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Managing water pollution to revitalise the shrimp supply chain in Tam Giang Cau Hai Lagoon, Vietnam

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Abstract

The area of shrimps farmed in the Tam Giang Cau Hai Lagoon expanded dramatically from 1995 to 2004, but then declined steadily. An exploratory investigation of the shrimp supply chain conducted in 2009 revealed that well-established relational contracts between shrimp farmers and wholesalers had succumbed to environmental risk following persistent and widespread outbreaks of disease in the Lagoon. These outbreaks have been attributed to water pollution, which - in turn - has been linked to the rapid expansion and intensification of shrimp production. While privatisation of the lagoon bed encouraged farmers to adopt more intensive production methods, over-intensification can be attributed to the open access nature of lagoon water, which allows farmers to externalise the cost of their water pollution. This study evaluates a range of pollution abatement instruments against well-known criteria and concludes that transferable quotas for shrimp seed would be the most effective policy instrument given prevailing social, institutional, organisational and political conditions. Even so, the introduction and administration of seed quotas pose major challenges that would require co-management with local user groups.

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1. Introduction

Supply chain management is a topic that has attracted the interest of many researchers and practitioners because market competition is no longer between individual firms but between supply chains (Trkman *et al.*, 2007; Li *et al.*, 2005). Food supply chains differ from those in other sectors owing to the perishable nature of

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products and production that is characterised by dependence on natural conditions, seasonality and a lag between production and harvest, all of which make output unpredictable. A food chain evolves within particular social, institutional and natural settings, and individual firms within the chain are exposed to risks facing other firms (Hallikas *et al.*, 2004). These risks may be behavioural (e.g. opportunism) or environmental (e.g. disease, natural disasters, economic shocks and changes in policy or technology) (Trkman & McCormack, 2009). According to Williamson (1996), higher levels of chain coordination help to manage behavioural risk, but coordination becomes more difficult as the level of environmental risk increases.

The area of shrimps farmed in Tam Giang Lagoon expanded at an average rate of 400% each year from 1995 to 2004 (Truong, 2012 p. 53). After peaking at 4,000ha in 2004, the area fell steadily to 2,700ha in 2008 following persistent and widespread outbreaks of disease in the Lagoon. Hop *et al.* (2005) and Thung (2007) conducted experiments that showed some alarming indicators of deteriorating water quality in the Lagoon between 1998 and 2004. These indicators included diminishing levels of diffused oxygen (i.e. an increase of organic pollution) - especially in places close to crowded shrimp farming areas, greater nutrient loads entering the lagoon and less absorptive capacity of the natural environment - conditions conducive to eutrophication, higher levels of total coliform density, and higher levels of organochlorine pesticides in the sediment. Water pollution poses a serious threat to all farmers who raise shrimps in the Lagoon and the resultant yield risk is not only co-variant (i.e. risk that simultaneously affects the vast majority of producers) but also systemic (i.e. it creates risk for other agents in the chain). It is estimated that some 100,000 poor people rely directly on aquaculture and capture fisheries in TGCG Lagoon as their main livelihood activity (Tuyen *et al.*, 2010).

This research addresses three related questions: Why has the quality of TGCH Lagoon water deteriorated so rapidly? How has water pollution impacted on the Lagoon's shrimp supply chain? How can the water pollution problem best be managed? To answer these questions, the authors drew on relevant literature in the fields of institutional economics, supply chain management and environmental economics, conducted an exploratory case study of the TGCH shrimp supply chain, and consulted key informants in local and provincial government authorities to help assess policy options. The paper identifies a set of pollution abatement instruments that could be applied to aquaculture in TGCH Lagoon, and tests them against normative criteria in order to recommend an appropriate policy.

2. Why has the Lagoon's water quality deteriorated so rapidly?

There are several sources of water pollution in the Lagoon including; (i) aquaculture production and other livelihood activities in the lagoon, (ii) agricultural production activities in upstream areas, and (iii) industrial production and urban dwellers in the lagoon catchment. There is no study to date quantifying the respective contribution of each of these sources of pollution. However, aquaculture - and shrimp culture in particular - has been clearly linked to the Lagoon's environmental deterioration (Tuyen, 2002; Huong & Berkes, 2011). Moreover, pollution levels closely tracked the growth of aquaculture. This study focuses only on pollution caused by aquaculture.

In 1993, the Vietnamese government issued Decree 64/CP which allowed households to exercise exclusive rights to certain parts of the lagoon bed in order to practice aquaculture. Demand for secure property rights was strong because export prices for giant tiger shrimps was increasing (FAO, undated) and farmers wanted to protect their investment in shrimp enclosures (Phap *et al.*, 2002 p.30). The Provincial People's Committee responded by issuing Red Book property rights to fixed-gear fishers located near the shoreline who converted their net and fence enclosures into earthen-walled ponds for shrimp production (Huong & Berkes, 2011). Shrimp farmers operating in deeper water further from the shore privatised the lagoon bed by erecting fine-mesh nets. Many of these farmers were allowed to formalise their de facto exclusive rights to the lagoon bed by taking up five-year and one-year permits issued by district and commune authorities respectively (Huong & Berkes, 2011).

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