licensing regime are further elaborated in two key sub-law instruments: Government Decree No. 38/2016/NĐ-CP, which provides detailed guidance on the Law on Hydrometeorology, and Government Decree No.

48/2020/NĐ-CP, which amends and supplements certain articles of the former decree. Together, these three legal documents form the comprehensive regulatory framework for private participation.

3.3. Conditions for market entry: licensing requirements

The conditions for obtaining a license to provide hydrometeorological forecasting and warning

services are specific and non-discretionary, focusing on ensuring a high level of technical competence and reliability. The requirements, detailed in the aforementioned Decrees and reflected in public service portals, differ slightly for organizations and individuals but share a common emphasis on professional expertise and technical capability [16]. The license itself is granted for a maximum period of five years and is subject to renewal, ensuring ongoing regulatory oversight.

The specific conditions are summarized in Table 1 below.

Requirement Category	For Organizations	For Individuals
Legal Status	Must have legal personality	N/A (operates as an individual).
Personnel	Minimum of one staff member with a university degree (or higher) in a relevant hydrometeorological field and at least 3 years of professional experience.	Must personally hold a university degree (or higher) in a relevant hydrometeorological field and have at least 3 years of professional experience.
Technical Infrastructure	Must demonstrate adequate equipment, data processing systems, stable data sources, and documented technical processes for forecasting and quality assessment.	Must demonstrate adequate equipment, data processing systems, stable data sources, and documented technical processes for forecasting and quality assessment.
License Validity	The license is granted for a maximum period of five years and is subject to renewal.	

Table 1. Licensing Conditions for Hydrometeorological Forecasting in Vietnam

3.4. The public-private interface: data access and collaboration

The relationship between the state, as the primary collector of raw meteorological data, and the private sector, as a user and value-adder of that data, is the most critical nexus for the development of a private weather industry. The Law on Hydrometeorology 2015 establishes the creation of a National Hydrometeorological Database to be managed by the state. However, the legal framework remains largely silent on the specific terms, conditions, and pricing mechanisms for private commercial entities to access this foundational data.

While the law encourages international cooperation and collaboration in principle (Clause 8 Article 5 of the Law on Hydrometeorology 2015), the practical mechanics for domestic, commercial data sharing are underdeveloped in the legislation. This leaves a policy vacuum regarding one of the most fundamental inputs for any private weather company.

Despite this legislative gap, practical, high-level collaborations are already taking place, suggesting that a pathway for public-private engagement exists, even if it is not fully institutionalized. The strategic partnership between Japan's Weathernews Inc. and Vietnam's national forecasting center is a leading example. This collaboration focuses on deploying advanced private-sector technology, such as AI-driven models, to improve the state's capacity for

typhoon and flood forecasting [15]. This case demonstrates a functioning public-private partnership (PPP) model, where private expertise is leveraged to enhance public service delivery. However, such bespoke, high-level agreements do not constitute a systematic, transparent, and accessible data policy for the broader market, particularly for smaller domestic firms that may not have the leverage to negotiate similar arrangements.

4. RECOMMENDATIONS FOR A MORE ROBUST AND ENABLING LEGAL ENVIRONMENT

To bridge the gap between the policy ambition of “socialization” and the current legal reality, a series of targeted reforms are necessary. These reforms should aim to enhance legal clarity, establish fair and transparent rules of engagement, and actively incentivize private investment and innovation. Drawing lessons from successful international models can provide a valuable roadmap for Vietnam.

4.1. Establishing a tiered data access policy: lessons from the U.S. model

Access to reliable, high-quality data is the lifeblood of any weather service. The current legal framework's ambiguity on data access is a major impediment to private sector growth. Vietnam should develop a formal, multi-tiered data policy, drawing inspiration from the highly successful open data model of the United States National Weather Service (NWS). The NWS's policy of providing free and open access to most government-generated data has been credited with fostering a private weather industry valued in the billions of dollars [7].

A proposed tiered policy for Vietnam could include:

- Tier 1 (Open data/Public good): Basic observational data from the national network, raw numerical model outputs, and general public safety warnings should be designated as a public good. This data should be made available to all users, including commercial entities, freely, in a timely manner, and in machine-readable formats. This approach would lower the barrier to entry for startups and stimulate the widest possible range of innovation.
- Tier 2 (Commercial data/Value-added): More specialized datasets, such as high-resolution

model outputs, curated historical climate records, and other value-added data products generated by the state agency, could be made available under a clear, transparent, and non-discriminatory commercial licensing framework. The revenue generated could help sustain and modernize the public infrastructure.

4.2. Creating a level playing field: lessons from Europe's ECOMET

To foster genuine competition and encourage private investment, it is crucial to ensure that the state's own hydrometeorological agency does not hold an unfair competitive advantage. The European model, particularly the framework established by ECOMET (Economic Interest Grouping of the European National Meteorological Services), offers valuable lessons. A core objective of ECOMET is to maintain a level playing field for commercial activities across Europe. Academic analysis of the European market has shown that high data costs charged by national meteorological services can be a significant barrier for new entrants [10].

To prevent this in Vietnam, it is recommended that the law be amended to clearly define and separate the public service and commercial functions of the national hydrometeorological agency. This practice, often referred to as “ring-fencing”, would require the agency's commercial arm to operate on a self-sustaining, cost-recovery basis. This would prevent the use of public funds to subsidize its commercial offerings, which could unfairly undercut private competitors and stifle the growth of the nascent market.

4.3. Incentivizing investment and innovation

Beyond simply permitting private participation, the government can use existing legal tools to actively encourage it. The Law on Investment 2020 provides a list of sectors and activities that are eligible for special investment incentives, such as tax breaks, preferential credit, and favorable land use terms. It is recommended that “Development and application of advanced technology in hydrometeorological forecasting and data analysis” be added to this list of incentivized sectors. Such a move would send a strong policy signal to the market, directly stimulating private investment into the high-tech modernization that the government has prioritized [11] and attracting capital for research,

development, and the deployment of cutting-edge technologies like artificial intelligence and high-performance computing.

4.4. Formalizing public-private partnership models

The existing high-level collaboration between Weathernews Inc. and the national forecasting center demonstrates the potential of public-private partnerships [15]. To scale this success, the government should more systematically utilize the legal framework provided by the Law on Public-Private Partnership (Law No. 64/2020/QH14). This law provides a structured and transparent process for large-scale projects that leverage private capital and expertise to develop public infrastructure and services. The government could proactively design and tender

PPP projects for specific objectives, such as modernizing the national weather radar network, developing a specialized agricultural climate data platform for the Mekong Delta, or building advanced storm surge modeling systems for coastal cities. Formalizing these collaborations under the PPP Law would provide greater legal and financial certainty for private partners, attracting a wider range of investors for critical infrastructure upgrades.

To contextualize these recommendations, Table 2 provides a comparative overview of the public-private engagement models in Vietnam, the United States, and Europe, highlighting the key areas where Vietnam's framework can be strengthened.

Parameter	Vietnam (Current Framework)	United States (NWS Model)	Europe (ECOMET Framework)
Data Access Policy	Ambiguous; no formal open data policy. Access appears to be ad-hoc or partnership-based.	Explicit “full and open” access to most government-generated data as a public good.	Regulated access; aims for wide availability but often on a cost-recovery basis to ensure sustainability.
Role of National Agency	Dual role: primary public service provider and potential commercial competitor. The boundary is legally undefined.	Core functions are public warnings and data generation. Acts as the "single official voice" for severe weather, with the private sector handling value-added services.	Varies by country, but ECOMET provides a framework to manage the commercial activities of national agencies and ensure a level playing field.
Primary Goal of Regulation	Ensure technical competence and quality control of all forecast providers (public and private) through a strict licensing regime.	Maximize societal and economic value by fostering a large, innovative downstream private industry built on free public data.	Facilitate a single European weather market with fair competition and sustainable cost-recovery for national agencies.

Table 2. Comparative Models of Public-Private Engagement in Meteorology

5. CONCLUSION

Vietnam has taken commendable and necessary steps to create a legal pathway for private sector involvement in the critical field of hydrometeorology. Driven by the dual imperatives

of extreme climate vulnerability and the national policy of “socialization”, the Law on Hydrometeorology 2015 establishes a foundational, albeit demanding, framework for private entities to contribute their expertise and resources. This legal recognition is a vital first step toward modernizing the nation's weather

information ecosystem to meet the complex demands of the 21st century.

However, as this analysis has demonstrated, the current legal framework is nascent and contains significant structural challenges that risk impeding the growth of a truly dynamic and competitive private weather market. The key challenges identified are twofold: the absence of a formal, transparent data access policy, which is the single most important enabler for a private data industry; and the lack of clear legal rules governing the competitive interface between the state's national agency and private firms, which raises concerns about maintaining a level playing field.

Ultimately, creating a transparent, predictable, and supportive legal environment for a private weather market is more than a matter of economic policy; it is a crucial component of Vietnam's national strategy for climate adaptation and sustainable development. A vibrant ecosystem of public and private actors, working in concert, can provide the diverse, high-quality information needed to protect lives, safeguard property, and build a more resilient and prosperous Vietnam in the face of a changing climate. The legal reforms proposed herein offer a pragmatic roadmap to help realize that future.

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