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Aquaculture Land-Use Policy: The Case of Clam Farming in Thaibinh Province, Vietnam

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Abstract: Policy-making and enforcement remains centralized in Vietnam. Policies have been formulated with less scientific and public justification, thus being largely bureaucratic and infeasible, and in many cases, they have created plagues for people at the grass-roots levels. This article focuses on the implementation of policies related to intertidal land-use and supports for clam farming in the Thaibinh province as a case study to explore the impacts of policies on clam farming and farmers. During the period of 2011–2013, provincial policies on intertidal land allocation and technical and financial supports had boosted clam farming development in the province to a surprising extent. Rapid expansion of the clam farming area has created significant consequences for the farming sector, as well as farmer's lives. However, for the same provincial policies, but with different enforcement, different farming outcomes for clam farmers in the three study communes have resulted. Where farmers had more of a voice and choice in bidding for the intertidal areas they preferred, they faced fewer problems. It is, thus, suggested that a more decentralized policy-making and enforcement are needed, in which more scientific assessment and farmer participation are required to not only make government policy more successful in supporting farmers and achieving their expected outcomes, but also to provide farmers with more room to make their own farming decisions from which farming and marketing risks could be mitigated.

Keywords: land-use policy; aquaculture; clam farming; North coastal Vietnam

1. Introduction

The annual average growth rate of aquaculture in Vietnam has remained at over 17% since 2000. For 2015 alone, agriculture created an export value of $6.7 trillion [1]. Aquaculture has helped reduce the incidence of poverty by 4.3% and decreased the poverty gap and poverty severity indices [2]. Given the economic return and rural labor absorption of the sector, the Vietnamese government has paid greater attention and has made investments to boost development of the sector through extensive and intensive practices. Under government policies, the local livelihood system which was traditionally dominated by food crops in coastal areas has been significantly restructured since the 2000s, with increased area being allocated for aquacultural production [3].

Thaibinh is located in the Red River Delta of Vietnam. The province is endowed with the largest intertidal area for clam farming among coastal provinces in Northern Vietnam [4]. In the early 1990s, increased market demand for clams and the reduction in natural clam resources initiated a demand for clam farming in the province, initially with a small area of about 150 ha. The clam production

area was gradually expanded in the following years and reached roughly 1019 ha in 2006. In 2011, the provincial government officially institutionalized clam farming, aiming at boosting the sector by zoning and bidding intertidal areas to farmers. Together, loans were made available for farmers to invest in clam farming. Clam farming areas had been quickly expanded to roughly 3500 ha in 2013. In 2014, the clam farming area retreated slightly, given the chaos in clam farming productivity in 2011 and the reduced clam market demand faced by farmers in 2012 (see Figures 1 and 2 [5]).

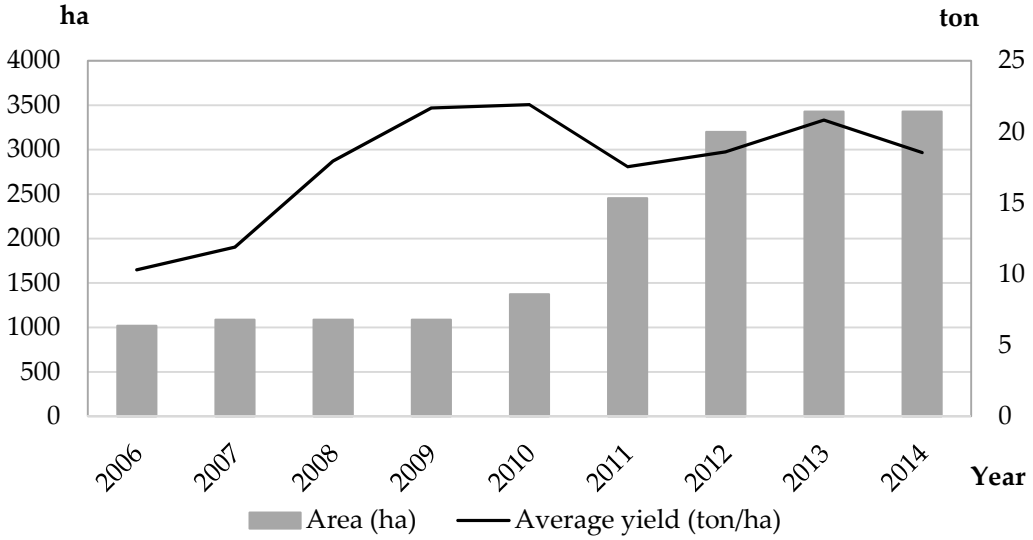

Figure 1. Clam production area and yield (2006–2014).

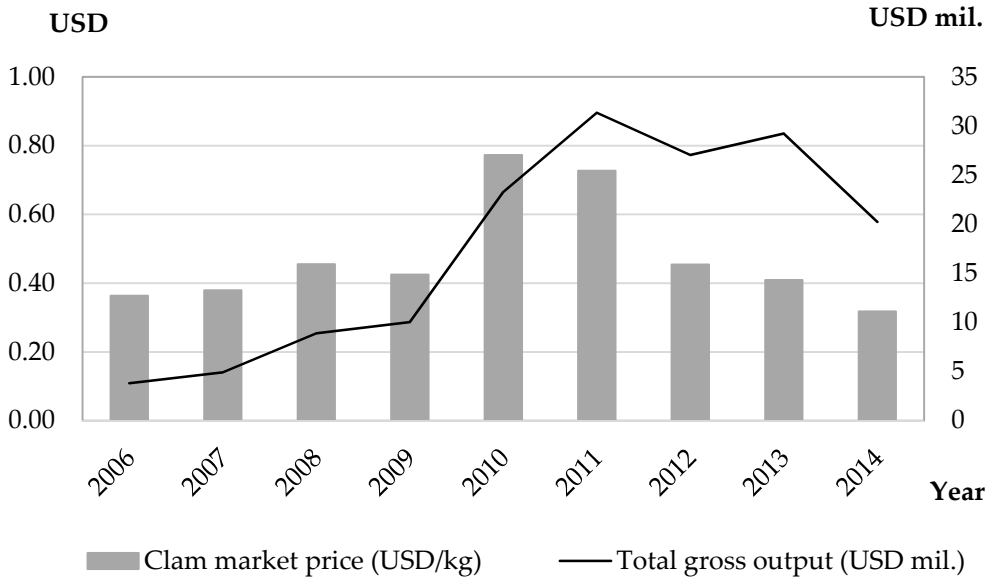

Figure 2. Total gross revenue of clam production (2006–2014).

The increased clam farming density resulted in a sharp increase in clam yield, especially in 2009 and 2010. However, increased natural and artificial disasters, coupled with the low quality of clam breeds, resulted in a sharp reduction of clam yield in 2011 and 2012. Since then, clam yield has fluctuated around 18 tons/ha. The clam market price was on the rise from 2006–2009. In this period, clams were considered as a "golden" farming opportunity in Thaibinh, as well as in the whole country. However, shortly after enjoying such a golden period, farmers were faced with a reduced

clam market price in the following years. A sharp decline in the clam market price had happened from 2011 to 2014 (Figure 2).

The large fluctuation of clam yield and market price reflects the fact that clam farming is subjected to different risks in farming practices and the market. The clam farming cycle, which is different from other aquacultural animals, such as shrimp, crabs, and fish, is relatively longer, i.e., two to three years. A longer farming cycle, mostly dependent on natural resources, i.e., nutrition for clams, intertidal conditions, and wastewater discharged from inlands, has made clam farming more vulnerable to risks, both natural and artificial. The probability of loss in clam farming in a growing season was estimated at 52% for the period of 2006–2014 (Calculated by Monte Carlo simulation using the Crystal Ball software (Oracle Co.: Redwood City, CA, USA) for clam production data collected from the household survey).

Government policy should be considered as a resource manager that plays a significant role in managing and protecting natural resources. To support farmers in the management of natural resources and risk mitigation, governments of many countries have developed a number of policies and regulations related to agriculture in general, and to aquaculture in particular [6]. However, in reality, many government policies have not been able to achieve their expected outcomes in supporting farmers to cope with farming risks. For example, agricultural protection policies that the Japanese government issued and implemented for post-war reconstruction forced the domestic price to exceed the international market price by 40% in the 1950s, and even by 120% in the 1990s, which harmed Japanese farmers in the following years [7]. Another example is a disaster assistance program created by the USA government that was criticized due to its high costs and the producer's benefit being offset by lower market revenues [8].

When launching an intervention policy, governments often consider at least three criteria, such as: (1) fiscal constraint; (2) social relief for serious catastrophes; and (3) market orientation [9]. However, government policy addressing certain risks could cause other risks to emerge. For instance, an increase in output volume by addressing farming risks could cause market risks because of product oversupply. Agricultural risks are thus interrelated and interdependent between, and among, market, government actions, and farmers' farming and marketing strategies [10].

Focusing on the case study of clam farming and marketing practices in the Thaibinh coastal area, this study aims to explore possible impacts of government policy and success (and failure) of farmers in their clam farming and marketing practices. This paper aims to answer two major questions: (1) What were the government policies/interventions regarding land-use in clam farming in the Thaibinh province? (2) What lessons can be learned from the enforcement of these policies/interventions in local conditions?

2. Research Methodology

2.1. Study Site

Thaibinh remains an agriculture-based province, located in the "rice bowl" of the Red River Delta of Vietnam. Sixty-six percent of the provincial workforce is devoted to the agricultural sector. Even though much change in the provincial GRDP (Gross Regional Domestic Product) structure has happened toward more industrial and service sector contributions over the last 30 years under the market-based economic policy of Vietnam, agriculture, forestry, and aquaculture still show a contribution of 25%–35% of the total provincial value of production in recent years. Most farmers have been traditionally living on food crop production and animal raising. About 26% of farmers living along coastal areas seek their livelihood from coastal aquacultural activities, mostly in combination with other traditional livelihood activities. In 2015, the total value of GRDP of Thaibinh was estimated at $1.956 trillion and GRDP per capita was about $1377. In which, total aquaculture production generated a value of $174 million [11].

Among coastal provinces in the north of Vietnam, Thaibinh has the largest clam farming areas (i.e., 3430 ha), followed by Namdinh (1710 ha), Thanhhoa (1200 ha), and Quangninh (1000 ha)

(in 2013) [12]. According to the Thaibinh Agriculture and Fishery Extension Center, salinity in the intertidal area is around 1.5%–2.5%, favouring aquaculture development. The total area that has the potential for aquaculture is around 17,000 ha [12], of which 15,119 ha (or roughly 89% of the total potential area) have been brought into aquaculture production with many type of species, such as shrimp, fish, and clam. In 2014, the total clam production generated a value of VND 445 billion (about 20 million USD, exchange rate: $1 USD = $22,000 VND) for Thaibinh province (Figure 2).

There are 12 communes of the province involved in clam farming. These are located along 50 km of coastline in the province. For the study, three communes were selected. These have the largest clam farming area as well as the longest history of clam production in the province. These characteristics allow researchers to capture the risks and farmer's resilience/capacity in clam farming over a relatively long period of time, i.e., from 2006 to 2014. There are 1310 households doing clam farming in the three communes at the time of the study (see Figure 3 [13,14]).

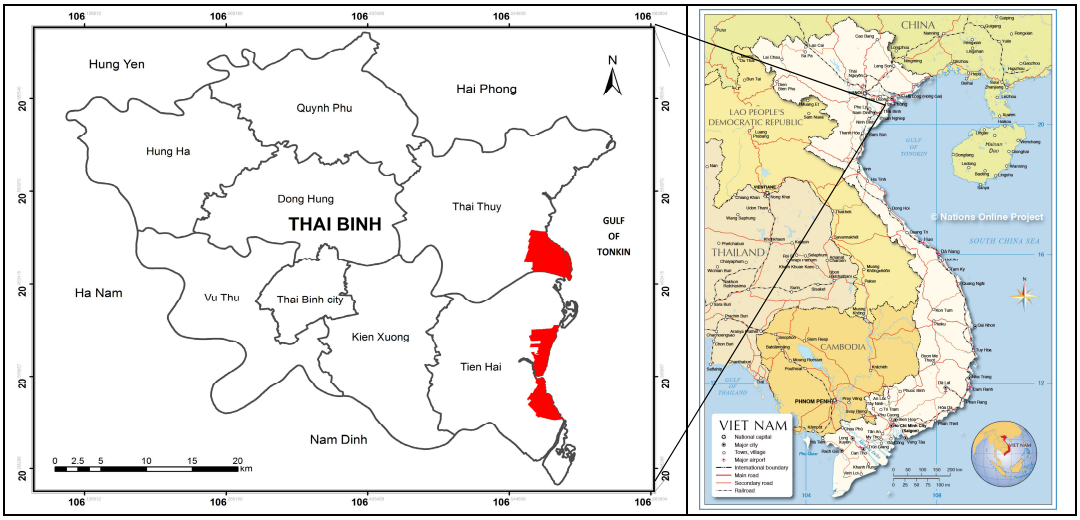

Figure 3. Map of the research sites. The red marked areas were selected communes for the research.

2.2. Data Collection

Fieldwork was carried out in the study site from August 2014 to April 2015. Secondary data regarding policies on intertidal land planning, and allocation, financial and technical supports for clam production was gathered from different local government offices and published papers/reports. Primary data was collected by using different research tools. Data on clam farming and marketing practices and risks, and farmer's capacity and strategies to recover from different risks that occurred between 2006 and 2014, was collected. Data was then combined to identify impacts of policies on clam farming practices, consequent risks and farmers coping strategies. The three research tools used for field research were:

2.2.1. Key Informants' Interviews (KIs)

Eleven key persons from local governments at three administrative levels: province, district, and commune, and clam traders were interviewed in order to obtain data on government policies and enforcement related to intertidal land planning and allocation; government (technical and financial) supports for clam farming; clam trader's performance in relation to local clam farming practices and their views on factors that govern local clam farming and marketing practices. (KIs include one person in the Thaibinh provincial aquaculture department; two people in aquaculture sub-departments in two districts; heads and aquacultural extensions of the three communes; and five clam traders.)

2.2.2. Focus Group Discussions (FGDs)

Three FGDs were conducted in the selected commune (one FGD/commune) with participation of 8–10 farmers who have good experience with clam farming and marketing practices. FGDs aimed to explore historical events of local clam farming and market, relevant government policies and impacts on clam farmers, as well as farmers' coping strategies to risks and policy constraints.

2.2.3. Household Surveys

Household surveys aimed to capture in depth information on farmer's clam farming and marketing practices, such as farming costs and profit, risks they faced, their coping strategies, and consequences of risks to their farming practices, as well as their lives.

Sample size of households for survey was calculated by the following equation:

$$n = \frac{N \times t^2 \times S^2}{N \times \Delta_x^2 + t^2 \times S^2} \quad (1)$$

where n = sample size; N = total households having clam farming in the three communes (1310); and t = confidence interval (2.17, with 97% confidence level).

Based on the first 31 households surveyed in the three communes for their clam farming loss, sample variance (S^2) of 194.88 and sample errors (Δ_x^2) of 2.52 were estimated.

For these parameters, n = 157 was generated.

2.2.4. Data Analysis

In this study, a chronological analysis was applied to identify the impacts of government intertidal land-use policies on clam farming practices at the farmer's level, the trend of clam farming and marketing practices, emergent risks, and farmer's coping strategies and consequences. In addition, a Mann-Whiney U-test was applied to test the impacts of different clam-raising plot sizes: those set by the Thaibinh government and those created by farmers in clam farming.

3. Land-Use Policies and Impacts on Clam Farming

Clam farming has been practiced since the early 1990s, initially trialed by some farmers in the Namthinh commune with a small intertidal area. Given that clam farming experience increased and there were good market prices, more farmers started to invest in clam farming. The raising area had been significantly expanded from 2005 to 2010, to roughly 1500 ha. For nearly 20 years (i.e., from the early 1990s to 2010), clam farming had been spontaneously invested in and developed by farmers through self-reclaiming of intertidal land for raising practices. In 2008–2009, when clam farming enjoyed a lucrative benefit, conflicts between farmers who owned intertidal areas for clam farming and others who wanted to join clam farming but had less favorable intertidal area left for them emerged and tensions increased. To reconcile the conflict, in 2011, local governments started a policy on intertidal land allocation that aimed to redistribute intertidal lands for clam production to more farmers through public bidding, which was based on intertidal land-use taxes (see Table 1 for the chronology of policies on intertidal land allocation for clam production in Thaibinh province). The Thaibinh government started to formulate policy on intertidal land use. In 2011, intertidal land allocation was officially implemented by Decision 1519/QD-UBND of the Thaibinh provincial government [15]. All intertidal land area was zoned and allocated to farmers who had an interest in clam farming. Many experienced clam farmers had left their original clam farming plots for newcomers, who accepted higher taxes. Together with an intertidal land-use policy, the Thaibinh government also issued policies, such as Resolution 24/2011/NQ-HDND, for financial and technical support to clam farmers [16], as well as Decision 05/2012/QD-UBND, to support juvenile clam production and clam processing technologies [17].

Table 1. Policies on intertidal land allocation for clam production.

Time	Name and Content of Policies
2011	Decision No 1519/QD-UBND Thaibinh: 05/08/2011: "Planning for expansion clam production, target to reach the level of 100,000 tons/year in 2015; 200,000 tons/year in 2020".
2012	Resolution 24/2011/NQ-HDND Thaibinh-14/12/11: "Supporting in developing clam production" and Decision 05/2012/QD-UBND Thaibinh 18/1/2012: "Promoting juvenile clam production and processing clam for commercial".
	Decision 11/2012/QD-UBND Thaibinh-13/7/2012: "Regulation for management clam farming unit in intertidal area".
	Decision 21/2012/QD-UBND Thaibinh-28/12/2012: "Regulation for auction for land renting fee, applied for land for agricultural production and business".
2014	Decree 67/2014/ND-CP-07/07/2014: "Government promoting program for aquaculture development, containing regulation to exempt aquaculture land renting fee".

As revealed from the Thaibinh DARD (Department of Agriculture and Rural Development) official interviewed, within two years after Decision 1519 was implemented, there had been 2708 clam households officially allocated with an intertidal area of 2472.4 ha in the whole province [4] (About 1000 ha were allocated to cooperatives and companies, making a total clam farming area of roughly 3500 ha in 2013 (Figure 1)). In addition, Resolution 24/2011/NQ-HDND and Decision 05/2012/QD-UBND provided favorable conditions for juvenile clam production and clam processing enterprises. In 2013, there were 10 farmers invested in juvenile production, which produced about 2.3 billion juvenile clams, accounting for 17% of the total juvenile clam demand in the province. In addition, a factory was invested for clam processing with a capacity of 15%–30% of total harvested clams in one year in the province.

However, enforcement of Decision 1519 was relatively different between and among the three communes, notably in terms of flexibility in land-use fees and participation of farmers which, again, resulted in different farmers' clam investments and resilience capacities. In the Thaido commune, the intertidal land area was equally allocated to households with one level of fee, applied through a random-pick approach. By contrast, in the other two communes, the intertidal land area was bid upon among farmers, and different land-use fees applied for different intertidal land locations that more or less favored clam farming production according to the farmers' experiences. With low land-use fees applied, more farmers started clam farming in the Thaido commune while a reduced number of farmers were doing so in the other two communes. Given the increased risks in clam farming and marketing in recent years, more farmers in the Thaido commune have been facing bankruptcy (see Table 2).

Table 2. Enforcement of Decision 1519 in the three communes.

Items	Thaido Commune (in Thaithuy District)	Dongminh and Namthinh Commune (in Tienhai District)
Intertidal land allocation approach	Every household was allocated with an equal intertidal land area by random pick.	Land-use fee was set through auction with farmer participation, ranging from 3 to 12 million VND (Vietnam Dong)/ha/year.
	Same level of land-use fee is applied regardless of the location of the intertidal land area, at three million VND/ha/year.	Farmers decided to pay for intertidal area based on their farming experience and financial capacity
Consequences	After land reallocation, the number of clam farms increased to nearly double, from 63 farms to 117.	After land reallocation, the number of clam farm slightly decreased from 600 to 510.
	32% of interviewed farms had to stop clam farming as a consequence of clam farming bankruptcy.	17% of interviewed farms stopped clam farming. Half of these farmers experienced bankruptcy. The rest stopped clam farming because of low profit.

Given the limited intertidal land area, while more farmers wanted to join clam farming, Decision 11/2012/QD-UBND set a ceiling size for clam-raising plots of no larger than 2 ha for individual households and 10 ha for organizations. This was invoked for the sake of equity, so all households living along the coastal area would have the same opportunity to own one clam-raising plot.

The inflexible intertidal land allocation approach resulted in an average clam-raising plot size of only 1.68 ha in the Thaido commune. For the more flexible land allocation approach adopted by the other two communes, the average clam-raising plot size was much larger as compared to the Thaido commune, up to 2.46 ha in the Dongminh and 2.90 ha in the Namthinh commune (see Table 3 [18–20]).

Table 3. Average of clam-raising plot size of the three communes.

Commune	District	Average of Plot Size (ha)
Dongminh	Tienhai	2.46
Namthinh	Tienhai	2.90
Thaido	Thaithuy	1.68

In the Dongminh and Namthinh communes, farmers with the same farming interests, or those who were relatives, decided to bid for intertidal plots adjacent to each other. This allows farmers to group themselves and enlarge the size of their clam-raising plot. In 2011, during the land allocation implementation, 21% of clam farmers in the Dongminh and 46% in Namthinh communes decided to merge their intertidal areas together. Additionally, from 2013, many farmers had given up clam farming due to serious losses in previous years. This resulted in opportunities for experienced farmers to hire additional intertidal areas to enlarge their clam farming area. Roughly 45% of surveyed households have hired additional land to enlarge their clam farming plot.

A Mann-Whitney U-test reveals a large impact of the clam-raising plot size on the farming profit/cost ratio (A profit/cost ratio is a measure of profitability, calculated by dividing the net profit by the total costs of 1 ha of clam production. The result shows how many dollars (as profit) the farmer received when they invested $1 into this sector.) (see Table 4). The difference between these two groups (Group 1: no larger than 2 ha; Group 2: larger than 2 ha) is caused by three factors, including (1) cost: both variable and fixed costs are found to be inversely correlated to plot size [21]; (2) density: Group 2 applies a lower clam density, and therefore a lower mortality rate as compared to Group 1 (This can be explained by farmers in Group 2 having a longer and better clam farming experience as compared to Group 1 (with more new farmers joining clam production after 2011)). Lower clam-raising density also favors the faster development of clams, which helps shorten the clam-raising cycle, which helps reduce clam farming risks. Lastly, (3) the farming structure allows Group 2 farmers to divide their clam farming plot into separate smaller plots (by a simple fencing system) to grow different clam sizes, from "juvenile" to "adult" clams. This helps Group 2 farmers control juvenile clam sources and reduces clam mortality since juvenile clams are getting used to farming conditions, as compared to Group 1 farmers who have to purchase juvenile clams from external sources. In addition, raising clams at different ages allows Group 2 farmers to have several harvests in a year. This not only helps Group 2 farmers in establishing greater relationships with clam collectors, but also reduces market risk. Additionally, farmers also revealed that the rate of clam loss caused by strong currents is also smaller in larger clam-raising plots.

Table 4. Clam-raising plot size and farming profit/cost ratio [a].

Plot Size	Total Clam Plots (for All Raising Cycles, from 2006 to 2014)	Mean (Profit/Cost Ratio)	SD
Group 1: Plot size $\leq$ 2 ha	458	0.24	1.12
Group 2: Plot size > 2 ha	181	0.48	1.06

[a] The profit/cost ratio is a measure of profitability which is calculated by dividing the net profit by the total costs of 1 ha of clam production. The result shows how much profit (in dollars) a farmer receives by investing one dollar into this sector. The difference of the cost/profit ratio between the two groups is significant at $p < 0.001$.

4. Policy Implications

As presented in previous sections, Decision 1519, together with other provincial policies, boosted clam production in the province, reflected via heavily increased clam farming areas, as well as the number of farmers evolving into clam farming practices since 2011. The sudden decrease in the clam market price since 2012 has mainly been caused by a surplus of harvested clams, coupled with increased clam farming risks caused by high clam mortality, especially in small clam-raising plots, revealing serious limitations in the policies. By setting a ceiling limit for clam-raising plots of no larger than 2 ha, Decision 1519 was clearly formulated without consideration of careful scientific assessment on clam farming costs and profits, and farmers' experiences and preferences. The infeasible approach adopted by the Thaido communal government regarding intertidal land allocation further exaggerates the risks for clam farmers.

It is likely that Decision 1519 aimed to provide equal opportunities to farmers who wanted to join clam farming practices in the province by splitting intertidal areas into small plots so that all farmers could be allocated one farming plot, even the poor. However, experienced farmers have more to consider for their clam investment, such as farming and marketing risks, which are related to the size and location of clam-raising plots, capital requirements, and profit that could be generated. As revealed by farmers in FGDs, raising plot sizes to around 3 ha is the best choice in the local socioeconomic and farming context. These findings were consistent with the research result of Dey et al. (2005), who revealed significant inefficiencies among aquaculture farms in India, Thailand and Vietnam [22].

Decision 1519 was purely based on the provincial intertidal area that can support clam production without a necessary assessment of possible risks, market demand, and possible coping strategies. For instance, the Decision set a target of harvested clams for market of 100,000 tons in 2015 and 200,000 tons in 2020 [15]. However, with 71,502 and 63,604 tons of harvested clams, respectively, in 2013 and 2014, the harvest already surpassed the existing clam market demands and strongly reflected a reduced clam market price in these years. Additionally, promoting clam farming production and little on clam processing, the provincial government did not make any assessment on clam market demands, as well as the efforts needed for the required market promotion. This creates a serious disjuncture between clam production and market demand, as observed in recent years. A lack of market information, trapped by small raising plot sizes set by policy, and a shortage of clam farming skill have brought many farmers, including the poor, into financial loss, even bankruptcy. Public encouragement may have led to a surfeit of production when the market fell. In short, there may not be anything wrong in economic terms with the government seeking both to encourage clam aquaculture and to balance efficiency and equity claims. In so doing, though, the government might have done it more effectively, rather than doing nothing at all.

Without farmers' participation, provincial policies were constrained into physical intertidal land allocation, loans, and some technical provisions (in the form of extensions). Since clam farming requires a large initial financial investment, it embeds itself with high risks. Moreover, different from inland aquaculture, clam farming is totally exposed to the (open) ocean environment with little control of farmers over their farming practices (Even existing net fencing does not totally control clam loss under high sea current increases). This creates additional risks for clam farmers. However, no warnings have been provided by the Thaibinh government to farmers before policies on intertidal land allocation were made, letting new and even poor farmers engage in such risky farming practices.

The government can devise ways to help farmers with its policy choices. The top-down policy formulation and enforcement have been creating trouble for farmers, instead of helping them gain better incomes and livelihoods. Many similar lessons were learned from other developing countries regarding their aquacultural policies and consequences on farmers' welfare, such as Bangladesh [23–25], Thailand [26], the Philippines [27], and some countries in Africa [28]. Decentralized policy-making with farmers' participation is needed to make the government policy successful in supporting farmers. As revealed in this study, even the same provincial policies, but with different enforcement, have resulted in different farming outcomes for clam farmers in the three study communes. A more feasible

intertidal land allocation taken by the Dongminh and Namthinh governments allowed farmers with similar interests to create a group and develop clam-raising plots that help them reduce their farming risks, while this is not happening in the Thaido commune.

More decentralized policy-making and enforcement will allow government aquacultural planning and policies to be more responsible to different stakeholders. In other words, policy formulation needs to be of a demand-driven approach [29,30]. This requires a vast amount of background information, ranging from opinions and verbalized needs from primary stakeholders (e.g., aquatic farmers in communities) to quantitative data on demand from various (multi) stakeholders [30].

For nearly 20 years of the farmers' own investments, clam farming areas were expanded to about 1500 ha in 2010. However, nearly 2000 ha of intertidal area was brought into clam farming within three years, from 2011–2013, after the Thaibinh government officially institutionalized intertidal land-use and clam farming supporting policies. Government policies have created shocks in a different direction: increases in clam farming area and juvenile clam price, and reductions in the clam market price. All clam farmers have been hit by these shocks, though to different extents.

Promoting clam production without carefully and systematically assessing the cost-benefit, market demands, possible risks, and controlling measures, as well as other supports for market research and development, processing technologies, food safety control strategies, etc., has contributed to crises in clam farming in the following years. For instance, nearly 1000 ha of clam production area was added between 2011 and 2014, while the market demand for clams suddenly decreased in 2012. Despite increasing the production area, revenues started decreasing afterwards, trapping the poorest and less experienced farmers. This has happened mainly because of a governmental policy that incentivizes land use for clam production but which did not take into account the market effects. Governmental policy seems to be the main reason explaining the loss in profitability, which may be equally important to the loss of international clam markets (i.e., China and the EU) which led to an oversupply in the domestic market. The change in profitability could result from changes in prices and cost increases.

5. Conclusions

Increased market demand, coupled with exhausted natural clam resources, initiated clam farming in intertidal areas of the Thaibinh province in the early 1990s. The clam farming area was gradually increasing in the following 20 years, powered by high clam market prices, increased clam farming experience, and farmers' capital accumulation to reinvest in clam farming. In this period, small clam farming areas provided farmers with significant advantages from natural resources that support clam growth, and access to large market demands. However, these advantages have been eroded since 2011 when the Thaibinh government's policies on intertidal land allocation and technical and financial supports were brought into effect.

Nearly 20 years of farmers' spontaneous investment in clam farming expanded clam-raising areas by up to 1500 ha. However, just three years after the provincial policies targeted toward boosting clam farming came into effect, nearly 2000 ha of new intertidal land was claimed for clam farming, with many new farmers who are not acquainted with clam farming joining the sector. The sudden and significant increase in the clam farming area has imposed massive consequences on farming practices, as well as on farmers' lives.

The increased clam farming area with a higher farming density has caused increased clam farming risks, i.e., a higher mortality rate. These, together, led to higher juvenile clam demand and, thus, the price increased. This exaggerated farming investment creates risks for clam farmers. In parallel, the increased farming area has produced a surplus of harvested clams, which was significantly over market demand; consequently, the clam market price was reduced. This brought chaos to the clam farming sector and to farmers in the Thaibinh province, shortly after policies related to clam farming development took effect.

An important lesson to be learned from this study is that governments (from the local to the national level) play important roles in directing farmers in clam farming practices. Ironically, the initial good intentions of the government to increase clam farming areas and to provide opportunities for more farmers in the sector have resulted in a reverse impact, which has posed lethal risks to the sector and to farmers.

The study results confirm that top-down policy formulation and enforcement has, thus, been creating trouble for farmers, instead of helping them to gain better income from clam farming. Even at farmer's level, the same provincial intertidal land-use policies but with different enforcement, have resulted in different farming outcomes for clam farmers in the three study communes. Intertidal land allocation without consideration of farmers' preferences and farming capacity taken by the Thaido government has created more trouble for the farmers as compared to the other two communes where farmers had more of a voice and choices in bidding for the intertidal area they preferred. It is thus likely that if greater scientific assessment, for instance with respect to the profit/cost ratio of clam farming practices, on clam market demand as well as on farmers' participation was taken into consideration for policy-making and enforcement, the risks to clam farming and marketing would have been smaller, and possible risk warnings could have been provided to farmers to make them better aware of and able to control, risks both in farming and marketing practices.

However, the participation of farmers will certainly cause more complications and costs for policy-making and enforcement. This implies that future studies should focus on this subject to identify not only a suitable approach to get more farmers involved, but also a trade-off between more farmer participation and the relevant costs embedded in effective policy-making and enforcement.

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