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Sustainability Standards in the Vietnamese Aquaculture Sector

Citation

UNEP (2016). *Sustainability Standards in the Vietnamese Aquaculture Sector.* Geneva: UNEP.

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Acknowledgements

This report was commissioned by the United Nations Environment Programme's (UNEP) Trade, Policy and Planning Unit of the Economy and Trade Branch (ETB), Division of Technology, Industry and Economics (DTIE). It is a key output of the trade unit's work under the Green Economy and Trade Opportunities Project (GE-TOP).

The preparation of this report was managed jointly by UNEP, and the Ministry of Industry and Trade (MOIT) of Viet Nam, with the involvement of the Ministry of Agriculture and Rural Development (MARD), the Ministry of Natural Resources and Environment (MONRE) and IDH Sustainable Trade Initiative. This study was undertaken by Nguyen Huong Tra, Nguyen Thanh Tung, Phung Giang Hai and Nhu Van Can.

From UNEP, the effort was led by Anja von Moltke, Head of the Trade, Policy and Planning Unit. Substantive contributions were provided by Liesbeth Casier, Katharina Schmidt, Lennart Kuntze and Benjamin Smith. Nicolás Cisneros managed the finalization and publication of the report. Simon Lobach edited and proofread the text, Laurence Duchemin prepared the layout, Désirée Leon assisted in the publication process, and Andrea Bassi was involved in the design of the model underlying this study. Stefanos Fotiou, Senior Regional Coordinator on Resource Efficiency for the Regional Office for Asia and the Pacific, also contributed to the project and the report.

From MOIT, the work was led by Vu Lien Huong, Head of General Affairs and Other Multilateral Organizations, Multilateral Trade Policy Department and overseen by Pham Quynh Mai, Deputy Director General of the Multilateral Trade Policy Department.

The study was developed through an inclusive stakeholder process and included a peer-review by the following organizations: MOIT (Trade Research Institute, Department of Import-Export, Europe Department, North America Department, Asia-Pacific Department, Africa and South-West Asia Department), MARD (Directorate of Fisheries, National Agro-Forestry-Fisheries Quality Assurance Department, Institute of Policy and Strategy for Agriculture and Rural Development), MONRE, The Ministry of Planning and Investment, The Ministry of Finance, Ministry of Science and Technology (The Directorate for Standards, Metrology and Quality), The Fisheries Center at Can Tho University and The Vietnam Association of Seafood Exporters and Producers (VASEP). Special thanks are also due to the shrimp and pangasius farms and processors that responded to the survey for this study.

Special thanks are due to those who contributed to the project, including Dr. Flavio Corsin, Country Director of IDH Vietnam; Mr. Nhu Van Can, Vice Director of the Aquaculture Department, Directorate of Fisheries at the Ministry of Agriculture and Rural Development; Nguyen Thanh Phuong, Associate Professor of Aquaculture and Vice-Rector at Can Tho University; Tran Minh Ha from the Ministry of Natural Resources and Environment; and Dr. Nguyen Manh Hai, Head in Charge of the Research Department for Public Service Policies at the Central Institute for Economic Management (CIEM).

UNEP and the authors would like to thank the European Commission for the financial support provided for this publication and the Green Economy and Trade Opportunities Project.

Any errors or omissions are the sole responsibility of the authors.

List of Acronyms

ASC	Aquaculture Stewardship Council
ASEAN	Association of Southeast Asian Nations
BAP	Best Aquaculture Practices
BAU	Business as Usual
BRC	British Retail Consortium
CAEPS	Certified Aquaculture Export Potential Study
CAIA	Canadian Aquaculture Industry Alliance
CSR	Corporate Social Responsibility
DAH	Department of Animal Health
D-Fish	Directorate of Fisheries
FAO	United Nations' Food and Agriculture Organization
FCR	Feed Conversion Rate
FMI	Food Marketing Institute
GAA	Global Aquaculture Alliance
GAP	Good Agricultural Practice
GHG	Greenhouse Gas
IFS	International Featured Standard
ISO	International Organization for Standardization
MARD	Ministry of Agriculture and Rural Development
MOF	Ministry of Finance
MOIT	Ministry of Industry and Trade
MONRE	Ministry of Natural Resources and Environment
MOT	Ministry of Transport
MPI	Ministry of Planning and Investment
MSC	Marine Stewardship Council
MT	Metric Ton
NAEC	National Agriculture Extension Center
NAFIQAD	National Agro-Forestry-Fishery Quality Assurance Department
NGO	Non-Governmental Organization
US	The United State of America
VASEP	Vietnam Association of Seafood Exporters and Producers
VGGS	Vietnam Green Growth Strategy for 2011-2020
VINAFIS	Vietnam Fisheries Society
VND	Vietnamese Dong
WTO	World Trade Organization
WWF	World Wildlife Fund

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Executive Summary

The Government of Vietnam has expressed strong interest in promoting the diffusion of internationally recognized sustainability standards in Vietnam's aquaculture sector through facilitative policies and mechanisms that accelerate green growth. The application of green economy measures and certification for production and processing of aquaculture products has the potential to improve the sustainability, productivity and quality of aquaculture production. Additionally, green economy measures can open new export markets that allow for higher value addition and even price premiums for sustainably-produced products, which can in turn lead to enhanced trade flows in sustainably produced aquaculture goods.

This study contains a survey involving 55 farms and processors in both shrimp and pangasius in Vietnam. It shows positive results for the application of sustainable certification in the shrimp sector, and to a lesser extent, for pangasius. In shrimp aquaculture, the effect of sustainability certification on the net economic benefits (gross margin) for both farms and processors are positive. The social and environmental benefits are positive both in farming and the processing/export of shrimp.

The landscape in pangasius aquaculture is not so positive. The effect of certification on the net economic benefits is negative for pangasius farms and statistically uncertain for pangasius processors/exporters. For processors, the survey found that the increase in prices and sales of certified pangasius is uncertain, and so is the effect of certification on the social and environmental benefits in pangasius farming and processing/export.

The survey has some limitations, most importantly the fact that certification in the aquaculture sector has only recently emerged. Additionally, it was difficult to expand the field surveys to the other stakeholders in the aquaculture sector, such as newly-certified and non-certified farms, new feed producers, fingerling producers, medical and chemical producers and suppliers, etc.

Challenges for compliance with internationally recognized sustainability standards remain, including the poor overall master planning for both shrimp and pangasius growing, lack of integrated infrastructure to reach economies of scale in production, the weak model of employment and organization of production, as well as the poor linkages in aquaculture production. In addition, the capacity gap in the private and public sectors still hinders the sector to catch up with international sustainability standards.

The policy recommendations emphasize that the capacity of both private sector and public sector needs to be strengthened to facilitate a green transition in the aquaculture sector. For the private sector, this includes awareness raising, financial support and strengthening of the bargaining power of both farmers and processing/exporting businesses. For the public sector, a mechanism for effective collaboration and coordination among key ministerial administrations (i.e., MoIT, MARD, MPI, MONRE) should be created. The structure should allow for on-time issuance of policies and guidelines at the national level, and swift adjustments in response to the existing and projected market demand and the needs of the producers. Such a structure should also be implemented at the local level.

Introduction

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The National Green Growth Strategy for the period 2011-2020 and the Vision Towards 2050 (VGGS) were approved by the Prime Minister of Vietnam on September 25, 2012. The Strategy highlights three key strategic objectives: i) reducing greenhouse gas emissions and promoting clean energy measures, particularly through the use of renewable energy; ii) greening current industries by promoting energy and resource efficient technologies; and iii) greening the national lifestyle and promoting sustainable consumption. Together with the National Target Programme to Respond to Climate Change, the Strategy and Vision shape the national policy framework for sustainable development.

The VGGS, however, is steered towards the mitigation of climate change, rather than towards identifying and seizing opportunities associated with the national transition to a green economy. This is attributable to constraints in the national investment capacity and in technological capabilities, and to a lack of appropriate national policies and international cooperation. If Vietnam is to harness available benefits from increasing international trade, accelerating poverty reduction and job creation in the course of achieving prosperity and sustainable development, it is imperative to put in place, inter alia, appropriate national-level policies and public and private sector structures for the implementation of, and compliance with, internationally recognized sustainability standards in the aquaculture sector.

Seafood ranked among the top ten exports of Vietnam throughout the last decade. Vietnamese seafood reaches most parts of the world, with the European Union (25.7 per cent), Japan (21.1 per cent) and the US (20.4 per cent) being the main export markets. In 2008, Vietnam accounted for almost 5 per cent of the global aquaculture production and value, three times its share in 1990. The value of Vietnam's seafood exports has been rapidly growing since the country's accession to the World Trade Organization (WTO), from US$ 3.4 billion in 2006 to almost US$ 6.7 billion in 2013. In 2013, seafood represented the sixth largest export product, contributing more than 5 per cent of the total export turnover of Vietnam. Aquaculture products represent the major part of Vietnam's fisheries exports, with pangasius and shrimp exports having the largest shares (AGROINFO, 2014).

However, the rapid expansion of aquaculture production and processing in Vietnam has been leading to serious sustainability problems, including environmental degradation from increased greenhouse

gas (GHG) emissions, overexploitation of fish stocks for animal feed beyond their ability to recover, and complementary issues including reduced food security of coastal and inland farming communities. The development and application of green economy measures and the increased demand for internationally recognized sustainability certification (such as Global Gap, BAP/GAA or ASC) could encourage the fisheries production (both aquaculture and fisheries capture) to redirect to sustainable development.

In this context, the government of Vietnam has expressed strong interest in promoting the diffusion of internationally recognized sustainability certification in Vietnam's aquaculture sector through facilitative policies and mechanisms that accelerate green growth. However, apart from the potential benefits, the application of certification also creates numerous challenges for aquaculture producers and processors. This Certified Aquaculture Export Potential Study (CAEPS) supports this explicit interest of the government by identifying the economic, social and environmental benefits and costs of sustainability certification in terms of enhanced export, revenue generation, job creation and others, outlining the technical and policy needs for the application of internationally recognized aquaculture standards at the national level, and providing strategic policy recommendations for harnessing the identified trade opportunities.

Specifically, the CAEPS aims to:

(i) Analyze the economic, social and environmental benefits and costs that arise from green economy measures, using the example of sustainability certification in Vietnam's aquaculture sector;

(ii) Identify trade opportunities associated with the transition to a green economy in Vietnam's aquaculture sector (with a focus on pangasius and shrimp);

(iii) Review how compliance with standards improves the sustainability of Vietnam's aquaculture sector;

(iv) Identify the challenges related to sustainability certification in Vietnam's aquaculture sector, including assessing the 'capacity gap' for public and private actor compliance with internationally recognized sustainability standards;

(v) Formulate strategic policy recommendations to address the identified challenges that hamper sustainability certification and the sustainable trade opportunities for Vietnam's aquaculture sector.

The research was conducted based on literature reviews and a field survey for the collection of the data used in the cost-benefit analysis. Additionally, interviews have been held with senior experts of different governmental agencies, business and professional associations. A workshop was organized with various stakeholders, including local farmers, processors, exporters, business associations, research institutes and provincial government, in order to validate and discuss the preliminary findings of the study.

This report includes six main chapters. Following the Introduction, Chapter 1 provides an overview of Vietnam's aquaculture sector with a focus on the two most important species - shrimp and pangasius. Chapter 2 describes the current adoption of sustainability certification in Vietnam's aquaculture. Chapter 3 - Methodology presents the way the study was carried out. Chapter 4 presents the cost-benefit analysis of compliance with sustainability certificates in Vietnam's shrimp and pangasius aquaculture. The economic, social and environment issues are elaborated here. Chapter 5 discusses challenges and opportunities for scaling up the sustainable certification in the aquaculture sector. Lastly, Chapter 6 provides the strategic policy recommendations for harnessing the trade opportunities for certified aquaculture in Vietnam.

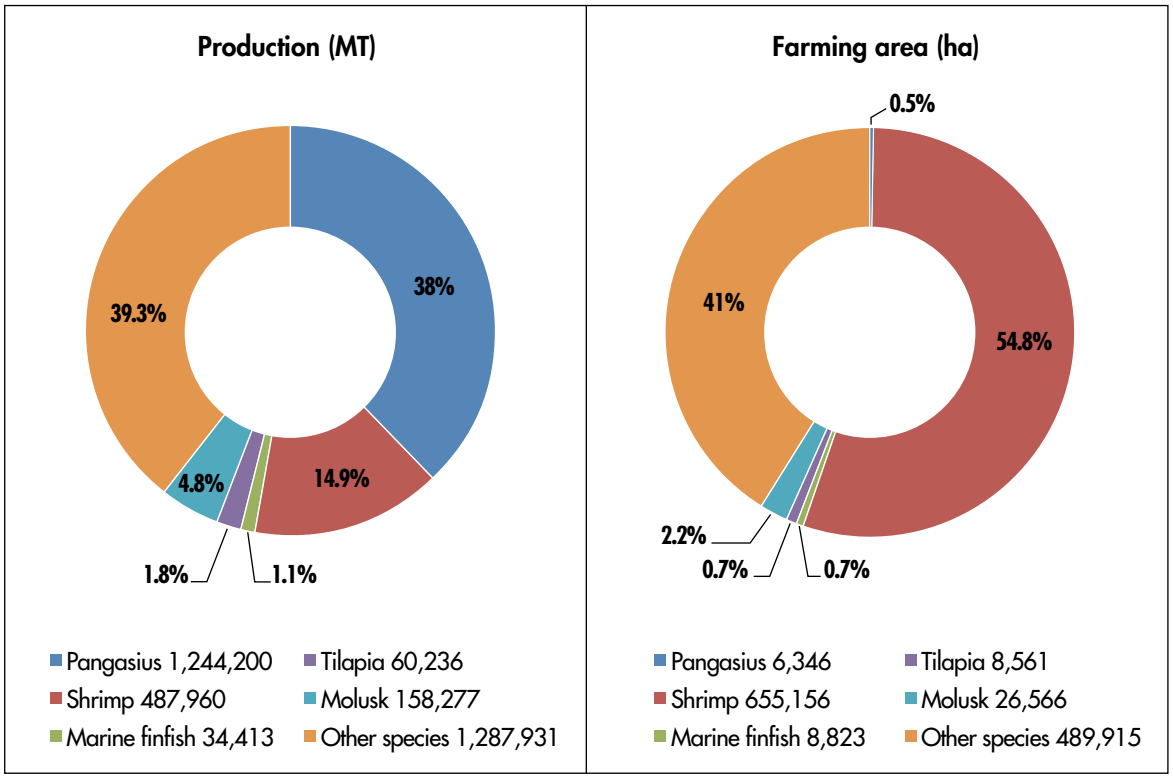
1. Background: Vietnam's Aquaculture Sector

This chapter gives a brief overview of the aquaculture sector in Vietnam. It largely focuses on pangasius and shrimp production and its importance for Vietnam's exports. It also describes the key stakeholders involved in farming these species.

1.1. Overview of Vietnam's Aquaculture Sector

The era of modern aquaculture in Vietnam started in the late 1990's when the Government of Vietnam issued a number of specific policies to facilitate expansion and improvement of the aquaculture sector. One of the policies, the National Aquaculture Development Programme for the period 2000-2010 aimed to develop the sector in order to i) supply materials for seafood processing and exporting, and ii) ensure national food security. This document specified and approved the potential areas and key species for mass production. Another important policy is Decree No. 09/2000/NQ-CP, which triggered a land reform by allowing farmers to decide what species to culture and whether or not to convert rice-farming and/or unfertile land to aquaculture to increase their benefits. As a result, total aquaculture production increased sharply from 480,800 metric tons (MT) in 1999 to over 3.4 million tons in 2013. It thereby accounts for more than 5 per cent of the world aquaculture production. The export value of Vietnam's aquaculture products in 2013 reached US$ 6,724 million, representing 5.3 per cent of the total export turnover of the country (VASEP statistics, 2014; FAO statistics, 2013).

Figure 1. Production and farming area of the key aquaculture species in 2012



Source: D-fish statistics, 2013

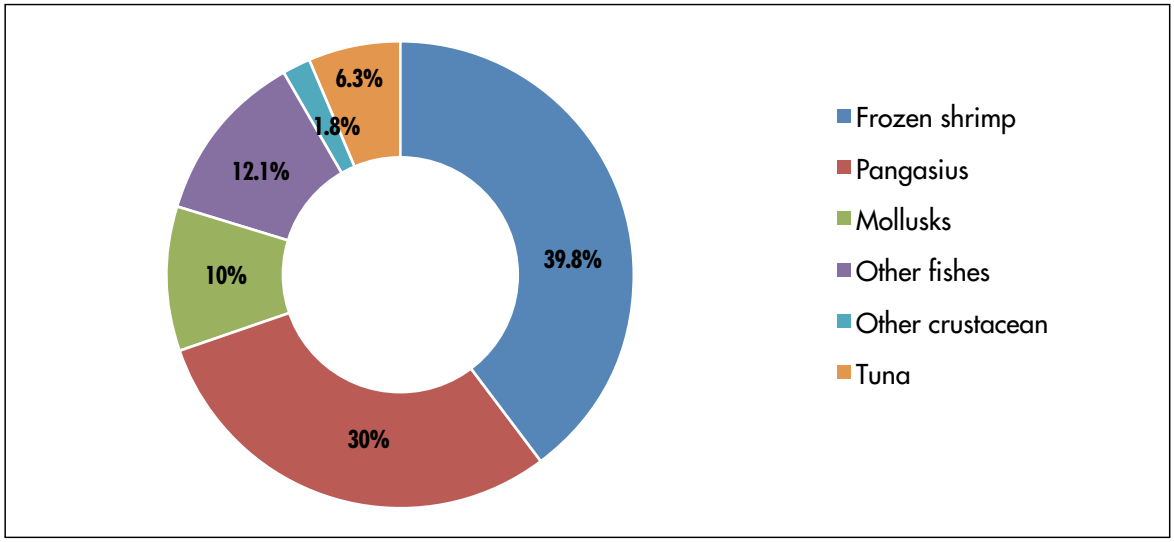
Aquaculture production in Vietnam is dominated by a few key species, such as pangasius (38.0 per cent), shrimp (14.9 per cent), and traditional fresh water species (39.3 per cent). Traditional freshwater species production has been at a stable volume for a long time and mainly supplies domestic consumption. Pangasius and shrimp are mainly produced for export.

In terms of farming area, the largest area is used for shrimp, in coastal brackish water (655,156 hectares or 54.8 per cent of the total aquaculture area), while a rather small area in the Mekong delta is used for pangasius farming (6,346 hectares or 0.5 per cent of the total area). This explains the high level of intensity in pangasius production compared to shrimp production.

1.2. The Development of Pangasius and Shrimp Production

Although shrimps and pangasius have been farmed for just over 10 years, they contribute the largest shares to the Vietnamese seafood export value (39.8 per cent and 30.0 per cent respectively in 2013) (Figure 2).

Figure 2. Seafood export product structure (by value) in 2013



Source: VASEP, 2014

The production of pangasius and tiger shrimp rose sharply from 2000 to 2008, when the Government of Vietnam implemented the National Aquaculture Development Programme for the period 2000-2010. Since 2008, the production of pangasius and tiger shrimp leveled off, while the production of white leg shrimp has continued growing (Figure 3).

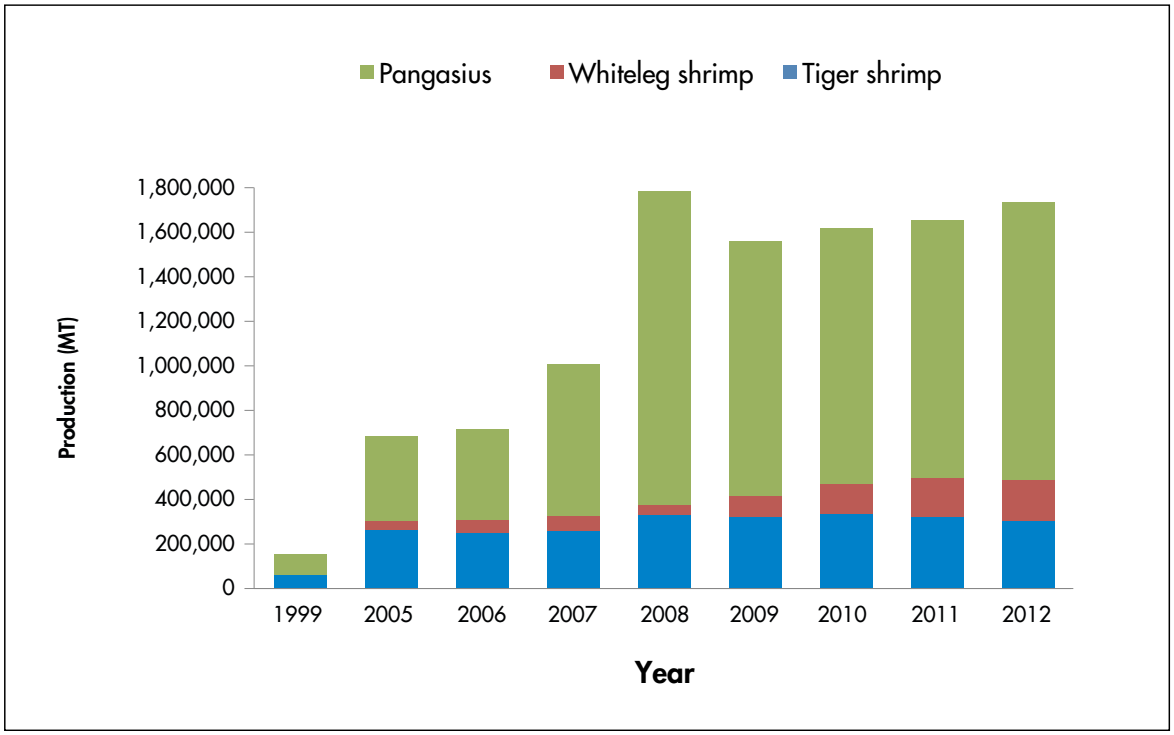
Box 1. Classifying Aquaculture Production Systems by Intensity

The aquaculture literature commonly classifies production systems by their level of intensity. Intensity of production runs along a spectrum from extensive (less than 1 ton of fish per hectare per year [t/ha/yr]) through semi-intensive (2–20 t/ha/yr) and intensive (20–200 t/ha/yr) pond farms. Yields from intensive cage, raceway, or recirculating systems can be even higher. In general:

- Extensive production requires a low level of control, relies on natural productivity and crop wastes as feed, and has relatively low operating costs.
- Semi-intensive production uses fertilizers and farm-made feed to boost fish yields, requiring a higher level of management control and leading to higher operating costs.
- Intensive production requires the highest degree of management control, relies completely on off-farm inputs (e.g., high quality feed, seed and fertilizers), and uses more energy, leading to high operating costs.

Source: World Resource Institute (2014)

Figure 3. Production growth of the key aquaculture species for export



Source: D-fish statistic, 2013

1.2.1. Pangasius farming

Pangasius farming in Vietnam is concentrated in 10 provinces in the Mekong delta (Table 1) where the natural conditions are very suitable for these species. Vietnam's success in juvenile production in the 1990's has led to a prosperous seed business today, with 152 hatcheries and 4,441 nursery farms which produce about 15.6 billion of larvae and 1.93 billion of fingerlings every year.

The pangasius grow-out technology is well developed. In the last 20 years, the production of pangasius increased rapidly from 23,250 tons in 1997 to peak at 1.4 million tons in 2008, and then cut down to 1.2 million tons in 2012. Nowadays, most pangasius farms operate the intensive or super-intensive systems, in which the productivity may reach as much as 360 t/ha/yr or more. It is estimated that the large farms, which have more than 4 hectares, account for just 56 per cent of the total area while they produce more than 81 per cent of the total volume. However, the consolidation of the small-scaled farms is taking off in this industry. The pangasius export turnover reaches around US$ 1.8 billion per year, making it an important product for the national economy, and for the farming communities in the Mekong delta. Pangasius production and processing has become a prioritized industry in the government's long-term development strategy.

Table 1. Farming area and production volume of pangasius in 2012

Provinces	Area (ha)	Volume (MT)
Tien Giang	125	38 851
Ben Tre	719	155 000
Đong Thap	1 879	386 610
Vinh Long	423	132 206
Tra Vinh	135	28 855
An Giang	1 384	260 428
Can Tho	1 355	165 837
Hau Giang	172	40 740
Soc Trang	138	33 623
Kien Giang	17	2 050
Total	**6 346**	**1 244 200**

Source: Vietnam D-Fish Statistic, 2013

1.2.2. Brackish water shrimp farming

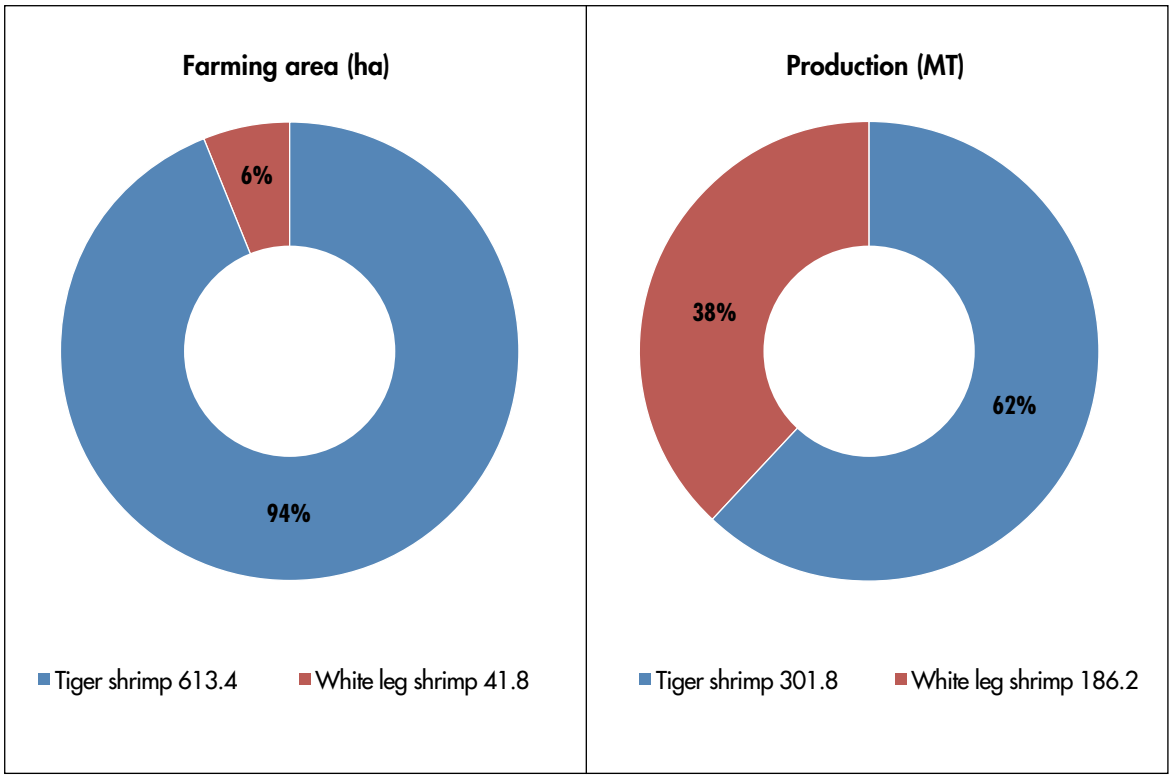
Brackish water shrimp is an important species in Vietnam's aquaculture production, both in terms of value and volume. There are two main cultured species. The tiger shrimp (*P. monodon*) is indigenous and is farmed in different systems such as the intensive, semi-intensive, extensive or ecological system (shrimp cum forest)[1]. The exotic white legs shrimp (*P. vannamei*) has been imported and is usually farmed in the intensive or super-intensive systems. The tiger shrimp is still the main product, in particular because of its high export value. However, the whiteleg shrimp has recently become increasingly popular since it is easy to farm, has low protein diet requirements, a short farming cycle and a higher readiness level of domesticated seed production.[2]

In 2012, the total production of white leg shrimp reached 186.2 MT, accounting for 38 per cent of the total production of the two species combined, although its farming area was only 6 per cent (Figure 4). The tiger shrimp is, by contrast, produced on as much as 94 per cent of the total shrimp area and accounts for only 62 per cent of the total production volume (or 301.8 MT). Shifting production from tiger shrimp to white leg shrimp thus allows for an increase of the total shrimp production with less use of land. However, expansion of intensive farming of this exotic species also comes with higher risks of environmental deterioration, disease outbreak, and genetic and/or biodiversity contamination.

[1] Shrimp cum forests form an organic aquaculture that raises shrimp sustainably and protects the ecological environment. This model limits aquaculture density, does not allow the use of antibiotics and generates natural food for shrimp, among others (vietbao.vn/Kinh-te/Viet-Nam-chu-trong-nuoi-trong-thuy-san-sinh-thai/10866653/87/).

[2] Ninh Thuan province, one of the core whiteleg shrimp production areas in Vietnam, had produced over 15 billion of high quality whiteleg shrimp seeds in 2013. (www.fistenet.gov.vn/e-nuoi-trong-thuy-san/a-san-xuat-giong/ninh-thuan-se-cung-cap-cho-thi-truong-hon-20-ty-tom-giong-chat-luong-cao/)

Figure 4. Comparison of farming area and production volume of tiger & white legs shrimp in 2012



Source: D-fish statistics, 2013

1.3. Stakeholders in Vietnam's Aquaculture Sector

The public stakeholders in Vietnam's aquaculture sector are mainly the Ministry of Agriculture and Rural Development (MARD) and its Directorate of Fisheries (D-Fish), the Ministry of Industry and Trade (MOIT), the Ministry of Natural Resources and Environment (MONRE), as well as public service organizations such as the National Agriculture Extension Center (NAEC), the National Agro-Forestry-Fishery Quality Assurance Department (NAFIQAD), and related research institutes, universities, state-owned enterprises, etc. The private stakeholders include the main actors in the value chain, such as the small-scale farmers, farming enterprises, service suppliers, input providers, and the processing, exporting and distribution companies, and their business associations, including the Vietnam Association of Seafood Exporters and Producers (VASEP).

Among the public stakeholders, MARD is responsible for the production process and directly manages the aquaculture sector at the national level. MARD has a variety of departments, which are in charge of various aspects of aquaculture production (Figure 5). D-Fish is responsible for technical management of the whole production process that takes place on the farms, including hatching, nursing, out-growing, harvesting and post-harvest management. It also takes on the responsibility for certification management, specifically for the VietGAP programme. Meanwhile, NAFIQAD is responsible for food safety and quality control of the aquaculture products during processing, packaging and exporting. The Department of Animal Health (DAH) is responsible for animal health control during farming, in cooperation with D-fish. Similar administrations under MARD work at the local level and have a strong influence on aquaculture management in each province.

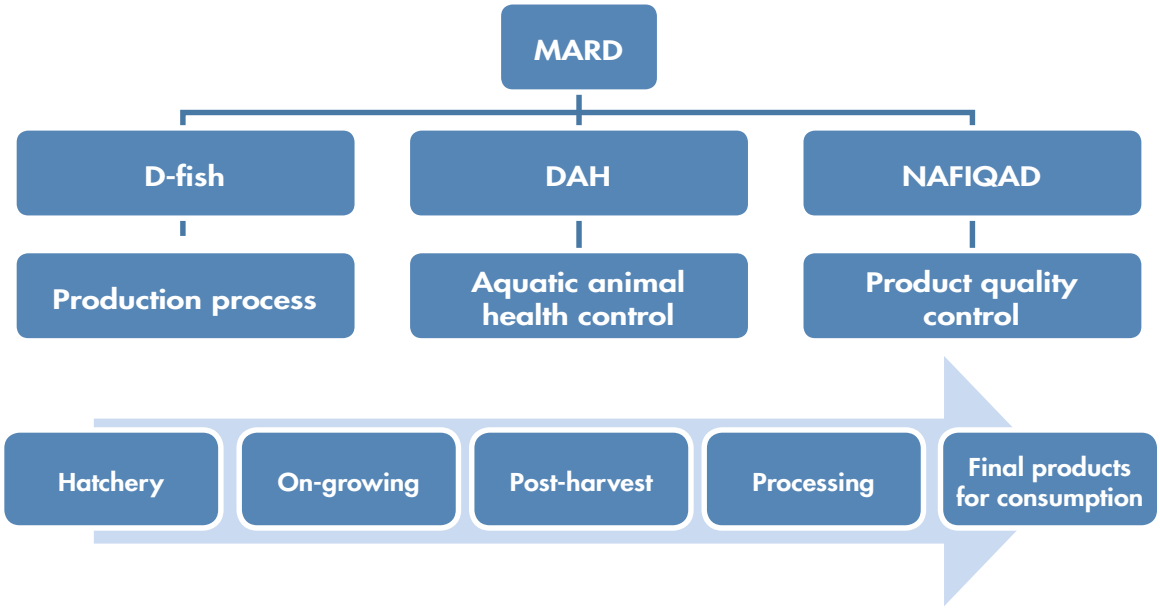
MONRE is responsible for the environmental management aspects (pollution, land, water, use of other natural resources, etc.) and is mainly involved in issuing technical regulations regarding the quality of sewage from the aquaculture farms, and the conditions for the use of land, water and other natural resources. The competence of MOIT also includes assuring market access and promoting trade of aquaculture products.

The public service authorities, including research institutes, universities and NAEC, provide technical support for the aquaculture sector. They carry out research, develop and improve technologies, and train farmers.

The private sector includes the key players in the aquaculture value chain. They include the small-scale farmers and the enterprises that run production, processing, distribution and/or exporting of aquatic products. We can see that the product quality is strongly affected by the operations of such organizations. Therefore, it is essential to introduce sustainability certifications to the private sector if food safety, quality, stable aquaculture production and long-term sustainable development of the sector are to be ensured.

Besides the key stakeholders involved in public administration and business, professional organizations and business associations such as VINAFIS and VASEP, as well as national and international non-governmental organizations (NGOs), also play important roles in the operation and development of the whole value chain. They have a voice on the development orientation and cooperation among different industry players.

Figure 5. Aquaculture value chain and competent authorities assigned by MARD



Source: Adopted by authors from MARD website (Available at: http://www.mard.gov.vn/Pages/Organization.aspx?TabId=gioithieu)

2. Sustainability Certification in the Aquaculture sector in Vietnam

This section discusses international trends in the aquaculture sector, and the response of the Vietnamese aquaculture business, including actions taken to make the sector more sustainable. The section ends with a brief discussion of the impact of certification on the sustainability, market access and trade flows of Vietnam's aquaculture.

2.1. International Trends towards Green Aquaculture Business

Aquaculture is one of the fastest growing global food production systems. It currently provides close to 50 per cent of the world's supply of seafood, with a value of US$ 125 billion. It contributes 13 per cent of the world's population's intake of animal protein[3] and employs about 24 million people (FAO, 2012). As wild capture is stagnating, aquaculture is expected to close the forecasted global deficit in fish protein by 2020. The rapid expansion of this so-called "blue revolution" exposes the sector to a wide range of concerns about its social and environmental impacts, including water pollution and degradation of the surrounding environment (Bush et al., 2013). There is a pressing demand in the global seafood market for "greening" the business.

This section reviews the key trends in the international market that drive the development of green aquaculture business. It includes the trend for sustainability requirements and the emergence of certification as a prominent strategy to meet such requirements.

2.1.1. Sustainability – an established trend

Following the emblematic closure of cod fishery in Newfoundland (Canada), a number of powerful initiatives have been launched to render the world's seafood market more sustainable. They range from awareness-raising programmes and voluntary guidelines to codes of conducts, certification and labeling programmes to sustainable sourcing plans. Most often these initiatives originate from North American and European markets, but recently a breakthrough commitment has been reached in the Japanese market (CAIA, 2009; FAO, 2011a; Greenpeace, 2014).

The existing technical and business entities, including the United Nations' Food and Agriculture Organization (FAO), the World Wildlife Fund (WWF) and the Food Marketing Institute (FMI), responsively incorporated their own sustainable seafood agenda through various technical guidelines, dialogue processes and discussions on sustainable fisheries and aquaculture. Famous standards and certification programmes such as the EuroGAP[4] and the International Standards Organization started to include environmental considerations (CAIA, 2009; FAO, 2011a; Bartholomew, 2012). New bodies and platforms were established, such as the Marine Stewardship Council (MSC), the Global Aquaculture Alliance (GAA), the Aquaculture Stewardship Council (ASC), the Seafood Choices Alliance, and the Conservation Alliance for Seafood Solutions. The abovementioned institutions have become influential in the global seafood market, and set the key sustainability certification standards (CAIA, 2009; FAO, 2011a; www.seafoodchoices.com; and www.solutionsforseafood.org).

The increasing trend for sustainable seafood is highlighted in various market studies. The US market report of 2008 by the Seafood Choices Alliance indicated growing awareness among the three sectors of the seafood value chain (retailers, chain restaurants and wholesalers) of the importance of sustainable seafood and positive environmental practices. The survey found out that sustainable seafood appeared to be a rising trend among the three sectors, based on the percentage of sustainable seafood they were selling at the time of the survey and their expectation that this type of seafood would significantly grow over the next five years. All the sectors were increasingly open to dialogue and interested in obtaining information that could facilitate informed and responsible choices. A majority was concerned about the health of the ocean and its impact on their businesses. Overfishing was seen as a top threat to seafood sustainability

[3] Excluding eggs and dairy.
[4] Later became GLOBALGAP.

by all subsectors, and wholesalers were also concerned about the environmental impacts of aquaculture. Retailers, chain restaurants and wholesalers took action to remove selected seafood choices from their product list because of environmental considerations. In 2007, 37 per cent of the retailers said to have taken such decisions, compared to just 20 per cent in 2001 (Seafood Choices Alliance, 2008). Another survey, the National Restaurant Association's annual survey of chefs, confirms that sustainable seafood is still a rising trend (NRA, 2013).

Similar research was carried out for the European market by the Seafood Choices Alliance. It highlighted a growing concern among consumers about the sustainability issue. They said that environmental considerations were more important (79 per cent on average) than price or convenience when purchasing seafood. Nearly one third of consumers (30 per cent on average) had acted on these concerns by not purchasing seafood with a negative environmental impact on the ocean. While most (91 per cent) agreed that governments must play a primary role in managing seafood resources responsibly, 84 per cent agreed that consumers must take action by boycotting seafood when fishing or farming practices harm the ocean environment. A meaningful segment of consumers said they were willing to pay higher prices for sustainable seafood, with an average price premium of 10 per cent (Seafood Choices Alliance, 2007b).

The Japanese market has for long been reluctant to change its seafood production and consumption practices. However, in March 2014, AEON, Japan's biggest retailer, announced breakthrough commitments as part of a new policy designed to massively improve the environmental performance of the business in response to a determined multi-year campaign launched by Greenpeace in Japan, as well as growing consumer awareness and concern about seafood sustainability. Amongst the commitments is an agreement to eliminate the illegal trading, harvesting and fishing of seafood from its supply chains. Slowly, awareness is growing that, in order to preserve fish stocks, action needs to be taken not only by individual consumers, but also by the many businesses that fish, farm and sell seafood (Greenpeace, 2010; 2014).

Watching these developments, it can be concluded that the sustainability issue started in wild capture fisheries but later expanded into aquaculture. Prominent leading roles are taken by international organizations, non-governmental organizations, and private sector initiatives. In addition, the demand for more sustainably produced seafood is increasing, which provides incentives for the aquaculture sector to pay attention to it. Sustainability has swept through the key markets such as North America, Europe, and Japan and has become an established trend in the world's seafood market.

2.1.2. Certification: a prominent strategy to sustainable seafood production

Certification was first driven by the perceived failure of public governance in the food sector, and was not directly related to sustainable production. Starting in Europe in the 1990s, the business sector started implementing private standards and certification programmes, which often dealt with food safety and quality. The ISO65, which Wal-Mart and the Global Food Safety Initiative (the association of the world's largest and leading food retailers) were committed to, is an example. The sustainability issues were incorporated and became a big item on the agenda in standards and certification programmes (CAIA, 2009).

The main certification schemes relevant to aquaculture are summarized in Annex 2. They can be promoted by retailers, industries, government or environmental non-governmental organizations. Besides the certification schemes for common large volume species and products, there are also "niche" programmes for organic, fair trade products.

The primary focus of standards and certification schemes is much influenced by the interests of the developer, although they may cover a range of aspects. For example, the schemes developed by a single retailer or a group of retailers often focus on quality and safety aspects, those developed by aquaculture producers concentrate on quality assurance, while those developed by environmental NGOs are more directed at the environmental and/or social implications. Most certification programmes contain up to 80 per cent of identical or very similar criteria (CAIA, 2009). Differentiation between standards is usually played out over a few issues of distinction. This is important to keep in mind as companies struggle with an endless variety of standards and certificates. They can comfortably choose a certification programme that can be easily and flexibly adopted, or move to another desirable programme in the future.

Over the last 15 years, the nature and imperatives of certification in aquaculture have changed remarkably and started to focus on the issue of sustainability. Some of the environmental NGOs have actively developed

voluntary certification programmes. At the same time, the private and industry collective standards, which were primarily developed for food safety purposes,[5] have been adapted to include the social and environmental dimensions of sustainability (CAIA, 2009; FAO, 2011a).

There is a growing consensus that sustainability certification programmes can contribute to the sustainability of the aquaculture sector. Internationally recognized sustainability certificates are a growing reality in the seafood sector, and seem to become a permanent feature of the modern seafood environment. They attempt to change attitudes toward sustainable production through market and stakeholder leverage, often at the global, but also at the regional or local levels. For early movers, they are seen as an important mechanism to differentiate, segment and, more importantly, gain or secure market shares. As time goes by, for followers it is becoming an entry permit into markets.

In response to the growing requirement of "greening" the aquaculture business, certification has been promoted as one of the strategies. In spite of its limitations, certification is becoming a prominent trend for sustainable seafood in the key global export markets, which are crucial for Vietnam's aquatic products (Murray, Little et al., 2013).

2.2. A Sustainable Aquaculture Sector in Vietnam

2.2.1. The national uptake of, and compliance with, internationally recognized sustainability standards

The sustainability standards for aquaculture in Vietnam have been introduced in various ways, often with support from donors and NGOs. Since the First National Responsible Aquaculture Workshop in the Mekong Delta in 1996, a variety of internationally recognized sustainability standards have been introduced and successfully certified in Vietnam such as Naturland, GLOBALGAP, ASC, etc. Training and technical assistance have been provided to farmers and enterprises through the cooperation between government, industry associations and NGOs such as WWF.

More recently, local standards have been developed and promoted by both private companies and the government, in order to target the domestic market consumption. The leading company in this field is Metro Cash & Carry, one of the largest food retailers in Vietnam. They introduced in 2011 the MetroGAP standards with a focus on food safety to cover the company's vegetable and seafood product lines. This movement is supported by consumer awareness activities at the stores to inform consumers about good agriculture/aquaculture practices and endangered species (Annex 3).

Standards and certification schemes in Vietnam's aquaculture sector were initially set up in response to food safety concerns. Sustainability concerns, which may be related to food safety but go much beyond that, have only appeared in Vietnam's aquaculture sector at a later stage. Only in 2003, the National Assembly approved the Law on Fisheries, which stated that "the Government shall issue policies to ensure the sustainable fisheries development" (Article 5). In response, the Vietnamese government developed a national plan[6] aiming to develop the fisheries sector in a fast and sustainable manner and combining production with eco-environmental protection.

In 2011, the VietGAP programme – promoting good aquaculture practices - has been established. The programme sets standards and guidelines, builds capacity for accreditation and certification organizations, and promotes the application and certification programmes through trainings. The VietGAP program is based on the FAO's Technical Guideline for Aquaculture Certification and the ASEAN shrimp GAP, taking into account key requirements of the recognized certification schemes. It includes four pillars: food safety, environmental integrity, animal health and socio-economic aspects. VietGAP sets minimum requirements for aquaculture certification, and serves as a stepping stone towards compliance with the major certification programmes, as required by international markets.

5 An exceptional example is Carrefour, which developed "Pêche responsable".
6 The Prime Minister's Decision No. 10/2006/QD-TTg dated 11 January, 2006.

2.2.2. National-level policies and green economy measures in Vietnam's aquaculture sector

The National Green Growth Strategy of Vietnam for 2011-2020 with vision to 2050 was approved by the Prime Minister in 2012. It aims at greening industries and lifestyle, the development of energy and resource-efficient sectors, the promotion of advanced technologies that allow more effective use of natural resources, lower GHG emissions and better adaptation to the effects of climate change.

The Green Growth Strategy sets out the framework and guidelines for transitioning to a greener economy. Agriculture and aquaculture are important sectors to reform in this regard. The strategy emphasises the great interest of the government to transition towards policies that favour green growth in the aquaculture sector.

The rapid development of aquaculture in Vietnam, as described in section 2.1 exposed the country to greater risks, evidenced by disease outbreaks and low export value. In 2001, the white spot syndrome virus (WSSV) broke out in northern and central Vietnam, causing about 34.99 per cent of mortality (Bui Quang Te, 2010). The early mortality syndrome (EMS) caused losses on 100,000 hectares of shrimp aquaculture, mainly in southern Vietnam (DoA, 2012). Therefore, the Government of Vietnam recently paid more attention to supporting and promoting environmental quality.

Since 2010, many policies and plans have been issued to facilitate the development of aquaculture in a sustainable way, with proper care for economic, social and environmental aspects. They relate to the restructuring and development of concentrated production zones, improving linkages throughout the value chain, environmental and natural resource preservation, and the promotion of standards and good governance (Annex 4).

Among the most important policies for aquaculture are the Aquaculture Development Scheme to 2020, issued in 2011, and the Fisheries Development Master Plan to 2020 and Vision toward 2030, issued in 2013, by the Prime Minister. They have the ambitious targets to create 4.5 million tons of aquaculture produce, US$ 5.0-5.5 billion in export sales, 3.5 million jobs and a threefold increase in workers' income by 2020. Pangasius and shrimps are cited among the key cultured species. The formulated targets include 80,000 hectares of industrial farming area and 340,000 tons of production of tiger shrimp, 60,000 hectares and 340,000 tons of white legs shrimp, and 10,000 hectares and 1.8-2.0 million tons of pangasius by 2020. The most relevant policies to standards and certification include the MARD's decisions on VietGAP and its certification scheme, and the recent Government's Decree No. 36/2014/ND-CP imposing compulsory compliance with VietGAP or an international certificate pursuant to Vietnamese laws.

2.3. Assessing the Impact of Sustainability Certification on Aquaculture in Vietnam

Certification in aquaculture is expected to contribute to sustainable development, improving economic performance, salaries and labour conditions as well as environmental quality. The engagement and expansion of smallholder producers in green aquaculture practices and commercialization would create more rewarding jobs in rural areas.

The proliferation of aquaculture certification schemes often leads to confusion among both producers and consumers. Compliance to fragmented certification procedures impose considerable transaction and reporting costs on farmers, which in a globalized market, could make the products more expensive and arguably less competitive. In Vietnam, certification schemes have often been criticized for being applicable only to large-scale producers, neglecting the needs of small-scale producers or widening the market access gap between small-scale and large-scale producers. Improving the trade value of the certified products in the market as well as supporting domestic and international efforts to harmonize the variety of sustainable protocols and standards would be essential for future development.

On the consumer side, the rising purchasing power, education levels, urbanization, demographics, and evolving lifestyles combined with the decline of food prices relative to other goods have led to changes in consumption patterns (Regmi, 2001). While in the past price and visual aspects were main purchase criteria, the intrinsic quality of food has now become a much more important parameter. In addition to

the physical quality of food, consumers are increasingly concerned with the processes of food production and trade, and their impacts on society and the environment. Voluntary initiatives help them demonstrate their commitment and efforts to maintain and improve environmental quality (Regmi, 2001). Even for less proactive companies, it can help minimize the reputational risk arising from consumers and environmental NGOs' collective actions against products and businesses that harm the environments.

Vietnam has comparative advantages for pangasius production, including climate and water availability. It also has the advantage of cultivating giant tiger prawn rather than the lower-value whiteleg shrimp (Minh, 2013). Currently, the pangasius and giant tiger shrimp account for about 70 per cent of the aquaculture trade.

Vietnam currently exports pangasius and shrimp to 156 international markets, most notably in Europe, the US, Japan, South Korea and China. Total pangasius exports reached US$ 1.8 billion in over 140 international markets in 2013. In the same year, shrimp products were exported to about 90 markets, making US$ 3.1 billion revenue (Table 2).

Table 2. Export value of pangasius and shrimp of Vietnam, 2012 – 2013

Items	2012	2013
Pangasius	$1.77 billion	$1.79 billion
Shrimp	$2.25 billion	$3.13 billion

Source: AGROINFO (2014)

The profits of these aquaculture products are declining, due to increasing production costs, unstable export prices as well as various risks of environmental pollution, disease and increased trade barriers in higher-end markets (Minh, 2013). Annually, Vietnam loses US$ 14 million due to aquaculture exports being returned because of quality barriers in foreign markets. Currently, Vietnam is one of the aquaculture exporters whose products are most often refused to be imported in the EU, the US and Japan.[7]

In Vietnam, there is an increasingly common view that the application of export sustainable criteria is a way to improve the value of pangasius and shrimp products on higher-end international markets such as Global GAP, BAP, Naturland and recently ASC. Different international markets use different criteria, which creates additional costs for aquaculture exporters.

Table 3. Import markets for different criteria

No	Certification	Key markets
1	ASC	EU, North America
2	BAP	US
3	Global GAP	EU
4	Ecological Shrimp	Switzerland, Germany

Source: Minh (2013).

Global GAP is more generally accepted in the EU, but it is specifically not acknowledged in the US, which currently accounts for about 20 per cent of the total shrimp and pangasius export volume of Vietnam. Some high-end US markets just accept BAP and ASC criteria.

7 cafef.vn/nong-thuy-san/xuat-khau-thuy-san-vuot-qua-tranh-chap-de-phat-trien-20140422104400410l4ca52.chn

It was reported during the workshop in Can Tho that sustainable certification in the aquaculture sector is an unavoidable trend to stimulate international trade. Over the past 10 years, the volume of shrimp and pangasius products steadily increased. About 15 per cent of the shrimp and pangasius product volume is currently certified, which is still small compared to the current potential production capacity.

Table 4. Area and aquaculture volume certified in Vietnam, 2013

No	Certification	Certified Farms
1	ASC	45 (pangasius)
2	BAP	15 (shrimp) and 10 (pangasius)
3	Global GAP	49 (pangasius) and 3 (shrimp)
4	Ecological Shrimp	5,850 ha (shrimp), no pangasius

Source: www.asc-aqua.org/index.cfm?act=tekst.item&iid=4&iids=204&lng=1
http://ndh.vn/ and Minh (2013)

Most certified products are processed by larger and more advanced companies. The application of sustainable certification contributes to the higher quality of aquaculture products and to a certain extent, improves competitiveness and reputation of the certified exporters on international markets, other things being equal. Nevertheless, the export price of certified products is observed not to be much higher than the price of non-certified products. Many exporters still consider that such sustainable certifications are technical entry barriers into the international markets. Among the most popular standards, the ASC is currently the strictest criteria due to its technical compliance requirements (Minh, 2013).

Smaller farms, cooperatives and households have difficulties applying such standards, as they have limited access to information and face high production (application) costs, including investments in infrastructure, labour and training, while their selling price is still uncertain, given the loose commercial linkages with local processing purchasers.

3. Methodology, Scope and Limitation of the Study

In this study, the methodology of integrated and systemic cost and benefit analysis (CBA) has been applied to the adherence to sustainability certification and eco-labeling schemes. The costs and benefits have been measured through the following components:

(i) *Investment:* from a private sector perspective, investments refer to the monetary costs of complying with sustainability standards, including, for example, annual certification fees, auditing and other management costs related to certification, as well as the costs for greening production (e.g. the purchase of machinery and the transformation of production processes and techniques, potential additional labour and training costs). From a public sector point of view, investment refers to the allocation and/or reallocation of financial resources with the aim of creating the enabling conditions for the development of sustainable businesses in a given country.

(ii) *Added benefits:* the monetary evaluation of economic, social and environmental benefits deriving from sustainability certification, focusing on impacts in the short, medium and long run across sectors and actors. These include enhanced access to markets, or the availability of premium prices for certified products.

(iii) *Avoided costs:* the estimation of potential costs that could be avoided as a result of the successful adherence to sustainability principles and processes. These refer to the use of green production practices (as a result of sustainability certification) and may include direct savings deriving from a more efficient use of natural resources, as well as indirect avoided costs, e.g. health expenditure, avoided losses from environmental degradation, and avoided payments for the replacement of key ecosystem services.

Annex 5 provides an overview of the different indicators that have been used to measure the three components.

The data used in the cost-benefit analysis was collected through surveys and complemented by interviews and focus group discussions with relevant government agencies and industry stakeholders during field visits. These served to verify and expand the findings from survey questionnaires, facilitate an understanding of the best practices of compliance with sustainability standards, and feed into the development of cost-benefit analyses of standards compliance. The data is further complemented by a literature review and a workshop where various stakeholders were consulted.

Population:

All the pangasius farms in Vietnam are located in the 10 provinces of the Mekong delta, with the highest concentration in the freshwater area of Dong Thap, An Giang, Can Tho and Vinh Long. There are shrimp farms in every coastal province throughout Vietnam, but most of them, including sustainability-certified ones, are also in the Mekong Delta, especially in Ca Mau, Bac Lieu, Kien Giang and Soc Trang. It is estimated that there are 20 shrimp farms and 40 pangasius farms with international or national sustainability certification in the Mekong delta.

The pangasius processing enterprises and most shrimp processing enterprises are also located in the Mekong delta. Out of more than 200 processing companies in the Mekong delta, only about 60 enterprises process certified products.

Sampling design:

It was not intended to study hatcheries, input suppliers, collectors or transporters. Although they supply the certain type of products or services that are allowed in certified aquaculture, a full certification for the operation itself is not often required, except for the hatcheries. It was not intended to study non-certified farms or processors either. Only farms or processors that had been certified for production or processing of shrimp and pangasius for at least one season were studied.

As the total number of certified farms and processors that met the one-season requirements was rather small, the project's survey actually studied every accessible unit, rather than taking a 10-20 per cent sample.

Sample:

In total, 70 farms and processors in 10 provinces of the Mekong delta were interviewed. After filtering out the uncompleted questionnaires, 55 "good" responses were eventually used in the study, including 24 from farming establishments and 31 from processing and exporting companies. Details are as below:

No.	**Provinces**	**Processing Company/Enterprise**	**Aquaculture Unit**
	Pangasius	**14**	**12**
1	Ben Tre	2	2
2	Đồng Thap	0	4
3	Can Tho	5	3
4	An Giang	3	2
5	Vinh Long	1	0
6	Tien Giang	3	1
	Shrimp	**17**	**12**
7	Soc Trang	1	3
8	Bac Lieu	4	2
9	Ca Mau	11	6
10	Kien Giang	1	1
	TOTAL	**31**	**24**

A sample of 70 farms and processing enterprises in nine provinces of the Mekong delta were surveyed. This includes the four largest provinces for shrimp production and five for pangasius production. 55 questionnaires, after pre-testing with aquaculture producers and processing enterprises, were filled out completely, of which there are 24 farms and 31 processing enterprises.

4. Cost-Benefit Analysis of Sustainability Certification in the Vietnamese Aquaculture Sector

This section provides a detailed cost-benefit analysis of adherence to sustainability certification in Vietnam's shrimp and pangasius aquaculture. The economic, social and environmental effects are analysed on the basis of the results of the surveys conducted. The objective is to examine the current and potential cost and benefits of sustainability certification in shrimp and pangasius aquaculture, in order to better facilitate investment decisions for producers and exporters, as well as strategic decisions for policy makers.

4.1. The Overall Cost-Benefit Analysis

This section consists of an integrated cost-benefit analysis, aggregating all the results from the surveys into a single indicator framework, and comparing average costs and benefits of certified and non-certified products. The objective is to provide an overarching analysis of the potential returns derived from greening measures in Vietnam's aquaculture sector.

The analysis conducted in this section uses the data collected and presented throughout the report, but it considers the average values of key cost-benefit indicators. More precisely:

- *Price:* calculated as the weighted average of the selling price, estimated using the volume produced by each surveyed farm. This price is calculated based on the prices of both conventional and certified production identified in the study.
- *Yield:* the yield is calculated as an average of the yields from each farm, and is measured on a per hectare basis.
- *Sales:* for farmers, revenues are calculated as the average yield multiplied by the average selling price; for processors/exporters, sales are calculated multiplying total annual exports by the average export price.
- *Cost:* The cost of production is calculated as a weighted average of all production costs indicated in the study, using the volume produced/exported by each farm/exporter. For certified products, the annual certification fees and extra labour costs are included in the calculation of the annual production costs.
- *Profits:* Net revenues are calculated as the difference between sales and production costs.

4.1.1. Shrimp farmers

The average price of certified shrimp is 32 per cent higher than the price of non-certified shrimp. In particular, the surveyed farms sell certified shrimp at an average price of VND 216.43 million (around US$ 10,000) per ton, compared to an average price of VND 163.82 million (US$ 7,800) per ton for non-certified shrimp. The average yield is 8 per cent higher in certified farming areas, being 7.48 tons per hectare against 6.92 tons per hectare in non-certified areas. However, the costs of production are 2.9 per cent higher in certified farms. In particular, the average cost of certified shrimp production is VND 65.72 million (US$ 3,000) per ton, while it amounts to VND 63.81 million (US$ 3,000) per ton in non-certified farms. As a result, the average unit profit of certified production is 63 per cent higher than for non-certified shrimp, corresponding to an increase in average profit per hectare of VND 436 million (US$ 21,000). The profit margin (defined as profits over revenues) is 9 per cent higher for certified production.

4.1.2. Shrimp processors / exporters

The surveyed shrimp exporters sell certified shrimp at a higher price compared to non-certified shrimp, but the price difference is smaller than in the case of shrimp farmers. The average export price is VND 311.88 million (US$ 15,000) per ton for certified shrimp and VND 256.43 million (US$ 12,000) per ton for non-certified shrimp, corresponding to a 21.6 per cent price differential. Also, the total amount

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of exported shrimp is higher for certified processors, as a result of the higher productivity of certified farming. More precisely, the average annual exports are 5,077 tons, compared to 4,718 tons of non-certified shrimps. For the processors, the additional costs of compliance with sustainability standards is VND 240.74 million (US$ 11,000) per ton, 13.5 per cent higher than under the conventional processing methods. When considering the total profits, certified exports obtain returns 72.5 per cent higher than non-certified exports. The profit margin is 6 per cent higher for certified products.

4.1.3. Pangasius farmers

Pangasius farmers benefit from slightly higher average prices when growing and selling certified pangasius. The average selling price is VND 22.7 million (US$ 1,080) per ton of certified fish and VND 22.27 million (US$ 1,060) per ton in non-certified fish, corresponding to just a 1.9 per cent price differential. However, the economic returns from increased selling prices for certified products are offset by the slightly higher production costs and lower yields in certified areas. The survey results show that the average production cost is 2.3 per cent higher and the average yield is 13.9 per cent lower in certified areas, compared to non-certified ones. As a result, certified production obtains 30 per cent lower profits than non-certified production, corresponding to a decrease in average profit per hectare of VND 144 million (US$ 6,900).

The difference between the two production modes becomes less remarkable when considering the profit margin. In particular, the profit margin in surveyed certified production is 1 per cent lower than in conventional production.

4.1.4. Pangasius processors/exporters

For processors and exporters, the average export price of certified pangasius is slightly higher than the price of non-certified products. The price of certified products is VND 49.96 million (US$ 2,400) per ton, while the price of non-certified products is VND 47.78 million (US$ 2,300) per ton, corresponding to a 4.5 per cent differential. The processing costs are VND 43.87 million (US$ 2,089) per ton for certified pangasius, and VND 43.58 million (US$ 2,075) per ton in case of conventional processing methods, corresponding to a price differential of only 0.6 per cent. Results show that certified exporters obtain profits 58 per cent higher relative to conventional ones. Considering the profit margin, it was calculated that certified exporters obtain 12.2 per cent compared to 8.8 per cent under conventional methods, corresponding to a 3.4 per cent margin differential.

Table 5. Summary comparative table of the cost-benefit analysis of certified and conventional production

Production	Certified production							Conventional production							Comparison			
	Price	Yield	Sales	Cost (including annual certification fee)		Profit		Price	Yield	Sales	Cost		Profit		Sales differential	Profit differential		Profit margin differential [8]
	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ha	Mn VND/ha	%	%
Shrimp - farm	216.43	7.48	1,619	65.72	492	150.71	1,128	163.82	6.92	1,134	63.81	442	100.01	692	486	435	63%	9%
Shrimp - Processors/ Exporters	311.88	5077	1,583,426	240.74	1,222,253	71.14	361,174	256.43	4718	1,209,827	212.07	1,000,547	44.36	209,280	373,599	151,894	73%	6%
Pangasius - farmer	22.70	333.81	7,577	21.70	7,245.21	1.00	332	22.27	380.18	8,466	21.02	7,990	1.25	476	(889)	(143)	-30%	-1%
Pangasius - processor/ exporter	49.96	8136	406,466	43.87	356,918	6.09	49,548	47.78	7465	356,640	43.58	325,287	4.2000	31,353	49,826	18,195	58%	3.4%

Source: own calculations from the survey

[8] Profit margin is defined as profits over revenues.

4.2. Detailed Cost-Benefit Analysis for Certified Shrimp

4.2.1. Overview of certified shrimp

4.2.1.1. Farms

Table 6 below gives an overview of the number of farms in the survey and their certification, as well as the corresponding certified production volume. BAP/GAA compliance was prevalent within the survey sample[9]. The BAP-certified farms contributed the largest share of production volume, with almost 4,300 tons per cycle (75 per cent of the total certified production volume), although BAP-certified areas accounted for only 34 per cent of the total farming area in the sample. Farms with a GLOBALGAP certificate were second and supplied 37 per cent of the total production volume. The prevalence of the national certificate VIETGAP was very modest.

Half of the sample consisted of smaller-sized farms, with less than 50 hectares per farm. The medium-sized farms (50-100 hectare per farm) in the sample accounted for 11 per cent of the total farming area. There were two large-sized farms (over 100 hectares per farm) in the sample, and one extremely large farm (over 1,000 hectares per farm), accounting for 25 per cent and 58 per cent of the total farming area. The large-sized farms were the most important producers in terms of volume since they contributed about 44 per cent to the total production.

Most shrimp farms in the sample applied the industrial farming method. They supplied about 78 per cent of the total production volume, using only 35 per cent of the total farming area. The four practitioners of the eco-farming method, including the extremely large farm, contributed the remaining 22 per cent of the total production volume and accounted for 65 per cent of the total farming area. All eco-farms in the sample gave no feed to the shrimp. They maintained relatively low density so that the cultured shrimp could feed themselves from the natural environment. In term of sustainability, this is one of the most sustainable methods of production and does not put much burden on the surrounding environment. However, it requires a relatively large area, and space is limited in the Mekong Delta, where aquaculture competes with other species and crops for land and water use.

[9] It should be noted that a farm can maintain more than one certificate at the same time for the same area and production volume.

Table 6. Shrimp farm distribution by certificate, size and farming method

	No. of farms	Farming area (ha)	Certified production volume (MT/cycle
All	12	1,869.3	5,676
Distribution by certificate*			
VIETGAP	1	15.0	150
		1%	3%
GLOBALGAP	3	377.0	2,100
		20%	37%
BAP/ GAA	6	630.3	4,271
		34%	75%
Friend of the Sea	4	137.0	976
		7%	17%
Naturland/ IMO	1	1,087.5	500
		58%	9%
Distribution by size			
< 50 ha	6	112.0	946.0
		6%	17%
50-100 ha	3	202.8	1,730.0
		11%	30%
> 100ha	2	467.0	2,500.0
		25%	44%
> 1,000ha	1	1,087.5	500.0
		58%	9%
Distribution by farming method			
Eco-farming	4	1,224.0	1,255.0
		65%	22%
Industrial farming	8	645.3	4,421.0
		35%	78%

* A farm can maintain more than one certificate for the same area and production volume
** VIETGAP is the national sustainability standard of Vietnam. Though it has not been recognized internationally, it is useful in the domestic market and is intended to serve the sustainable development purpose of the aquaculture sector in Vietnam.
Source: own survey

4.2.1.2 Processors

The shrimp processors in the sample processed a wide variety of shrimp with internationally recognized certificates. Similar to the shrimp farms, the most common certificate among the processors was BAP/GAA (8 out of 17 processors, or 47 per cent, offer BAP-certified shrimp products), followed by GLOBALGAP (4 processors or 23 per cent) and Friend of the Sea (3 processors or 18 per cent). Naturland / IMO and the national certificate of VIETGAP were offered by only one company each (Table 23). The processors that were interviewed attribute this occurrence to i) the large number of orders for the more popular types of certificate in the shrimp sector; and ii) the availability of raw material for shrimp with such certificates. This finding is consistent with the finding on the most common types of certification in the farm sample.

4.2.2. Investment and costs in certified shrimp

4.2.2.1. Investment

a) Investment in certification of shrimp farmers

The shrimp farms in the sample invested in total VND 104.90 billion (US$ 5 million) in start-up investment and paid an additional VND 750 million (US$ 36,000) every year for the annual renewal of their sustainability certificates. A farm paid on average VND 8.74 billion (US$ 420,000) on one-off start-up investment and VND 62 million (US$ 3,000) every year for the renewal fee. On average, the total start-up investment was VND 56.1 million (US$ 2,700) per hectare of certified farming. Allocated by the certified volume per cycle, the average cost per ton was just VND 18.5 million (US$ 880). The annual renewal fee was tiny, on average VND 0.40 million (US$ 19) per hectare or VND 0.13 million (US$ 6.3) per ton. However, it should be noted that the certification cost and annual renewal is not variable upon the number of hectares. It is a fixed amount up to a certain level of farming acreage and only changes at the next level, leading to smaller farms paying more per hectare than larger farms.

Infrastructure renovation was the major investment made. It accounted for 98 per cent of the start-up investment costs, or VND 55.0 million (US$ 2,600) per hectare. Training and consultancy, initial certification and compliance together made up only 2 per cent of start-up investment costs (Table 25).

Even the smallest farm in the sample, which had 15 hectares of certified farming, reported that the start-up investment and annual renewal were *not too big an investment*. However, the majority of smallholder farmers in the Mekong Delta face two challenges when attempting to join certification programmes. The first challenge is posed by the start-up investment and the certification fee, which would be too costly for their limited cash income. The second challenge is the need to convert some aquaculture ponds to water treatment ponds to comply with the requirements of the certificate, which would leave them with even smaller farming areas. It would require some kind of enabling policies, for example incentives for grouping smallholder farmers, to reach economies of scale.

b) Investment in certification of shrimp processors

The shrimp processors in the sample invested in different processing certificates, including BAP, BRC, IFS and ISO. Some of these are not directly related to sustainability certification, but are still required to access the destination market for the certified shrimp. From the business point of view, this should be associated with the costs of certification. Certified products are destined to some, often more developed, consumer markets that impose higher processing standards. Therefore, the processors are only able to sell to such markets if they make additional investments in standardization and certification for the processing facilities.

The shrimp processors in the sample invested in total VND 6.568 million (US$ 310,000) in start-up investment and paid an additional VND 882 million (US$ 42,000) every year for annual renewal of their sustainability-related certificates. On average, a processor paid VND 386.35 million (US$ 18,000) for the total start-up investment and VND 51.88 million (US$ 2,500) for the annual renewal fee. This was reported affordable for the processors in the sample, who processed an average of 5,000 tons of finished products per year on average.

Similar to the shrimp farmers, infrastructure renovation was the major investment cost item for the shrimp processors. It accounted for 82 per cent of the total start-up investment costs. Initial certification accounted for 15 per cent and all other costs for only 3 per cent.

4.2.2.2. Production costs

a) Production costs of farmers

Certification added to the total production costs of the shrimp farmers in the sample, but the certification cost was relatively small.

The production costs of shrimp farmers consists of breedstock, feed, medicine, chemicals, labour, and other production costs, including the environmental treatment costs, allocated certification investment, etc. The first four are the major cost items and are more likely to change because of certification. The other production costs, including the environmental treatment costs and allocated certification investment, do not have a significant effect on the total production costs of certified products, since this item is very small in the cost structure, and thus is not presented as a separate item in the analysis.

The average production cost of the internationally certified products in the last shrimp season of 2013 was VND 65.47 million (US$ 3,100) per ton in the whole sample, 2.5 per cent higher than the production cost of the non-certified products in the same cycle. 7 out of 11 farms in the sample experienced an increase in the production costs, ranging from 0.1 to 6.7 per cent. Four farms recorded no significant variance in the production cost per ton of certified product, in comparison to the cost of a non-certified product.

However, it would be more useful to look at the costs of eco-farming and industrial farming separately, as the different farming methods have different cost structures, resulting in different levels of average production costs per ton.

The industrial farms in the sample had an average cost of internationally certified shrimp of VND 79.57 million (US$ 3,800) per ton, which was 2.4 per cent higher than the average costs per ton of non-certified shrimp. The increase in production cost per ton was recorded in 5 out of 7 farms, ranging from 0.1 to 6.7 per cent. The change in production costs was mainly driven by higher costs of brood stock, medicine and chemicals, and labour (4.8, 4.5 and 2.4 per cent increase on average, respectively). The farms had to purchase certain types of broodstock, medicine and chemicals at a higher price, and spent more on labour in order to complete an increased amount of paperwork to comply with the standards.

Out of the 7 farms, only 1 had a slightly higher feed cost, 4 had the same and 2 had a lower cost. The farms also had to pay a higher price for the higher-quality feed and sustainability certificate, but in many cases it was neutralized by the higher survival ratio and feed conversion rate, thanks to healthier broodstock and better farm management processes. Overall, the average feed cost of certified products was 0.5 per cent *lower* than the non-certified products in the sample.

The average cost of the eco-farms in the sample was VND 21.97 million (US$ 1,000) per ton for internationally certified shrimp, which was 3.0 per cent higher than the average costs per ton of non-certified shrimp. As the eco-farms had insignificant costs of feed, medicine and chemicals, the higher production costs were mainly attributable to higher costs of labour (on average 25.6 per cent higher than in the case of a non-certified product) and brood stock (5.4 per cent higher). Similar to the industrial farms, the eco-farms had to hire more workers and pay them better for the completion of more paperwork and a more complex management process. They also had to pay for higher-quality broodstock and for the sustainability certificate to comply with the standards.

The production costs of the VIETGAP-certified shrimp was VND 7.6 million (US$ 360) per ton, 4.1 per cent higher than the production of non-certified product in the same cycle of production. The feed cost was 11 per cent higher and the breedstock cost was 17 per cent higher than the costs of a non-certified product. Higher-quality breedstock and feed resulted in less use of medicine and chemicals, leading to a lower cost. No difference in the labour cost was reported, as VIETGAP did not require much more paperwork or a more complex management process.

Table 7. Change in production costs per ton of internationally certified versus non-certified shrimp

	Total production costs	By key cost items			
		Breedstock	Feed	Medicine, chemical	Labour
Change in production costs of certified vs. non certified (mil. VND/MT)					
All	1.57	0.19	-0.16	0.41	0.26
Eco-farming	0.64	0.14	-	-	0.50
Industrial farming	1.88	0.21	-0.21	0.55	0.19
% change in production costs of certified vs. non certified					
All	2.5%	4.9%	-0.5%	4.5%	4.1%
Eco-farming*	3.0%	5.4%	-	-	25.6%
Industrial farming	2.4%	4.8%	-0.5%	4.5%	2.4%
Average production costs of certified product (mil. VND/MT)					
All	65.47	4.12	30.76	9.65	6.67
Eco-farming*	21.97	2.79	-	0.02	2.44
Industrial farming	79.57	4.55	40.74	12.77	8.04
% of cost item in the cost structure of certified product					
All	-	6.3%	47.0%	14.7%	10.2%
Eco-farming*	-	12.7%	-	0.1%	11.1%
Industrial farming	-	5.7%	51.2%	16.0%	10.1%

* No feed cost in eco-farming method
Source: own survey

b) Environmental treatment costs

There was *no big difference in the environmental treatment costs* between the farms for certified and non-certified production. Out of the 11 internationally certified farms, only 3 farms reported an increase in the total environmental treatment costs. All together, the internationally certified farms in the sample spent VND 2,292 million (US$ 110,000) on environmental treatment, of which 90.4 per cent went to water treatment. The average cost per hectare was VND 3.26 million (US$ 160) on water treatment and VND 3.61 million (US$ 170) on all environmental treatment among industrial farms. The environmental treatment costs were insignificant among eco-farms.

The total environmental treatment costs of all the shrimp processors in the sample increased slightly (5 per cent) after certification, but the environmental treatment costs per ton actually decreased by 2 per cent. Environmental treatment costs are an insignificant component of the total production costs, with an average of only VND 63,748 (US$ 3) per ton. For processors, 92 per cent of the costs went to water treatment.

4.2.3. Economic benefits from certified shrimp

This section analyses the economic benefits related to sustainability certification in shrimp production, processing and export. Following the analytical framework, it examines i) the change in the market price, ii) the change in the profit margin per ton, iii) the change in access to markets, as indicated by the sales volume, and iv) the change in revenues as a result of an improved reputation. The purpose is to identify and measure the direct and indirect economic benefits, if any, related to certification.

4.2.3.1. Significant increase in price of certified versus non-certified shrimp in farming

The data from the sample shows that sustainability certification led to a significant increase in the price.[10]

In the last season of 2013, the selling price for certified shrimp was 10 per cent higher than the price for non-certified shrimp. On average, a ton of certified shrimp was sold for VND 19.41 million (US$ 940) more than a ton of non-certified shrimp. 11 out of 12 farms in the sample, with both international and national certification, received a higher price for certified shrimp, compared to the non-certified shrimp sold at the same point in time.

Table 8. Change in selling price of shrimp with and without certification

Average selling price (mil. VND/MT)	Certified shrimp	Non-certified shrimp	Difference	% change (with vs. without)
Whole sample	216.43	197.02	19.41	10%
Farm with national certification	180.00	175.00	5.00	3%
All farms with international certification	217.32	197.56	19.76	10%
Including:				
Eco-farms	*275.30*	*244.14*	*31.16*	*13%*
Industrial farms	*198.51*	*182.45*	*16.06*	*9%*

Source: own survey

4.2.3.2. Significant increase in profit margin of certified versus non-certified shrimp

The data from the sample shows that sustainability certification resulted in a significant increase in the profit margin.

Overall, in the last season of 2013, the profits from shrimp were 15 per cent higher than from non-certified shrimp. A farm in the sample earned on average VND 17.88 million (US$ 850) more per certified ton than per non-certified ton. 11 out of 12 farms in the sample, with both international and national certification, received a higher profit margin for certified shrimp, compared to the non-certified shrimp sold at the same point in time. The only one farm that did not have a price increase recorded a minor decrease in profit margin.

The level of change in the profit margin was the lowest for national certification, higher for eco-farming with international certification and reached the highest level for industrial farming with international certification. Profit margins for VIETGAP-certified shrimps were 2 per cent higher, equalling VND 2 million (US$ 95) more per ton compared to non-certified shrimp. Eco-farms with international certification earned VND 31.14 million (US$ 1,482) more per ton of certified product, between 4 and 15 per cent higher, 14 per cent being the average.

Although the internationally certified industrial farms earned only VND 14.1 million (US$ 670) more per ton of certified product, it represented an increase 16 per cent. The industrial farms often had a much smaller profit margin than the eco-farms due to higher production costs and a much lower selling price. The change in profit margin ranged from minus 1 to 32 per cent among the industrial farms in the sample.

The increase in the profit margin indicates that we have a net economic benefit from certification.

[10] The effect of certification on the selling price was examined based on a with/without scenario, meaning that the selling price for certified shrimp was compared to the price for non-certified shrimp at the same point in time. This method is expected to eliminate the price fluctuation in the market and reveal the real premium received by the certified product, if any.

Table 9. Change in the profit margin for shrimp with and without certification

Average profit margin per ton (mil. VND/MT)	Certified shrimp	Non-certified shrimp	Difference	% change (with vs. without)
Whole sample	139.26	121.38	17.88	15%
Farm with national certification	102.00	100.00	2.00	2%
All farms with international certification	140.17	121.90	18.27	15%
In which				
Eco-farms	*253.32*	*222.18*	*31.14*	*14%*
Industrial farms	*103.48*	*89.38*	*14.10*	*16%*

Source: own survey

4.2.3.2. Increase in sales volume before and after certification

The data from the sample shows that sustainability certification resulted in a considerable increase in the sales volume.

The effect of certification on the sales volume was measured by comparing the tonnage of sales from the same farming area before certification and in the last season of 2013. In overall, the sales volume increased by 12 per cent since certification, equivalent to 565 tons. 7 out of 12 farms in the sample had a higher volume of sales in the last season of 2013 compared to the last season before certification. That included two eco-farms with 11 to 25 per cent increase in volume, and four industrial farms with increases of 9 to 50 per cent. The one farm with VIETGAP national certification had a modest change of 4 per cent, partly because it was not certified until February 2013.

The hard data on volume increase was supplemented by a question measuring whether or not the respondent thought that their product sold better after certification. Again, 11 out of 12 farms in the sample, with both international and national certification, agreed or highly agreed that their products sold better. It reinforced the hard data analysis on sales volume of certified products. The discussion with the respondents also revealed that certification provided a kind of assurance for the quality and accountability of the processing and farming businesses, and thus to some extent promoted its reputation and branding, even benefiting the sales of non-certified products.

4.2.3.3. Additional revenues from improved corporate reputation

Certification could have indirect economic benefits for processors, as a result of an improved corporate reputation. In this study, this indicator was measured by the change in export revenue of the processors after certification insofar as it was explicitly related to i) an increase in export volume, ii) an increase in the average export price, or iii) both.

The increase in farmers' revenues was not included in this analysis, since i) it was already counted under the farmers' direct economic benefits as a result of higher sales volumes or selling prices, and ii) certified products were destined to export rather than domestic markets, and marketed by the processors, not the farmers. Therefore, it can be assumed that improved corporate reputation, if any, was an indirect benefit for the processors. In this study, many processors reported that customers asked for certified products and that orders increased after the products were offered. Some processors also reported that they enjoyed better export prices because they could deliver certified products.[11]

[11] It should be noted cases were excluded from the sample, if the processors reported that their volumes or prices improved because they had certification, but also because the market had more demand. In those cases, it was not clear whether the change in revenue was directly related to certification or not. As a result, the analysis below reflects a conservative assessment of the impact of certification on processors' revenue.

Out of the 17 shrimps processors in the sample, 9 reported a change in export revenue in direct relation with certification. In one case, this occurred thanks to increased orders after certification, in one case thanks to a better price, and in another four cases both factors played a role. Most processors reported a positive change, but one saw a slight decrease in volume, due to the fact that the company could not purchase enough certified raw material to meet export orders. However, the negative change in volume was absorbed by the positive change in price, and in overall the company had an additional revenue of 9 per cent after certification.

Regarding the value of the revenue change, the total amount of additional revenue from certification among the 9 companies was VND 3,994 billion (US$ 190 million), representing a 19 per cent increase in the total export revenue of all the shrimp processors in the sample. Most of the additional revenues came from the 4 processors that saw both volumes and prices increase.

In this sample, it looked like the price improvement had a smaller impact on revenue than the volume increase. The companies benefiting from improved prices while volumes did not change or decreased, reported an increase in revenue between 6 and 19 per cent. The company that benefited only from a higher volume saw its export turnover increase with 52 per cent, and the companies benefiting from both better volumes and prices saw an increase in revenue between 55 and 101 per cent.

Table 10. Change in export revenues resulting from processors' improved corporate reputation

	Total	Disaggregation by driver for change		
		Both volume & price	Price only	Volume only
Change in revenue resulting from certification (difference in million VND)	3,993,531	2,979,953	621,378	392,200
% change compared to total revenue before certification	19%	14%	3%	2%
Number of businesses having additional revenues	9	4	4	1

Source: own survey

4.2.4. Social benefits from certified shrimp

This section discusses the additional social benefits resulting from a private sector investment in shrimp certification. The key benefits included job and income generation for workers at the certified shrimp farms and processing factories. For the private sector, they represented costs rather than benefits since the farms and processors had to spend more to employ additional workers. However, for the society this is an indirect added benefit and should be integrated in the total cost-benefit model.

The data from the shrimp sample shows that sustainability certification resulted in a net increase in job creation and in overall social benefits for workers. The net social benefits came from certification-driven new jobs and the additional income they earned from general salary increase.

4.2.4.1. The key workforce figures

In 2013, the farms and processing factories in the shrimp sample employed in total 15,430 workers, of which 450 were involved in farming and 1,980 in processing. The average salary was VND 47 million (US$ 2,200) per person per year. A farming worker earned an average salary of VND 54 million (US$ 2,600) per year, which was 18 per cent higher than the average salary of processing workers.

Table 11. Key labour force figures of shrimp businesses in 2013 (after certification)

	Number of workers in 2013	Average salary per year in 2013 (mil. VND)	Average salary per month (mil. VND)
Shrimp			
All businesses	15,430	47	3.89
Farms	450	54	4.50
Processors	14,980	46	3.81

Source: own survey

4.2.4.2. Job creation for workers at certified shrimp farms and processing factories

59 per cent of businesses in the shrimp sample employed more workers in 2013 than in the year before certification. In total 1,166 new jobs were created. Only a part of these new jobs were related to certified aquaculture.

A more in-depth analysis shows that only 6 farms and 4 processing factories (34 per cent of the shrimp businesses in the sample) reported an increase in employment and explicitly linked it with certification. The farms needed more workers to complete stricter requirements for paperwork and record-keeping and to monitor the ponds more closely. Further, they needed more workers to assure a higher quality and to expand production. It is observed that certification has both a positive and a negative impact on jobs. One company in the shrimp sample even reported a 2 per cent decrease in employment and explained that i) their sales volume decreased because they could not purchase enough BAP-certified raw shrimp; and ii) they could not find workers with the higher skills required for processing certified products. The net job creation linked with certification in the shrimp sample was 597 new jobs, representing a 4 per cent increase compared to the year before certification. 37 net jobs were created in farming (a 9 per cent increase compared with the year before certification) and 560 in processing (a 4 per cent increase).

Table 12. Job creation linked with certified shrimp

	Shrimp
All new jobs linked with certification	597
% job creation*	4%
New jobs in farming	37
% job creation*	9%
New jobs in processing	560
% job creation*	4%

* Jobs created in the year 2013 after certification, compared to the year before certification

4.2.4.3. Income generation for workers at certified shrimp farms and processing factories

Workers in 69 per cent of businesses (20 out of 29) in the shrimp sample were better paid in 2013 compared to the year before certification. The average annual salary increased by 5 per cent (VND 2.1 million or US$ 110 per person per year). The level of salary improvement was very minor in farming: on average a worker earned just VND 0.4 million (US$ 21) or 1 per cent more per year. In processing, every worker made VND 2.4 million (US$ 110) more in annual salary, or 5 per cent more. The most common reasons for increasing salary were the following: i) the businesses had to keep up with the increasing living standards (7 businesses), ii) workers were paid more for their higher skill level (5 businesses), and iii) workers were paid more for higher productivity. However, there was no significant evidence that such increases in salary were related to compliance with sustainability standards.

4.2.4.4. Net social benefits from certified shrimp

Given the net job creation and the average salary in the shrimp business, it was estimated that compliance with sustainability standards helped create a net income for workers of VND 27.84 billion (US$ 1.33 million). 95 per cent of this amount (VND 26.45 billion or US$ 1.26 million) was solely related to certification (increased the number of jobs thanks to certification) and the remaining 5 per cent (VND 1.39 billion, or US$ 0.07 million) was related to certification-driven new jobs and salary rises.

4.2.5. Environmental benefits

This section discusses the environmental benefits directly related to the private sector investment in shrimp certification. The key benefits included the improved sustainability of aquaculture production, improvements in the surrounding environment and the relationship with the community. Most of the benefits were generated in farming and contributed to improving the performance of farms. The only direct benefit from greening the processing was related to a reduction in water pollution.

The data from the shrimp sample shows that sustainability certification contributed to an improvement of all key sustainability indicators related to yield, survival ration and feed conversion. Cost savings were already achieved after a short time and are expected to increase in the long run. The other key environmental effects related to water pollution and the surrounding environment have all been assessed as positive.

4.2.5.1. Improved key indicators of the sustainability of the production

In this study, three indicators were used to assess the potential for sustainable production: i) the survival ratio, ii) the feed conversion rate (FCR), and iii) the yield. The environmental impact of production were measured by comparing the "after" to the "before" values.

The key indicators of sustainable production were improved in many farms in the sample.

8 out of 12 shrimp farms recorded an improved survival ratio, 4 farms had lower FCRs and 7 farms had a higher yield per hectare of certified farming.

In the last season of 2013, the shrimp farms in the sample recorded a survival ratio of 68 per cent, the average FCR was 1.18 and the average yield 3.34 tons per hectare. All the three indicators were higher than before certification. The survival rate increased by 8 per cent, the average yield increased by 12 per cent or 0.35 tons more per hectare, and the FCR decreased by 5 per cent or 0.06 kilo of feed per kilo of weight.

The level of improvement, however, varied among different farming methods and different certificates. The survival ratio increased by 11 per cent (from 43 to 54 per cent) in eco-farming, higher than in industrial farming (from 65 to 72 per cent, or a 7 per cent increase). Both farming methods had the same level of yield improvement of 12 per cent. As feed did not apply in eco-farming, the FCR improvement actually came from the 8 industrial farms, which had an average FCR decrease of 5 per cent (from 1.60 to 1.52 kilo of feed per kilo of yield).

Among the five key types of certification, the highest level of improvement in the survival rate was observed among the 3 farms with Friend of the Sea, increasing by 13 per cent, from 70 per cent before to 83 per cent after certification. They also enjoyed the largest yield improvement, from 6.23 to 7.11 tons per hectare, or a 14 per cent increase. Two eco-farming businesses with Friend of the Sea-certifications did not apply feed, and the FRC remained unchanged in the third one, so no change in the FCR was recorded in this sub-group. However, across the sample, there was no statistically significant evidence that the different level of improvement in production sustainability indicators was linked to the different type of certificate. No improvements were recorded in the farm with Naturland/IMO[12] (Table 29).

[12] It was, however, challenging to collect data and detect a change in this very special business, as it applied extensive eco-farming on a huge mangrove forest area of more than 1,000 hectares. This farm was unique in the survey sample.

4.2.5.2. Potential for cost saving

As the feed conversion rate improved after certification, a saving in feed costs could be expected. Given the volume of production in the last season of 2013, it was estimated that 316 tons of feed was saved in shrimp farming. If the farms produced the maximum certified volume, the total saving on feed could be up to 342 tons. These figures could be much higher if the FCR continues to improve in the future.

Given that the average feed price in 2013 was VND 35,000/kg for shrimp, the total saving was estimated at about VND 11.05 billion (US$ 0.53 million) on the total production volume of the last season in 2013. Based on the maximum production volume, the total saving on feed costs could reach as high as VND 11.95 billion (US$ 0.57 million). These analyses reinforced the previous observations in many farms that the feed cost remained unchanged despite the higher prices for certified feed in compliance with the internationally recognized sustainable standards.

4.2.5.3. Other environmental benefits

Beside the indicators of sustainable production, which applied in farming only, certification had different environmental effects on processing. The key potential benefits in farming included less disease breakout, better environmental treatment leading to better survival rates, a better surrounding environment and improved relationships with the community[13] leading to lower losses. Lower water pollution rates were the only key potential benefit in processing that had a direct link with certification. The businesses in the sample were asked to assess the improvement of those dimensions after obtaining certification.[14]

In farming, 8 out of 12 shrimp farms incurred less losses from better environmental treatment, 10 farms had a better surrounding environment, and 10 farms incurred less losses as a result of improved relationships with the community. In processing, 14 out of 17 shrimp processors reported less water pollution. Such improvements helped reduce losses for the business, which is expected to contribute to better business performance in the long run.

The average scores for the four dimensions were 3.95.[15] It should be noted that these variables were supposed to quantify the subjective assessment of the businesses, and were not based on hard data. In most cases, the score levels were close to 4. It implies that the respondents thought the environmental impact was on the positive side, but could have been better.

4.3. Cost-Benefit Analysis for Certified Pangasius

4.3.1. Overview of certified pangasius

4.3.1.1. Farms

The survey indicates that 52.3 per cent of the pangasius farms in the sample are medium-sized, between 10 and 50 ha. Two large farms (with areas of over 100 ha) have certified farming areas of about 420 ha, representing nearly 60 per cent of the total certified pangasius area.

[13] A better relationship with the community could help reduce costs such as theft, disturbance, etc.

[14] More specifically, the farms were asked to give a score out of a Likert scale to reflect to what extent they agreed that i) losses were lower as a result of better environmental treatment, ii) losses were lower as a result of improved relationships with the community, and iii) the surrounding environment had improved. The processors had been asked to what extent they agreed that the negative impact on water pollution was reduced.

[15] The highest possible score is 5.

Table 13. Pangasius farm distribution by certificates and size

Distribution by certificate*	Number of farms	Farming areas (ha)	Certified production volume (MT/cycle)
All	21	1 473	267 200
VIETGAP	2	310	118 000
GLOBALGAP	10	244	60 200
ASC	16	284	79 200
BAP/ GAA	1	8	3 200
Other (BMP)	1	10	2 800

Distribution by size	No. of farms	Certified farming areas (ha)	Production volume (MT/ year)
All	21	719.4	493 100.0
< 2 ha	0	0	0
< 10 ha	3	24.0	9 600.0
10 - 50 ha	11	189.2	72 500.0
50 - 100 ha	5	86.7	130 000.0
> 100 ha	2	419.5	281 000.0

* A farm can maintain more than one certificate for the same area and production volume.
Source: own survey

Processors

Table 14 gives an overview of the number of processors in the sample, with their corresponding certification schemes. The ASC was the most popular certification, though it is currently the strictest one in Vietnam. 9 out of 20 processors offered ASC-certified products.

Table 14. Pangasius processor distribution by certificates

	No. of processors	%
All	20	
VIETGAP	5	25%
GLOBALGAP	8	40%
ASC	9	45%
BAP/ GAA	1	5%

* A farm can maintain more than one certificate for the same area and production volume.
Source: own survey

4.3.2. Investment and costs in certified pangasius

4.3.2.1. Investment

a) Investment in certification of pangasius farmers

The average start-up investment for certified pangasius farming was VND 56.6 million (US$ 2,700) per hectare of certified farming, slightly lower than the shrimp farmers. The average additional investment per ton was very small, just VND 193,700 (US$ 9.3) per ton. The annual renewal fee was also small, VND 4.3 million (US$ 210) per hectare or VND 14,800 (US$ 0.71) per ton, on average. The start-up investment and annual renewal was affordable for the pangasius farmers in the sample.

In the cost structure, the infrastructure renovation was the most important cost for obtaining sustainable certification, accounting for almost 52 per cent of the total start-up investment of pangasius farms. On average, the infrastructure cost is VND 29.3 million (US$ 1,400) per hectare or VND 100,000 (US$4.7) per ton, which is 1.6 times higher than the cost of compliance and 6 times higher than the cost of the initial certification.

b) Investment in certification of pangasius processors

The average pangasius processor paid VND 220 million (US$ 10,503) on the total start-up investment and VND 26.9 million (US$ 1,300) for the annual renewal fee. This was affordable for the processors in the sample, who process an average amount of 8,000 tons of final product per year.

Also among processors, infrastructure renovation was the highest cost for obtaining sustainable certification. The average investment cost per processor was VND 94 million (US$ 4,500) or 43 per cent of the total start-up investment, but the cost variation was very high. Some processors in the sample had to spend a billion VND (US$ 48,000) for the initial infrastructure, others did not need to make any investment. Most processors investing in certified sustainable product were large companies, whose infrastructure already met most of the requirements of the export markets. Unlike shrimp processors, initial certification for pangasius processors was relatively significant, accounting for 35 per cent of the total start-up investment. Labelling, which was applied in ASC certificate, accounted for about 10 per cent (Table 33).

4.3.2.2. Production costs

Certification added up to the total production costs of the pangasius farmers in the sample, and the average level of increase was 5.7 per cent in comparison with the non-certified product. All the key cost items were higher, including brood stock (12.2 per cent), feed (0.8 per cent), medicine / chemicals (1.5 per cent) and labour costs (1.4 per cent). For processors, the total product cost per ton was almost unchanged (only 0.7 per cent higher than the non-certified product), as none of the key cost items were significantly higher priced.

a) Production costs of farmers

The average production cost of the certified pangasius products in the last season of 2013 was VND 22.6 million (US$ 1.100) per ton in the whole sample, representing a 5.7 per cent increase over the production costs of the non-certified products in the same season.

11 of 12 farms in the sample experienced an increase in the production costs. Only one farm recorded no variance in the production costs per ton of certified product compared to the production costs of a non-certified product.

Table 15. Change in production costs per ton of internationally certified versus non-certified pangasius

	Total production costs	Breeding stock	Feed	Medicine & chemicals	Labour
Change in production costs (mil. VND/MT)	1.232	0.207	0.144	0.005	0.020
Change in production costs (%)	5.7%	12.2%	0.8%	1.5%	1.4%
Average production costs of certification product (mil. VND/MT)	22.680	1.902	18.063	0.333	1.430
Key cost items in the cost structure of cert. product	100%	8.39%	79.65%	1.47%	6.30%
No. of farms recording a change in production costs					
Higher	11	9	5	1	5
Same	1	3	6	9	7
Lower	0	0	1	2	0

Source: own survey

b) Production costs of processors

The average production cost of the internationally certified products in 2013 was US$ 2,072 per ton in the whole processor sample. This was just 0.7 per cent higher than the production cost of the non-certified products in the same year.

Only 2 out of 13 processors in the sample experienced an increase in the production cost. 11 out of 13 processors recorded no variance in the production unit cost of certified product compared to the cost of a non-certified product.

Table 16. Change in production costs per ton of international certified vs non-certified pangasius processors

	Total production costs (US$)	Labour	Medicine, chemicals	Fuel	Intermediate costs	Other costs
Change in production costs (mil. VND/MT)	0.015	0	0	0	-0.012	0.417
Average pro. costs of cert. product (US$/MT)	2,072	140	26	50	4.36	20.7
Key cost items in the cost structure of certified product		6.79%	1.25%	2.43%	0.21%	1.00%
Number of processors recording a change in production costs						
Higher	2	0	0	0	1	1
Same	11	13	13	13	12	12
Lower	0	0	0	0	0	0
% of processors recording a change in production costs						
Higher	15.4%	0.0%	0.0%	0.0%	7.7%	7.7%
Same	84.6%	100.0%	100.0%	100.0%	92.3%	92.3%
Lower	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: own survey

4.3.2.3. Environmental treatment costs

For pangasius farms, there were no additional environmental treatment costs after certification, while environmental treatment costs only slightly increased for pangasius processors. For farms, the average water treatment cost tripled from VND 7.1 million (US$ 340) per farm before certification, to VND 21.5 million (US$ 1,000) after certification. However, the effect of these costs on the total production cost per ton was insignificant since the absolute amount of environmental costs was tiny, given the large production volumes.

For processors, the water treatment costs increased slightly after certification, by just 1.4 per cent. The processors in the sample had already set up a quite good water treatment system, even before certification. Similar to farms, it did not have much effect on the total product costs of pangasius processors.

4.3.3. Economic benefits from certified pangasius

This section analyses the economic benefits arising from sustainability certification in pangasius production, processing and export. Following the analytical framework, it examines i) the change in the market price, ii) the change in the profit margin per ton, iii) the change in access to markets, indicated by the sales volume, and iv) the change in revenues arising from an improved corporate reputation. The purpose is to detect and measure the direct and indirect economic benefits, if any, related to certification.

4.3.3.1. No significant increase in the price of certified versus non-certified pangasius for farmers

The data from the pangasius farmer sample shows that there was no significant increase in the price for farmers. 10 out of 17 farms reported that they received higher selling prices for certified pangasius, but the selling price for certified pangasius was not significantly different from that of non-certified in the last season of 2013. A ton of certified pangasius was sold for an average price of VND 22.7 million (US$ 1,100), just about 2 per cent higher than the non-certified product.

4.3.3.2. Decrease in the average profit margin of certified versus non-certified pangasius for farmers

The data from the pangasius farmer sample shows that there was a decrease in the average profit margin for farmers. 9 out of 17 farms reported that they earned higher profit margin for certified pangasius, while 7 farms reported lower profits for certified products. The insignificant increase in the selling price of certified pangasius, as a result of the higher production costs, contributed to the decrease in profit margin of certified pangasius. Across the sample, on average, the profit margin of 17 farms was VND 1 million (US$ 47) per ton for certified pangasius and VND 1.25 million (US$ 59) for non-certified pangasius.

Table 17. Change in selling price and profit margin of certified and non-certified pangasius for farms

	Certified pangasius	Non-certified pangasius	Difference	% change
Average selling price (VND mil./ton)	22.70	22.27	0.43	1.9%
Average profit margin (VND mil./ton)	1.00	1.25	-0.25	-25.0%

Source: own survey

4.3.3.3. Uncertain increase in the export volume of certified versus non-certified pangasius

The data from the pangasius processor/exporter sample does not show a clear trend in export volume. Only 5 out of 14 processors reported that they had an increase in export volume for certified pangasius in 2013, while 9 processors said that they exported less or the same volume after certification. These records could not statistically confirm an increase in export volume after certification. It is observed that the export volume of pangasius did not depend much on certification, but mainly on actual demand on international markets.

4.3.3.4. No significant increase in the price and profit margin of certified versus non-certified pangasius for processors

The data from the pangasius farmer sample shows that there was no significant increase in the price or profit margin for processors/ exporters. Just 5 out of 14 processors reported selling certified pangasius for a higher price than non-certified pangasius. This price increase was only 4.5 per cent in 2013. About 30 per cent of processors reported a higher profit margin for certified pangasius than for non-certified pangasius. These few observations on the selling price and the profit margin indicate that the economic benefits of certified products for processors were uncertain at the time of the study.

Table 18. Change in volume, selling price and profit margin of certified and non-certified pangasius for processors

	Certified pangasius	Non-certified pangasius	Difference	% change
Total export volume (tons), 14 processors	113,909	104,515	9,394	9.0%
Average selling price (US$/kg)	2.379	2.275	0.10	4.54%
Average profit margin (US$/kg)	0.29	0.20	0.09	43.38%

Source: own survey

4.3.4. Social benefits from certified pangasius

This section discusses the social benefits resulting from private sector investment in pangasius certification. The expected benefits included job and income generation for workers at the certified pangasius farms and processing factories. For the private sector, they represented costs rather than benefits, as farms and processors had to employ additional workers. However, for the society, this was an indirect added benefit and should be integrated in the total cost-benefit model.

The data from the pangasius sample shows new jobs and income improvement after certification. However, there is no significant evidence that this increase in jobs and income is related to compliance with the sustainability standards.

4.3.4.1. The key workforce figures

In 2013, farms and processors in the pangasius sample employed a total of 22,438 workers, of which 1,936 were involved in farming and 20,502 in processing. The average salary was VND 44.73 million (US$ 2,100) per person per year. The processors paid workers better than farms. A processing worker earned an average VND 45.64 million (US$ 2,200) per year. This was 29.8 per cent higher than the average salary of a farming worker (Table 35).

4.3.4.2. Job creation for workers at certified pangasius farms and processing factories

69 per cent of the processors and farms in the pangasius sample employed more workers in 2013 compared to the year before certification. In total, 2,202 new jobs were created. However, none of the businesses reported that such an increase in new jobs resulted from certified aquaculture. Some processors reported that they employed the same number of workers or less workers in 2013. The main reason cited was the decline in market demand, especially exports.

Table 19. Job creation linked with certified aquaculture, pangasius

	Pangasius
New jobs linked with certification	2 202
% job creation*	11%
New jobs in farming	650
% job creation*	51%
New jobs in processing	1 552
% job creation*	8%

* Job created in the year 2013, after certification, compared to the year before certification
Source: own survey

Income generation for workers at certified pangasius farms and processing factories

Workers in 9 out of 36 processors and farms in the pangasius sample were better paid in 2013 compared to the year before certification. The level of salary improvement was very minor in processing, where workers only earned an additional VND 1.04 million (US$ 50) or about 2.3 per cent per year. In farming, workers earned an extra VND 6.22 million (US$ 300) or 21.5 per cent, per year. 3 out of 21 farms explained that this increase resulted from higher productivity, as well as higher costs for social and medical insurance, as required by certification.

4.3.4.4. Net social benefits from certified pangasius

The net income for pangasius workers in the sample increased by VND 121 billion (US$ 5.8 million) after certification. However, there was no significant evidence that this increase in net income was the result of compliance with the sustainability standards. The net social benefit of certification was unclear.

4.3.5. Environmental benefits

The key direct environmental benefits include the improved sustainability of aquaculture production, the improved surrounding environment and the better relationship with the community. Most of the benefits were generated in farming and contributed to improving the performance of the farms. The direct benefit created by the processors was related to reduction in water pollution.

The data from the pangasius sample shows that only one sustainability indicator (the survival rate) improved thanks to the improved processes in sustainability certification. The average yield decreased, and the feed conversion rate reveals no clear trend. However, many farms experienced a yield decrease due to the lower density, which helped to control degradation of the water environment and minimize disease outbreak. Therefore, it is expected that the sacrificed yield would pay off in the long run. The other key environmental effects related to water pollution and surrounding environment are positively assessed by most respondents.

4.3.5.1. Improved key indicators of production sustainability

Similar to shrimp production, three indicators were used to assess the potential for the sustainability of pangasius production. They included i) the survival ratio, ii) the feed conversion rate, and iii) the yield.[16]

8 out of 12 pangasius farms reported an improved survival ratio; 6 farms had lower feed conversion rates (FCR) and 1 farm had a higher yield per hectare of certified farming.

In the last season of 2013, the pangasius farms in the sample recorded an average survival ratio of 81 per cent, an FCR of 1.57 and yields of 335.8 tons per hectare. Only the survival ratio and FCR improved, the average yield decreased by 41.5 tons per hectare. This reduction in the yield was mainly due to the application of lower growing densities, as required by the certification.

In pangasius farming, the change in density had an immediate negative impact on the yield. Many pangasius farms had to reduce their densities in order to comply with the sustainability standards. Consequently, the average yield per hectare decreased in various cases. In the short term, this factor negatively impacted the business performance of the farms. In the long term, the effects may be balanced out by less disease outbreak and avoided costs for treatment. In addition, the lower density also means less feed and waste disposal on the same farming area, which may help to avoid a lot of treatment costs and eventually lead to a more environment-friendly farming model. More research is required to verify this effect.

4.3.5.2. Potential for cost savings

Given the volume of production in the last season of 2013, it was estimated that 1,576 tons of feed were saved in pangasius farming. If the farms will produce the maximum certified volume in the coming seasons, the total saving on feed could be up to 1,586 tons. These figures could be much higher if the FCR continues to improve in the future.

Given the average feed price in 2013 of VND 18,060 (US$ 0.86) per kilo for pangasius, the total savings in the last season of 2013 were estimated at about VND 28.5 billion (US$ 1.3 million). Based on the maximum production volume, the total savings on feed costs could reach as high as VND 28.64 billion (US$ 1.4 million) across the pangasius businesses. The feed cost remained unchanged despite the higher price of certified feed.

4.3.5.3. Other environmental benefits

11 out of 21 pangasius farms incurred less losses from better environmental treatment, 19 farms had a better surrounding environment, and 11 farms incurred less losses from improved relationships with the community. 14 out of 20 pangasius processors reported less water pollution. Such improvements helped to reduce the losses for the business, and would expectedly contribute to better business performance in the long run (Table 38).

[16] The environmental impacts on production were measured by comparing the "after" to the "before" values and analysing how many businesses saw positive changes.

4.4. Conclusions from the CBA Analysis

Sustainability certification created benefits for both the farmers and the processors of shrimp, in all the examined aspects: net economic benefits (gross margin), net social benefits (new jobs created, net income generation) and net environmental benefits (the survival ratio, FCR).

For pangasius, the positive effects of implementing sustainability certification for both farmers and processors are uncertain. For pangasius farms, the analysis found that the effect on the net economic benefits (gross margin) is negative. There is no significant evidence on the social benefits from certified pangasius farms. The effect on the environmental benefits is statistically uncertain: out of the three sustainability indicators, only one (the survival rate) improved, the second (yield) decreased and the last one (feed conversion rate) revealed no clear trend.

For pangasius processors, the economic benefits are, under the current conditions, also statistically uncertain. There is no significant evidence regarding the social or environmental benefits from certified pangasius processors.

5. Challenges and Opportunities for Greening the Aquaculture Sector through Voluntary Sustainability Standards in Vietnam

This section outlines the key challenges and opportunities for sustainability certification in Vietnam. It is based upon the CBA analysis, interviews and participants' feedback during the national validation workshop in the Mekong Delta. The review of relevant literature also helped to give more background and understanding of the topic.

International standards and certification have become prominent aspects of international fish trade and marketing (FAO 2011a), with currently well over 10 certification schemes for fisheries and aquaculture in existence. Certification is becoming a requirement for export market access. Although certification can promote entry into international markets, it is likely that large-scale consolidation will eliminate many small-scale farmers, especially in Vietnam. Up to now, one of the most common features of Vietnamese aquaculture (except for pangasius farming) is that they are still scattered and operated at a small scale. Most producers are households and their production areas have an average size of less than 2 hectares (MARD, 2012). This context makes it more difficult to adhere to modern international standards. As a result, smaller producers could likely be increasingly marginalized from major markets. The increasing number of certification schemes is driving up producers' costs and consumer prices, and overlooking the particular challenges of small-scale operations. Aquaculture farmers in Vietnam can choose among 10 certification schemes, but lack the information to determine which one suits their needs. Moreover, the different international certification schemes also have different methods and targets to verify producer compliance. The multiplicity and increasing specificity of these standards, along with a lack of harmonization among them, makes it increasingly difficult for small-scale farmers to obtain certification (FAO, 2011a).

The specified challenges are defined below.

5.1. Challenges for Compliance with Internationally Recognized Sustainability Standards in Vietnam's Aquaculture Sector

5.1.1. Production land and planning

A master plan for aquaculture development in the short, medium and long term has been issued by MARD. However, the delay in implementation of the master plan has caused particular problems related to production land and infrastructure, complicating the construction of the adequate long-term infrastructure needed to comply with sustainability standards. Supportive infrastructure, such as water supply and treatment ponds, are costly if they are to be built for every single farming establishment, in particular for small-scale shrimp farmers. For governmental agencies and for certifying bodies, a full implementation of the master plan would facilitate effective selection of favourable areas for aquaculture production, as well as trainings to improve compliance with certain schemes. Although the infrastructure and planning problem is detrimental for the sector as a whole, it poses additional challenges for the implementation of green economy measures, such as the effective promotion of and compliance with sustainability certification schemes.

In brief, the scattered character of the sector will constrain certification, as it leads to higher costs (larger yields/area are cheaper to certify).

5.1.2. Infrastructure

As a result of the lack of planning, and since the most effective areas for aquaculture production have not been identified, the development of adequate infrastructure in accordance with the master plan lags behind. The absence of realistic local-level plans, the insufficient resources for investment, and the spontaneous development of farming activities mentioned above, make it very difficult to develop a synchronized infrastructure system to support sustainable aquaculture production in Vietnam.

The road density in the Mekong Delta is only 0.2 km/km^2, which is much less than the national level (about 0.34 km/km^2). Fortunately, it is supplemented by the inland waterway transport system to meet the needs of the aquaculture sector. The density of river transportation is 0.68 km/km^2 (MOT, 2013). This mode of transportation is normally used for agricultural materials, aquaculture feed and fingerlings, but should be more developed to meet the requirements of the sector regarding the trade in special species that need to be transported alive from ponds to processing enterprises, like pangasius. The power grid has reached the entire Mekong Delta, but the needs for electricity for aquaculture production are still not fully met, due to the lack of a wire system, especially in the remote and scattered aquaculture areas. Preliminary estimates provided by the local authorities of a number of coastal provinces including Soc Trang, Bac Lieu, Ca Mau, Tien Giang, Ben Tre, etc. show that an area of over 20,000 hectares of brackish water shrimp was affected by power shortages (MARD, 2013). The irrigation system is also a key component of the infrastructure required for aquaculture development in the Mekong Delta. It is divided into 4 regions, 22 sub-regions and 120 irrigation areas. The system is, however, designed for agriculture needs (mainly for rice production) and not very effective for serving the aquaculture sector. In line with the transportation situation, only the concentrated aquaculture areas can make use of the irrigation system, while the majority of aquaculture areas are scattered across the region. The communication and information sharing system has improved over recent years to facilitate aquaculture development, but the monitoring system has not been properly invested in. This is one of the reasons for increased risks in aquaculture (MARD, 2009).

In brief, the infrastructure needs to be much improved to facilitate international certifications. The infrastructure inside the fences of individual production areas is the responsibility of the producers, but the common infrastructure (which normally requires high investments) needs the support from the government. This is linked to the environmental and social requirements, but could be constrained due to the limited financial resources.

5.1.3. Employment and organizational model of production

Households still form the most popular production unit in aquaculture, even though the number of households and co-operatives has decreased. In 2011, there were nearly 1,150 companies / enterprises, 200 co-operatives and 720,000 households involved in Vietnam's fisheries sector. The total labour force in the sector was 1.45 million people, which has since then decreased with nearly 119,000 people (equivalent to 7.6 per cent less). The labour force in the fisheries sector has decreased in all regions with concentrated fisheries, including the Mekong Delta, the Coastal Central Part and the southeastern zone of the Southern region. The educational level and the technical skills of the labour force have slightly improved – in 2011, 2.95 per cent of the labour force had reached a primary technical level, 1.23 per cent had a medium level, and 0.21 per cent has university education (GSO, 2011). This shows that the quality of the labour force is still low, while the production is still mainly organized on individual formats.

In brief, the low quality of the labour force could increase the risks in the production process and negatively affect the quality of aquaculture products (unexpected residue, disease, etc.), which in turn makes their certification more difficult. The individual format (household) of aquaculture means that the production land is quite scattered, the production calendar is diverse and the investment is diversified. These are factors that lead to high risks, both from the economic and the environmental perspective, and constrain international certification.

5.1.4. Linkages in aquaculture production

During the past few decades, the co-operative was the most popular model of organizing and linking production in Vietnam's aquaculture. However, in the development process, the old-style co-operative model showed many weaknesses, leading to the collapse of this type of linkage in production. Nowadays, the need for linkage in production emerges again, as a result of the increasing requirements of the market, especially in standardization and certification among small-sized farmers. However, Vietnam's aquaculture is now facing many difficulties to establish effective linkages among producers, which relate to the legal framework, and the planning and effectiveness of the linkage model itself. The government at the national and the subnational level has attempted to facilitate this process, but the expected results have not yet been produced.

In brief, weak cooperation among producers means scattered production, "bad" competition and lack of unity in the aquaculture sector. Again, these factors limit the effectiveness of aquaculture activities. On the other hand, weak linkage also constrains the effort to develop infrastructure and harmonize the production calendar.

5.1.5. Science and technology

Science and technology have greatly contributed to the development of aquaculture in the last 10 years. The successes in seed production and disease treatment, among others, have led to a significant improvement compared to the early development stage of the sector in Vietnam. However, technological progress has not yet been sufficient to unleash the full potential of aquaculture in Vietnam.

In brief, improving the application of science and technology in aquaculture will help to improve the quality of products relating to standards of food safety, ecology or traceability.

5.1.6. Capacity of the private and public sector

Capacity gap in the private sector

The capacity gap in the private sector derives from a knowledge and skill gap among aquaculture farmers and processors. Most of the knowledge and skills are acquired during short training courses organized by various organizations, including government agencies and private enterprises that supply feed and chemicals, among others. According to the MARD's Plants Protection Department, in 2014 only 30 per cent of the farmers fully used the manuals of feed, chemicals or medicine in aquaculture. The others mainly relied on their own experiments, which often led to inconsistencies in production. The capacity to control inputs for aquaculture production remains low, which complicates the ability to comply with sustainability certification schemes.

Capacity gap in the public sector

The capacity of the government agencies to control the quality of aquaculture inputs is currently limited due to the institutional, financial, technical and human resources issues. For example, within MARD, D-FISH is assigned to administrate aquaculture and the Department of Veterinary is in charge of disease testing, quarantine, and aquatic veterinary drugs. This is not consistent and can lead to overlapping, ineffective use of human resources and inefficient management. A report by D-fish shows that, as a result, the seed quality is insufficient, as the broodstock, infrastructure and technology used in the seed production establishments are not satisfactory.

Compliance with internationally recognized standards should be a joint effort of various ministries. While MARD manages the technical production of aquaculture, processing and trade are managed by MOIT, and resources (basically land and water) for production by MONRE. Technology, investment, infrastructure, taxation and credit fall under the competencies of respectively the Ministry of Science and Technology (MOSTE), the Ministry of Planning and Investment (MPI) and the Ministry of Finance (MOF). The collaboration between the ministries does not yet run smoothly and many tend to follow their own directions. It is, however, highly necessary for these ministries to cooperate and align their policies to contribute to the implementation of the Green Growth Strategy in Vietnam.

Obviously, the aquaculture sustainability certification schemes require a high level of synchronization in the chain of production, processing and distribution; and therefore also a corresponding synchronization of the policies of the different ministries involved.

5.2. Opportunities arising from compliance with internationally recognized sustainability standards in Vietnam's aquaculture sector

Section 4 of this report discusses the costs and benefits that sustainability certification can bring to businesses, workers and environment. This section places the case study in the context of new market opportunities that can arise from compliance with internationally recognized sustainability standards and therefore provide extra benefits for the sector and the various stakeholders.

Capture fisheries and aquaculture supplied the world with about 148 million tons of fish in 2010 (with a total value of US$ 217.5 billion), of which about 128 million tons was utilized as food for people. With sustained growth in fish production and improved distribution channels, the world's fish food supply has grown dramatically in the last five decades, with an average growth rate of 3.2 per cent per year in the period 1961–2009, outpacing the increase of 1.7 per cent per year in the world's population. World per capita food fish supply increased from an average of 9.9 kg (live weight equivalent) in the 1960s to 18.4 kg in 2009 (FAO, 2012). Of the 126 million tons available for human consumption in 2009, fish consumption was lowest in Africa (9.1 million tons, with 9.1 kg per capita), while Asia accounted for two-thirds of total consumption, with 85.4 million tons (20.7 kg per capita), of which 42.8 million tons was consumed outside China (15.4 kg per capita). In addition, consumers' tastes and preferences for aquaculture products also change in category, quantity, quality, as well as safety and sustainability requirements. In other words, while the demand for aquaculture products continues to increase, there is also a growing consumer recognition of safe and sustainable production, starting from the high-end markets and now moving to some emerging middle-income markets. The issues such as food safety, traceability, certification and eco-labels, as well as social responsibility, are becoming increasingly prioritized by consumers, companies and destination markets.

In this context, it is an encouraging trend that farmers, processors and traders must pay more attention to consumers' and other stakeholders' growing interests in seafood safety, quality and sustainability certification. First, the issue of antibiotic residue, impurities and related problems, should be entirely solved before the products come to the customers. This contributes to food safety on the one hand, and facilitates better informed and controlled use of chemicals in both capture and aquaculture on the other. It prepares the producers for compliance with more comprehensive requirements of sustainability standards.

Both the EU and the US are major export markets for aquaculture products. Both have enacted regulations related to food safety, but have more recently also required certain standards for the imported seafood. Therefore, Vietnamese producers must reach sustainability standards (international certification) to access these markets.

Vietnam has already taken initiatives to increase compliance with international standards (The Fish Site, 2011). In 2004, Vietnam intensified its efforts towards improving the food safety and quality of its products, particularly those destined to export markets, through a wide-ranging program including farmers' education. These changes were initiated by the aquaculture sector itself and quickly updated with an environmental and social agenda to improve the efficiency of production and ensure its sustainability. Both the government and the private sector (farmers, processors and exporters) have made significant advances in the management of aquaculture to reduce negative environmental impacts and improve efficiency, including profitability.

The brief literature review on the new market opportunities that arise for certified aquaculture products demonstrates that upscaling certification in the Vietnamese aquaculture sector merits further attention from the government, farmers and processors in light of the implementation of the Green Growth Strategy and Action Plan.

6. Policy Recommendations to Address the Challenges and to Harness Trade Opportunities Derived from Sustainability Certification

This section presents potential responses to the identified challenges and recommendations to harness the trade opportunities derived from sustainability certification in the Vietnamese aquaculture.

6.1. Production Land and Planning

It is recommended to speed up the review of aquaculture master plans (at the key production areas first) and to make the necessary adjustments, in order to create the favourable conditions to develop aquaculture infrastructure in an efficient and sustainable way. Clear and efficient planning helps to save costs and to facilitate socio-economic development, especially in remote areas. The implementation of the master plan can provide the framework for the development of an integrated synchronous infrastructure system to support a sustainable aquaculture sector. Criteria such as energy saving, optimal use of land and water resources, minimized pollution and degradation of land should be included.

The Master Plan of Aquaculture should be jointly developed by the MARD and MONRE, in order to ensure that aquaculture develops in an effective and sustainable way.

6.2. Infrastructure

Establishing concentrated farming areas to closely link with processing plants should be the key direction of the future development of aquaculture and fisheries processing sectors. This would minimize the negative environmental impacts and support the synchronous infrastructure development. As a result, farmers and processors will find it easier to comply with sustainability standards. Less intensive production modalities, which reduce the pressure on land and water resources, should be introduced for the sustainable development of the sector.

The MOIT and the MARD have a key role to play through their collaboration. They can guide aquaculture producers to achieve reasonable scale in production and to ensure a traceability system. The MONRE and the MPI could design policies to promote practical research that develops the technology related to environmental and waste remediation (especially related to sewage of catfish and shrimp). The MPI also

needs to design a policy framework to encourage the investment in infrastructure development and green technologies, to reduce production costs, and to enhance the competitiveness of the aquaculture sector.

For most sustainability certificates, the major investment is in infrastructure and in the production process. Funding is one of the critical bottlenecks to change production methods. Vietnam's credit system needs to be adapted, in order to support producers in improving their production. The MOF, the MPI and the State Bank are the key institutions that need to play a role in fixing these problems, by issuing policies that reduce credit procedures, expand credit limits or increase incentives.

6.3. Employment and Organizational Model of Production

It is recommended to develop an improved training policy directed at upgrading the skills of workers in the aquaculture sector. Sustainability certification requires knowledge about the requirements to achieve the standards set by the certification schemes. An improved training policy must take the needs of both short-term and long-term segments into account, so that the highly skilled technical, managerial and operational staff are adequately prepared and added to the labour force. National Extension Services should play a key role in this sector.

In the new context, moving into large-scale production is the most appropriate pathway. Therefore, the policies to accumulate production land or concentrate producers into larger-scaled units of production are key issues. This requires strong collaboration among various ministries, such as MARD, MONRE, MOSTE, MPI and MOF, to ensure effectiveness, sustainability and inclusiveness in using natural resources and production development.

6.4. Linkages in Aquaculture Production

To upgrade the scale of production, one of the key strategies identified is "linkage development". Currently, the co-operative model still exists in aquaculture, but is not very effective and popular. The co-operative model should be developed to become the main base for strengthening the linkages in the aquaculture sector. Other possible linkage models (such as groups, clubs, associations, etc.) should also be considered for further support. The legal framework (i.e. contracts, planning, financial, human resources and land) is of key importance to support these policies. The MARD and Vietnam Co-operative Association (VCA) should play a key role by supporting the establishment, operation and development of linkage models, together with the supporting policies to be developed by the MPI, the MOF and the MONRE.

6.5. Science and Technology

As mentioned above, Vietnam's aquaculture has a relatively long history of development and has recently made considerable achievements. However, due to limitations in many key issues such as land, finance, human resources, etc., this sector still receives limited investment and does not make use of the most appropriate science technology. However, the certification schemes all use criteria related to food safety, environment, ecology, etc., which require high investments in science technology. The focus should first be on food safety, environmental treatment and anti-disease problems, and later expanded to other related issues. The MOSTE should play a key role in this sector and National Extension Services should be a key institution in transferring technology.

6.6. Capacity of the Private and Public Sector

Private sector

The MARD should implement policies regarding training and education, to ensure the quality of human resources in aquaculture development. Management skills and techniques are the principal subjects. Further, policies relating to dissemination are needed to ensure that policies are implemented in reality.

Awareness-raising is also necessary to facilitate the linkage development to gradually meet the requirements of international certifications.

- To the farmer:

Relevant policies should be put in place to raise awareness among aquaculture producers on green and sustainable production, and to meet the requirements of international markets to increase exports. A higher level of knowledge and awareness will ensure the effectiveness of the policy and the long-term commitment of farmers. It is crucial to improve and expand the dissemination of information and knowledge in a transparent and effective way, so that farmers can make well-informed decisions. Dissemination can be done in many ways, such as information workshops, training courses, distribution of flyers and leaflets, website-based information services, the establishment of online and offline forums on needs, demand, market and consumer trends, etc. National Extension Services should play a key role in this endeavour.

In addition, the financial capacity of farmers should be strengthened, so that they can afford investments to comply with sustainability standards. It is important to note that sector-specific policies of financial access are necessary for aquaculture farmers, since most of them cannot produce qualified collateral for commercial loans due to their limited assets. The MOF and the State Bank could be key units in issuing related policies, especially to facilitate the credit access for farmers.

Strengthening the bargaining power of farmers through capacity building, farmer organizations and linkages is also essential to implement policies aiming to strengthen farmers' capacities for negotiation, and to allow them to organize themselves into larger-scale producer groups or cooperatives. This would facilitate vertical and horizontal linkages among farmers and between farmers and other value chain actors, especially processors and exporters. The MARD and the VCA should play key roles in this endeavour, especially in establishing and developing linkage models.

- To the processing and exporting companies:

Awareness raising for processing and exporting enterprises about sustainability certification schemes and standards is equally necessary. It is important that companies receive full, clear and precise information about the contents and procedures of different certificates. Local authorities and their functional departments could play a facilitating role because of their close relationship with company/enterprises in the different localities. However, support policies at the national level are necessary to ensure proper legal frameworks and resources for implementation.

Improved capacities for effective negotiation, market penetration and price setting are vital for processing and exporting companies, as this would help obtain optimum net profits, which would eventually provide larger net earnings for every actor in the domestic supply chain. The MOIT and the MARD are the key institutions to ensure the efficient capacity of the company when participating in the international markets. Policies of education and training on international law, trading and marketing should be very useful in this matter.

Public sector

Through the Green Growth Strategy, several ministries/sectors are involved in Vietnam's transition to a greener economy. There is, however, insufficient collaboration among the related policy-making and administrative bodies. The government should play a key role in this sector to rule the collaboration between the ministries and sectors in management works. Therefore, the government of Vietnam should establish a clear mechanism of collaboration among the ministries.

For aquaculture, the situation is more difficult due to the generally low visibility of the sector to "non-fishery" government administrations, such as industry and trade, investment and planning, finance, natural resources and environment, etc. The responsibility for aquaculture production, promotion and trade seems to be deviated toward the D-fish and the MARD, with other ministries assuming little direct accountability. Given the coherent need for working together on current and future trade opportunities, it is recommended that a mechanism for collaboration and coordination among the key administrations is put in place. The structure should allow for the timely issuance of policies and guidelines at the national level, and swift adjustments in response to the existing and projected market demand, as well as the status and needs of the producers. It is also recommended that the structure should reach out to the local levels.

7. Conclusion

The Government of Vietnam has expressed its strong interest to promote the diffusion of internationally recognized sustainability standards in Vietnam's aquaculture sector through facilitative policies and mechanisms that accelerate green growth in aquaculture. The application of green economy measures and certification (such as Global Gap, BAP/GAA or ASC) for production and processing of aquaculture products has the potential to improve the sustainability, productivity and quality of aquaculture production. Additionally, green economy measures facilitate access to new export markets that allow for higher value addition and even price premiums for sustainably produced goods, and highly likely lead to enhanced trade flows in sustainably produced aquaculture products.

The survey in this study of 55 farms and processors in both shrimp and pangasius in Vietnam shows positive results in the application of sustainable certification in the shrimp sector, rather than in the pangasius sector. The effect of sustainability certification on the net economic benefits (gross margin) for both shrimp farms and processors is positive. While the increases in the selling price and sales volume are significant, the level of increase in production costs is lower. The processors/exporters even earn additional revenues from both certified and non-certified products from their improved corporate reputation. The social and environmental benefits are positive both in shrimp farming and shrimp processing/exporting. Net jobs are created and additional income is generated, while sustainability indicators improved, environmental degradation has diminished and businesses are suffering less losses. Shrimp farms and processors/exporters make a profit in most price scenarios, specifically (1) the baseline scenario, which uses the average selling price derived from survey data; and premium prices reaching 10 per cent (2), 20 per cent (3), and a price reduction scenario (4), which simulates the impacts of potential price reductions.

The landscape in pangasius aquaculture is not so positive. The effect of certification on the net economic benefits (gross margin) is negative for pangasius farms and statistically uncertain for pangasius processors/exporters. While the benefits of certification on selling price and revenue are insignificant, the production costs for certified products are higher for farms. For processors, the increase in production costs of certified products is insignificant, while it is uncertain whether higher selling prices and sales can be achieved. The effect of certification on the social and environmental benefits (or loss) is also uncertain in pangasius farming and processing/exporting. The pangasius farms are more vulnerable under the current market conditions. They incur losses in the baseline and price reduction scenarios and can only make a profit if the price increases. The pangasius processors/exporters make a profit in the baseline scenario and premium price scenarios, but incur a small loss in the price reduction scenario.

Challenges for compliance with internationally recognized sustainable standards remain, including the poor overall planning for both shrimp and pangasius, the lack of integrated infrastructure for economies of scale, the weak employment and organizational model, as well as poor linkages within aquaculture production. In addition to that, the capacity gap in the private and public sectors still hinders the sector to catch up with international sustainability standards.

Policy recommendations have been made to address the outstanding issues in master planning, organization of production, labour force and skill level, market and trade promotion and collaboration and coordination among key administrations. Special emphasis has been put on the trade aspect and the collaboration among the key ministries to capture the trade opportunities arising from sustainability certification.

The capacity of both private and public sector needs to be strengthened to facilitate the green economy in the aquaculture sector. For the private sector, this includes awareness raising, financial support and strengthening of the bargaining power for both farmers and processing and exporting businesses. For the public sector, a mechanism for effective collaboration and coordination among key administrations (i.e., MoIT, MARD, MPI, MONRE) should be put in place. The structure should allow for the timely issuance of policies and guidelines at the national level and swift adjustments in response to the existing and projected market demand and needs of the producers. Such a structure should also be reached out to the local levels.

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Annexes

ANNEX 1. STANDARDS AND CERTIFICATION SCHEMES IN AQUACULTURE

		Main market orientation	Market access issues addressed				
			Food safety	Animal health	Environment	Social/ ethical	Food quality
1	Codex Alimentarius	Global	x	-	-	-	x
2	World Organisation for Animal Health	Global	x	x	-	-	x
3	Freedom Food, UK	UK, Europe	-	x	x	-	-
4	GLOBALGAP	Europe	x	x	x	-	x
5	GAA & ACC	US	x	-	x	x	-
6	Naturland	Europe	x	-	x	x	x
7	FOTS	Global	-	-	x	-	-
8	Seafood Watch	US	-	-	x	-	-
9	ATJ, Japan	Japan	-	-	x	x	x
10	Accredited Fish Farm Scheme, Hong Kong	Hong Kong	x	-	-	-	x
11	SQF	Global	x	-	-	-	x
12	BRC	Global	x	-	-	-	x
13	QCS	Global	x	-	-	-	x
14	Fair Trade	Global	-	-	x	x	-
15	ISO 22000	Global	x	-	x	-	x
16	ISO 9001/14001	Global	-	-	x	-	x
17	Fair-Fish	Switzerland	-	x	x	x	-
18	ISEAL	Global	-	-	x	x	-
19	SSPO, COGP, Scotland	Global	x	x	x	-	x
20	Carrefour Quality Line	Global	x	-	-	x	x
21	SIGES Salmon Chile	Europe, US	x	x	x	-	x
22	Shrimp quality guarantee ABCC, Brazil	UK, Europe	x	x	x	x	x
23	Thai quality shrimp, GAP, Thailand	Europe, US	x	-	-	-	x
24	COC-certified Thai shrimp, Thailand	Europe, US	x	x	x	x	
25	IFOAM	UK, Europe	x	x	x*	x	x
26	Soil Association	UK	x	x	x*	x	x
27	Agriculture Biologique	Europe	x	x	x*	-	-
28	Bioland, Germany	Europe	x	x	x*	-	-
29	Bio Gro, New Zealand	Global	x	x	x*	-	-
30	Debio, Norway	UK, Europe	x	x	x*	-	-
31	KRAV, Sweden	Europe	x	x	x*	-	-
32	BioSuisse	Switzerland	x	x	x*	-	-
33	NASAA, Australia	Global	x	x	x*	-	-
34	Irish Quality salmon and trout	Europe	x	x	x*	-	x
35	Label Rouge, France	France, EU	x	-	-	-	x
36	La truite charte qualité	France, EU	x	-	-	-	x

37	Norway Royal Salmon	Europe	x	x	-	-	x
38	Qualité aquaculture de France	France, EU	-	-	x	-	-
39	SSOQ, Bangladesh	Global	x	-	x	x	x
40	China GAP	Global	x	x	x	x	x
41	VietGAP, Vietnam	Vietnam	x	x	x	x	-
42	CORP**	Global	x	-	x	-	x
43	ASC	Global	-	-	x	x	-

* Organic
** Standards of fish meal and fish oil producers

GAP Good Aquaculture Practices
GAA Global Aquaculture Alliance
ACC Aquaculture Certification Council
FOTS Friend of the Sea
ATJ Alter-Trade Japan
SQF Safe Quality Food
BRC British Retail Consortium
QCS Quality Certification Services
ISO International Standard Organization
ISEAL International Social and Environmental Accreditation and Labelling Alliance
SSPO Scottish Salmon Producers' Organisation
COGP Code of Good Practice
COC Codes of Conduct for shrimp production of Thailand
IFOAM International Federation of Organic Agriculture Movements
NASAA National Association for Sustainable Agriculture, Australia
SSOQ Shrimp Seal of Quality
CORP Code of Responsible Practice of the Marine Ingredients Organization (IFFO)
SQF Safe Quality Food
ASC Aquaculture Stewardship Council

Source: Adapted from FAO (2011); freedomfood.co.uk; enaca.org; asc-aqua.org; hkaffs.org

ANNEX 2. INTRODUCTION OF INTERNATIONALLY RECOGNIZED SUSTAINABILITY STANDARDS FOR AQUACULTURE TO VIETNAM

The key events on introduction of international recognized sustainability standards for aquaculture in Vietnam can be listed as follows:

- 1996: The First National Responsible Aquaculture Workshop in the Mekong Delta was conducted to introduce the importance of responsible aquaculture for sustainable development.
- 2000: The training events on responsible aquaculture were conducted by MOFI and VASEP, with financial support from DANIDA.
- 2001: Launch of the first organic shrimp project certified by the Naturland with support from VASEP-SIPPO.
- 2003-2005: SGS & VASEP developed and implemented the SQF1000 standard for pangasius for three provinces in the Mekong Delta.
- 2005: Launch of the *Agifish Pure Pangasius Union* (APPU) model, established by five groups of stakeholders: processor, farmers, hatchery owners, feed & medicine producers. The model aimed to unite the stakeholders in order to ensure food safety, responsibility of the whole value chain and application of standards as market requirements.
- 2007: First *Organic Pangasius* of Binca & NTACO, certified by IMO to meet Naturland standards.
- 2007: State Shrimp Aquaculture Dialogue to improve sustainable shrimp farming and establishment of ASC standards for shrimp.
- 2008-2010: *Pangasius Aquaculture Dialogue* (PAD) in Vietnam to improve sustainable pangasius farming, and establishment of ASC standards for pangasius.
- 2009-2010: Boom in the number of pangasius farms and processing companies with GlobalG.A.P certificate.
- 2010: Cooperation Agreement signed between VINAFIS, VASEP and WWF for the sustainable development of pangasius production in order to meet ASC standards.
- 2011: Introduction and implementation of MetroGAP focus on food safety, conducted by Metro Cash & Carry Vietnam.
- 2011-2015: Implementation of the Aquaculture Improvement Programme (AIP) for Vietnamese pangasius, supported by WWF.
- 2011: Establishment of the VietGAP programme, the national standard for aquaculture with a focus on pangasius and shrimp, conducted by the D-fish.

ANNEX 3. NATIONAL POLICIES ON SUSTAINABLE AQUACULTURE DEVELOPMENT IN VIETNAM

The key existing policies relevant to sustainable aquaculture development in Vietnam include:

- The PM's Decision No. 1960/QD-TTg dated 16 September, 2010 on the Strategy for Vietnam Fisheries Development to 2020, aiming to lead aquaculture and fisheries towards sustainable development by re-organizing the existing production systems, setting up good brand names, utilizing the natural resources sustainably, and balancing the profit among stakeholders of the value chain.

- The PM's Decision No. 332/QD-TTg dated 3 March, 2011 on the Aquaculture Development Scheme to 2020. The overall objective is to develop aquaculture as a sustainable industry with proper care for both economic and social development, improvement of farmers' livelihoods, food supply for domestic consumption and demand for export. The immediate objectives include 4.5 million tons of production volume and 3.5 million jobs by 2020.

- The PM's Decision No. 01/2012/QD-TTg dated 9 January, 2012 on the Government policies to promote and encourage application of good agriculture practices (including aquaculture and forestry products).

- The PM's Decision No. 899/QĐ-TTg dated 10 June, 2013 on approval of the Restructuring Programme of Agriculture toward sustainable development and expansion of the trade value.

- The PM's Decision no. 1445/QĐ-TTg dated 16 August, 2013 for approval of the Fisheries Development Master Plan to 2020 and Vision toward 2030. Its objective is to develop a strong competitive fisheries sector with proper care for farmers' livelihoods, the environment and natural resource management. The key species include pangasius and shrimp, among others. The recommended interventions focused on environmental protection and linkages between production, processing, trade and market. The national certificate of VietGAP is promoted as a measure for ecosystem preservation, disease control, food safety and quality, and sustainable development of the aquaculture sector.

- The PM's Decision No 2760/QD-BNN-TCTS dated 22 November, 2013 on approval of the Restructuring Programme of Aquaculture toward sustainable development and expansion of the trade value.

- The MARD's Circular No. 44&45/TT/BNN-TCTS to regulate the conditions of intensive shrimp and pangasius establishments and zones for food safety and hygiene, with a view towards sustainable development.

- The MARD Minister's Decisions No.1503/QD-BNN-TCTS and No. 48/2012/QD-BNNPTNT on the establishment of VietGAP national standards and certification scheme. The standards focus on 4 main aspects of food safety, environmental integrity, animal health management and social responsibility.

- The Government's Decree No. 36/2014/NĐ-CP dated 29 April, 2014 imposing stricter conditions on pangasius farming, processing and export, including compulsory compliance with VietGAP or an international certificate pursuant to Vietnamese laws.

ANNEX 4. KEY INDICATORS IN THE STUDY SURVEY

Table 20. Key indicators of investment in the study

Area of assessment	Capital Investment	Training Costs	Certification Costs
Investment	1. Infrastructure renovation costs (VND)	2. Training and consultancy service for farmers on sustainable techniques (VND/farmer)	3. Initial certification costs (VND) 4. Annual renewal fee (VND/year) 5. Additional compliance costs (VND/year) 6. Other costs directly related to certification (VND/year)

Table 21. Key indicators of added benefits in the study

Area of assessment	Economic Benefits	Social Benefits	Environmental Benefits
Added benefits	7. Increased access to markets • To local material market (MT/cycle) • To global market (MT/year) 8. Premium market price (VND/MT) 9. Increased profit margin (VND/MT)		13. Sustainability of production (yield, survival ratio and FCR) 14. Improvement of surrounding environment (1-5 score)
	10. Additional revenues from improved corporate reputation (VND/year)	11. Job and income generation for workers (number of additional employees and additional payroll in VND/year) 12. Better income and job security for workers (1-5 score)	

Table 22. Key indicators of avoided costs in the study

Area of assessment	Economic Costs Savings & Avoided Costs	Social Costs Savings & Avoided Costs	Environmental Costs Savings & Avoided Costs
Avoided Costs	15. Reduced losses from improved stock management and improved disease management (1-5 score) 16. Reduced losses from improved traceability (1-5 score)	17. Reduced losses from improved relationships with the community (1-5 score)	18. Costs of waste water treatment (VND/year) 19. Other environmental treatment costs (VND/year) 20. Saving in feed costs from improved sustainability ratio (VND/cycle) 21. Reduced losses from improved environmental treatment (1-5 score)

ANNEX 5. TERMINOLOGY

The key terms used in this study are defined below.

Farmer: in this study, an aquaculture farmer operates aquaculture activities on his/her own farm.

Processor: in this study, a processor is an owner/manager of processing enterprises in the fisheries sector.

Industrial farming: in this study, industrial farming is aquaculture farming which uses industrial and high-tech measures for operating its farming activities. Industrial processed feed, high density of seed, chemicals, anti-biotic and industrial produced inputs are usually used in this farming method.

Eco-farming: in this study, eco-farming is aquaculture farming which uses traditional measures for operating its farming activities. Aquaculture species are raised in low densities in ponds, very little or no industrial processed feed is being used, and the use of medicine and chemicals is also limited.

In this study, the industrial farming method is exercised by all pangasius farmers in the sample. Both farming methods are recorded within the shrimp farmers in the sample.

ANNEX 6. SURVEY TABLES

Table 23. Shrimp farm distribution by certificate, size and farming method

	Number of farms	Farming area (ha)	Certified production volume (MT/cycle)
All	12	1 869.3	5 676
Distribution by certificate*			
VIETGAP	1	15.0	150
		1%	3%
GLOBALGAP	3	377.0	2 100
		20%	37%
BAP/ GAA	6	630.3	4 271
		34%	75%
Friend of the Sea	4	137.0	976
		7%	17%
Naturland/IMO	1	1 087.5	500
		58%	9%
Distribution by size			
< 50 ha	6	112.0	946.0
		6%	17%
50-100 ha	3	202.8	1 730.0
		11%	30%
> 100ha	2	467.0	2 500.0
		25%	44%
> 1 000ha	1	1 087.5	500.0
		58%	9%
Distribution by farming method			
Eco-farming	4	1 224.0	1 255.0
		65%	22%
Industrial farming	8	645.3	4 421.0
		35%	78%

* A farm can maintain more than one certificate for the same area and production volume.
** VIETGAP is the national sustainability standard of Vietnam. Though it has not been recognized internationally, it has a positive impact in the domestic market and is intended to serve the sustainable development purpose of the aquaculture sector in Vietnam.
Source: own survey

Table 24. Pangasius processor distribution by certificate

	No. of processors	%
All	17	
VIETGAP	1	6%
GLOBALGAP	4	23%
BAP/ GAA	8	47%
Friend of the Sea	3	18%
Naturland/ IMO	1	6%

Source: own survey

Table 25. Total investment in certification of shrimp farmers

Description	Start-up investment					Annual fee
	Infrastructure renovation	Training & consultancy service	Initial certification	Compliance	Total start-up investment	Annual renewal
Total investment (mil. VND), all surveyed farms	102 780 98.0%	784 0.7%	865 0.8%	474 0.5%	104 903	750
Average cost per farm (mil. VND/ farm)	8 565	65	72	40	8 742	62
Average cost per hectare (mil. VND/ ha)	54.98	0.42	0.46	0.25	56.12	0.40
Average cost per ton (mil. VND/ MT)	18.11	0.14	0.15	0.08	18.49	0.13

Source: own survey

Table 26. Total investment in certification of shrimp processors

Description	Start-up investment	Investment by key items		Annual fee
		Infrastructure & technology	Initial certification	Annual renewal
Total investment (mil. VND)				
All processors	6 568	5 400 82%	1 008 15%	882
Average costs per processor (million VND)	386.35	317.65	59.29	51.88

Source: own survey

Table 27. Key labour force figures for shrimp businesses in 2013 (after certification)

	Number of workers in 2013	Average salary per year in 2013 (mil. VND)	Average salary per month (mil. VND)
Shrimp			
All businesses	15 430	47	3.89
Farms	450	4	4.50
Processors	14 980	46	3.81

Source: own survey

Table 28. Job creation linked with certified shrimp

	Shrimp
All new jobs linked with certification	**597**
% job creation*	4%
New jobs in farming	**37**
% job creation*	9%
New jobs in processing	**560**
% job creation*	4%

* Jobs created in the year 2013 after certification compared to the year before certification
Source: own survey

Table 29. Environmental benefits - improved production sustainability indicators after versus before certification in shrimp farming

Description	Survival ratio (%)	FCR (kg feed/kg weight)		Yield (MT/ ha)	
Shrimp					
Sustainability indicators after certification					
All	68%	1.18		3.34	
Disaggregation by farming method					
Eco-farming*	54%	-		1.02	
Industrial farming	72%	1.52		7.76	
Disaggregation by type of certificate					
National certification (VIETGAP)	78%	1.2		8.30	
International certification					
GLOBALGAP	80%	-		5.00	
Naturland/IMO	5%	-		0.45	
Friend of the Sea	83%	0.39		7.11	
BAP	71%	1.56		7.48	
Difference and change percentage					
All	8%	-0.06	-5%	0.35	12%
Disaggregation by farming method					
Eco-farming*	11%	-	-	0.11	12%
Industrial farming	7%	-0.08	-5%	0.82	12%
Disaggregation by type of certificate					
National certification (VIETGAP)	5%	-0.05	-4%	0.30	4%
International certification					
GLOBALGAP	10%	-	-	0.50	11%
Naturland	-	-	-	-	-
Friend of the Sea	13%	-	-	0.88	14%
BAP	8%	-0.08	-5%	0.86	13%

* Feed did not apply in shrimp eco-farming and no FCR was recorded
Source: own survey

Table 30. Environmental benefits from certification

Description	For farming			Description	For processing
	Reduced loss from better environmental treatment	Better surrounding environment	Reduced loss from improved relationships with the community		Water pollution reduced
Number of business experiencing positive change					
Shrimp farms	8	10	10	Shrimp processors	14
%	67%	83%	83%	%	82%
*Average score**					
Shrimp farms	3.92	4.08	3.92	Shrimp processors	3.88

* 3 reflects that the respondent could not tell whether the environmental impact was positive or negative or whether the positive impact was related to compliance with sustainability standards.
A score higher than 3 reflects that the respondent thought the positive environmental impact was related to compliance with sustainability standards.

Source: own survey

Table 31. Pangasius farm distribution by certificates and size

Distribution by certificate*	No. of farms	Farming areas (ha)	Certified production volume (MT/cycle)
All	21	1 473.2	267 230
VIETGAP	2	309.5	118 000
GLOBALGAP	10	244 418	60 200
ASC	16	284 418	79 230
BAP/ GAA	1	8	3 200
Other (BMP)	1	9.5	2 800

Distribution by size	Number of farms	Certified farming areas (ha)	Production volume (MT/year)
All	21	719.4	493 100.0
< 2 ha	0	0	0
2 - 10 ha	3	24.0	9 600.0
10 - 50 ha	11	189.2	72 500.0
50 - 100 ha	5	86.7	130 000.0
> 100 ha	2	419.5	281 000.0

* A farm can maintain more than one certificate for the same area and production volume.
Source: own survey

Table 32. Pangasius processor distribution by certificates

	No. of processors	%
All	20	
VIETGAP	5	25%
GLOBALGAP	8	40%
ASC	9	45%
BAP/ GAA	1	5%

* A farm can maintain more than one certificate for the same area and production volume.
Source: own survey

Table 33. Investment in certification of pangasius processors

Description	Start-up investment	Investment by key items			Annual fee
		Infrastructure and technology	Initial certification	Labelling	Annual renewal
Average costs per processor (million VND)	220.0	94.4	77.4	21.3	26.9

Source: own survey

Table 34. Environmental costs from certification

	Before certification	After certification
Farms		
Average water treatment costs (VND mil./year), 10 farms	7.1	21.5
Average other environment treatment costs (VND mil./year)	0.714	12.071
Processors		
Average water treatment costs (VND mil./year)	592.27	600.45

Source: own survey

Table 35. Key labour force figures in 2013 (after certification), pangasius

	Number of workers in 2013	Average salary per year in 2013 (mil. VND)	Average salary per month (mil. VND)
All businesses	22,438	44.73	3.73
Farms	1,936	35.14	2.92
Processors	20,502	45.64	3.80

Source: own survey

Table 36. Job creation linked with certified aquaculture, pangasius

	Pangasius
New jobs linked with certification	2 202
% job creation*	11%
New jobs in farming	650
% job creation*	51%
New jobs in processing	1 552
% job creation*	8%

* Jobs created in the year 2013 after certification compared to the year before certification
Source: own survey

Table 37. Wage performance in pangasius farming and processing after certification

	No. of farms	No. of processors	All
Higher wages	7	2	9
Same wages	14	13	27
Lower wages	0	0	0

Source: own survey

Table 38. Environmental benefits from certification

Description	For farming			Description	For processing
	Reduced loss from better environmental treatment	Better surrounding environment	Reduced loss from improved relationships with the community		Water pollution reduced
Number of business experiencing positive change					
Fish farms	11	19	19	Fish processors	14
%	52%	91%	91%	%	70%
*Average score**					
Fish farms	3.52	3.95	3.90	Fish processors	3.65

* 3 reflects that the respondent could not tell whether the environmental impact was positive or negative or whether the positive impact was related to compliance with sustainability standards. A score higher than 3 reflects that the respondent thought the positive environmental impact was related to compliance with sustainability standards.
Source: own survey

ANNEX 7. TABLES PERTAINING TO COST-BENEFIT ANALYSIS

Table 39. Summary comparative table of the cost-benefit analysis of certified and conventional shrimp production at the farmers level

Scenario	Certified shrimp production – Farmers							Conventional shrimp production – Farmers							Comparison			
	Price	Yield	Sales	Cost (including annual certification fee)		Profit		Price	Yield	Sales	Cost		Profit		Sales differential	Profit differential		Profit margin differential
	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ha	Mn VND/ha	%	%
-20%	173.14	7.48	1,296	65.72	492	107.42	804	163.82	6.92	1,134	63.81	442	100.01	692	162	112	16%	1%
Base-case	216.43	7.48	1,619	65.72	492	150.71	1,128	163.82	6.92	1,134	63.81	442	100.01	692	486	435	63%	9%
10%	238.07	7.48	1,781	65.72	492	172.35	1,290	163.82	6.92	1,134	63.81	442	100.01	692	647	597	86%	11%
20%	259.71	7.48	1,943	65.72	492	194.00	1,452	163.82	6.92	1,134	63.81	442	100.01	692	809	759	110%	14%

Table 40. Summary comparative table of the cost-benefit analysis of certified and conventional shrimp production at the processor/exporter level

Scenario	Certified shrimp production – Processors/Exporters							Conventional shrimp production - Processors/Exporters							Comparison			
	Price	Yield	Sales	Cost (including annual certification fee)		Profit		Price	Yield	Sales	Cost		Profit		Sales differential	Profit differential		Profit margin diff.
	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ha	Mn VND/ha	%	%
-10%	280.69	5077	1 425 084	240.74	1 222 253	39.95	202 831	256.43	4718	1 209 827	212.07	1 000 547	44.36	209 280	215 257	(6 449)	-3%	-3%
Base-case	311.88	5077	1 583 426	240.74	1 222 253	71.14	361 174	256.43	4718	1 209 827	212.07	1 000 547	44.36	209 280	373 599	151 894	73%	6%
10%	343.07	5077	1 741 769	240.74	1 222 253	102.33	519 516	256.43	4718	1 209 827	212.07	1 000 547	44.36	209 280	531 942	310 236	148%	13%
20%	374.26	5077	1 900 112	240.74	1 222 253	133.52	677 859	256.43	4718	1 209 827	212.07	1 000 547	44.36	209 280	690 285	468 579	224%	18%

Table 41. Summary comparative table of the cost-benefit analysis of certified and conventional pangasius production at the farmers level

Scenario	Certified pangasius production – Farmers							Conventional pangasius production - Farmers							Comparison			
	Price	Yield	Sales	Cost (including annual certification fee)		Profit		Price	Yield	Sales	Cost		Profit		Sales differential	Profit differential		Profit margin differential
	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ ha	Mn VND/ha	Mn VND/ha	%	%
-10%	20.43	333.81	6 820	21.70	7 245.21	-1.27	(425)	22.27	380.18	8 466	21.02	7 990	1.25	476	(1 646)	(901)	-189%	-12%
Base-case	22.70	333.81	7 577	21.70	7 245.21	1.00	332	22.27	380.18	8 466	21.02	7 990	1.25	476	(889)	(143)	-30%	-1%
10%	24.97	333.81	8 335	21.70	7 245.21	3.27	1 090	22.27	380.18	8 466	21.02	7 990	1.25	476	(131)	614	129%	7%
20%	27.24	333.81	9 093	21.70	7 245.21	5.54	1 848	22.27	380.18	8 466	21.02	7 990	1.25	476	627	1,372	288%	15%

Table 42. Summary comparative table of the cost-benefit analysis of certified and conventional pangasius production at the processor/exporter level

Scenario	Certified pangasius production – Processors/Exporters							Conventional pangasius production - Processors/Exporters							Comparison			
	Price	Yield	Sales	Cost (including annual certification fee)		Profit		Price	Yield	Sales	Cost		Profit		Sales differential	Profit differential		Profit margin differential
	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Ton/ha	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ton	Mn VND/ha	Mn VND/ha	Mn VND/ha	%	%
-5%	47.46	8136	386 143	43.87	356 918	3.59	29 225	47.78	7 465	356 640	43.58	325 287	4.2000	31 353	29 503	(2 128)	-7%	-1.2%
Base-case	49.96	8136	406 466	43.87	356 918	6.09	49 548	47.78	7 465	356 640	43.58	325 287	4.2000	31 353	49 826	18 195	58%	3.4%
10%	54.95	8136	447 113	43.87	356 918	11.09	90 195	47.78	7 465	356 640	43.58	325 287	4.2000	31 353	90 473	58 842	188%	11.4%
20%	59.95	8136	487 760	43.87	356 918	16.08	130 842	47.78	7 465	356 640	43.58	325 287	4.2000	31 353	131 119	99 489	317%	18.0%

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Job Number: DTI/1955/GE