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of the requirements for the

Doctoral degree in AGRICULTURAL, FOOD AND RESOURCE ECONOMICS

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ESSAYS ON FOOD SAFETY AND COMPETITIVENESS IN THE PHILIPPINE SEAFOOD INDUSTRY

Volume I

By

Catherine Ragasa

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Agricultural, Food, and Resource Economics

2008

ABSTRACT

ESSAYS ON FOOD SAFETY AND COMPETITIVENESS IN THE PHILIPPINE SEAFOOD INDUSTRY

By

Catherine Ragasa

Despite increased research in recent years, the impact of food safety measures on the food industry remains an open question. There is still active debate on how food safety can be positioned to increase industry competitiveness, on the costs and benefits of food safety systems, and on the equity impacts associated with these systems, particularly at the firm level. Moreover, the reasons for an individual firm to allow its food safety certification to continue or discontinue are not well understood. In this context, this dissertation analyzes three themes related to food safety and industry competitiveness.

The first essay describes the contrasting experiences of Thailand, Vietnam, and the Philippines with regard to dynamics of competition in international seafood markets. Using a case study approach and institutional analysis, results show that policies and institutions adopted by Thailand and Vietnam had led to a favorable business environment; strong collective action; effective export-oriented strategies by the private and public sectors; and a remarkable culture of product quality and food safety. Policies favorable to the industry have been more easily passed in Thailand and Vietnam than in the Philippines due to the lack of sustained investments from sector actors to push forward these policies in the latter. The culture of free-riding, dole-out mentality, and lack of sustained collective action is more prevalent in the Philippines than in Thailand and Vietnam. The Philippines can learn from these countries' experience, but structural

changes need to occur including permitting healthy competition among interest groups and creating a favorable environment for collective action and business sector to flourish and for individual actors to participate and contribute to the betterment of the sector.

The second and third essays continue to explore deeper the food safety dimension of the Philippine seafood industry. The second essay employs logit, survival, and firm-level financial cost-benefit analyses using primary data from 59 seafood processing firms in the Philippines. It shows that: (1) product's price and quantity levels and active membership in associations are significant factors affecting initial adoption, while price differential between EU and other markets, difficulty in credit access, and active membership in associations are significant factors affecting continued certification; (2) output prices did not increase and are not expected to increase in the near future due to HACCP adoption; and (3) quantity increases, reduction in product wastage, and other realized benefits from HACCP adoption were limited. Results point to strong disincentives for continued adoption due to losses by many firms. Despite strong motivations to discontinue, there are losses of market access to EU by other industry players due to difficulties in shifting factors of production to other productive sectors.

The third essay employs a translog cost function to analyze 2-period panel data from 59 firms. Results show that: (1) reported HACCP expenditures are underestimated, likely due to investment crowding-out effect, lower flexibility in production, or costs hidden in other accounts when calculating production costs; (2) there is no evidence of cost efficiency gains with HACCP systems; and (3) there are no economies of size in seafood processing even with HACCP systems, contrary to most findings in the literature.

ACKNOWLEGMENTS

I would like to express my sincerest gratitude to my Guidance Committee. I am grateful to Dr. Rick Bernsten, my major professor, for being instrumental in my admission to MSU, offering his home during my first days in MSU, and being available for countless meetings and requests for help. Dr. Suzanne Thornsbury, my research supervisor, has offered her infinite patience, critical thinking, and remarkable knowledge on the topic. I thank her for the supervision and determination in constantly pushing me hard to achieve quality work. This dissertation has also benefited substantially from critical inputs and extremely useful suggestions from Dr. Satish Joshi, Dr. John Staatz, Dr. Allan Schmid, and Dr. Cathy Weir. I am grateful for their invaluable guidance. I would like to thank a number of professors whom I have approached in one way or another during the times that I needed advice on technical details – Dr. Roy Black and Dr. Dolan Kirk – thank you for your time and helpful comments.

I would also like to thank numerous units or programs that provided funding for my PhD program and dissertation: Bean/Cowpea CRSP, Graduate School, Institute of International Agriculture, Dissertation Completion Fellowship, and Larizabal Foundation Graduate Student Fellowship. Additional thanks are owed to the Department of Agricultural Economics, especially to Dr. Eric Crawford for the assistantship and fellowship funds provided and, most important, the faith and confidence he had in me, which greatly helped me through the PhD program.

I am indebted to my mentors in the Philippine Institute for Development Studies: Dr. Cristina David and Dr. Eliseo Ponce. I thank my supervisors in the World Bank, Dr. Derek Byerlee and Dr. Eija Pehu, for their mentorship and wonderfully understanding

while I finished this dissertation. I am grateful to two research assistants - Emma Cinco and Gee Lavina - for their help in setting up appointments, acting as interviewers in some cases, and finding financial statements and datasets from Philippines government offices. I am also indebted to three colleagues who have helped me edit sections of this dissertation: Kelly Cassaday, Gunnar Larson, and Aziz Gokdemir.

There are many other people to whom I am certainly indebted: (i) my host families while I was doing my field work; (ii) colleagues in government agencies who shared their precious time with me; (iii) owners and representatives of firms and experts of different organizations and agencies interviewed, especially Mr. Alvin Gimelo, Mr. Jet Tanciangco, and Mr. Jose, for their kindness in pre-testing several drafts of the questionnaire; and (iv) my friends in Cook Hall and the MSU Filipino Club – I appreciate their camaraderie over my many years at MSU.

I want to express my sincerest gratitude to my boyfriend, Sachin Shahria, for his understanding and care. He gave me constant inspiration and kept me going throughout the dissertation process. Last but not least, I would like to offer this work to my family – to my parents, Daniela and Ciriaco; my brothers, Rogelio, Elmer, Dante, and Herbert; and to the little angels in the family, Michael Angelo, Maria Katrina, Jeremy, Dave John, and Jerommel.

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LIST OF ACRONYMS

ABC	Aquaculture Business Club
ADB	Asian Development Bank
AFA	ASEAN Fishery Federation
AFMA	Agriculture and Fisheries Modernization Act
AIC	Akaike information criterion
AMCFP	Agro-Industry Modernization Credit and Financing Program
ANCOVA	analysis for covariance
ANOVA	analysis of variance
APEC	Asia Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BAFPS	Bureau of Agricultural and Fisheries Product Standards
BAP	Best Aquaculture Practices
BFAD	Bureau of Food and Drugs
BFAR	Bureau of Fisheries and Aquatic Resources
BOI	Board of Investment
BRC	British Retail Consortium
CA	Competent Authority
CAC	Codex Alimentarius Commission
CAP	Common Agricultural Policy (EU)
CCP	Critical Control Points
CFIA	Canadian Food Inspection Agency
CFP	Common Fisheries Policy (EU)
COC	code of conduct
CR4	concentration ratio of top 4 firms
DA	Department of Agriculture (Philippines)
DB	Doing Business
DEP	Department of Export Promotion (Thailand)
DFT	Department of Foreign Trade (Thailand)
DOF	Department of Fisheries (Thailand)
DOLE	Department of Labor and Employment (Philippines)
DOST	Department of Science and Technology (Philippines)
DTI	Department of Trade and Industry (Philippines)
e	elasticity of total costs with respect to output
EC	European Commission

EEC	European Economic Community
EIU	Economist Intelligence Unit
EMS	environmental management system
EOI	export-oriented industrialization
ESE	European Seafood Exposition
EU	European Union
EurepGAP	European Retailer-Producer Working Group on Good Agricultural Practices (now called GlobalGAP)
EUREP	European Retailer-Producer Working Group
FAFST	Foundation for the Advancement of Food Science and Technology
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistical Database
FDA	Food and Drug Administration (United States)
FDI	Foreign Direct Investment
FDRA	Food Development and Regulatory Authority (Philippines)
FDC	Food Development Center (Philippines)
FILP	Fisherfolk Integrated Livelihood Program
FNRI	Food and Nutrition Research Institute (Philippines)
FTA	Free Trade Agreement
GAA	Global Aquaculture Alliance
GAP	Good Agricultural/Aquacultural Practices
GCI	Global Competitiveness Index
GDP	Gross Domestic Product
GHP	Good Hygienic Practices
GMA	Ginintuang Masaganang Ani (Philippines)
GMP	Good Manufacturing Practices
GNP	Gross National Product
GCR	Global Competitiveness Report
GSP	Generalized System of Preferences
GVA	Gross Value Added
HACCP	Hazard Analysis and Critical Control Points
IFPRI	International Food Policy Research Institute
IISP	International Institute for Sustainable Development
IMF	International Monetary Fund
IO	Input-Output (matrix)
IPPC	International Plant Protection Convention

ISI	import-substitution industrialization
ISO	International Organization for Standardization
IUCN	The World Conservation Union
JMC	Joint Management Committee (for the Harmonization and Mutual Recognition of Accreditation and Certification Programs in Government [Philippines])
LACF	Low-Acid Canned Food
LM	logit model
MCT	mean comparison test
MOA	Ministry of Agriculture and Cooperatives (Thailand)
MOFI	Ministry of Fisheries (Vietnam)
MOU	Memorandum of Understanding
MRL	maximum residue level
MSU	Michigan State University
Nafiqaved	National Fisheries Quality Assurance and Veterinary Directorate (Vietnam)
NBC	net benefit-cost (analysis)
NFI	National Food Institute (Thailand)
NGO	Non-government Organization
NSF	National Safety Foundation
NSO	National Statistics Office (Philippines)
NSCB	National Statistical Coordinating Board
NVA	net value added
OECD	Organisation for Economic Co-operation and Development
OIE	International Office of Epizootics
PhP	Philippine peso
PDC	Product Development Center (Thailand)
PFC	Philippine Fisheries Code
PFDA	Philippine Fisheries Development Authority
PIDS	Philippine Institute for Development Studies
PSE	Philippine Stock Exchange
PTTC	Philippine Trade Training Center
QA	quality assurance
QC	quality control
QMS	quality management system
RC	environmental regulatory cost

SA	survival analysis
SAARC	South Asian Association for Regional Cooperation
SEAFDEC	Southeast Asian Fisheries Development Center
SEC	Securities and Exchange Commission (Philippines)
SIAL	Salon International de I'Alimentation
SIFC	Small Industry Finance Corporation (Thailand)
SOE	state-owned enterprises
SPS	Sanitary and Phytosanitary Standards
SQF	Safe and Quality Food
SSOP	Sanitary Standard Operating Procedure
TFDA	Thai Food and Drug Administration
TFFA	Thai Frozen Foods Association
TFPA	Thai Food Processors' Association
TIF	Thai Industries Federation
TMSFA	Thai Marin Shrimp Farmers Association
TRT	*Thai Rak* Party
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNIDO	United Nations Industrial Development Organization
URAA	Uruguay Round Agreement on Agriculture
US	United States
US$	US dollar
USDA	United States' Department of Agriculture
USFDA	United States' Food and Drug Administration
VASEP	Vietnam Association of Seafood Exporters and Processors
WEF	World Economic Forum
WHO	World Health Organization
WITS	World Integrated Trade Solution (World Bank)
WTO	World Trade Organization
WWF	Worldwide Fund for Nature

CHAPTER ONE

INTRODUCTION

1 Background

Food safety has become an increasingly important issue for policymakers worldwide. In the wake of numerous recent food scares (e.g., mad cow disease, *E. coli* 0157, Salmonella, and dioxin contamination of meat and dairy products) developed countries, and increasingly developing countries, have improved regulatory measures to minimize the risk of contamination in their food supply. The resulting food safety standards not only represent concern for public health, but also increasingly affect international trade and market access.

As a consequence, research related to the economics of food safety has accelerated rapidly over the last two decades. Starbird (2005) groups research work on food safety into four interrelated domains: (i) regulatory impact assessment, mainly for the United States meat industry; (ii) producer behavior and strategy; (iii) consumer behavior and perceptions; and (iv) price effects of food safety crises. Studies attest to the complexity of food safety systems, which involve multiple interrelationships and processes that impact effectiveness and sustainability. Due to these complexities, many aspects of food safety are still not understood and subject to debate. For instance, despite increased research in the last few years, the impact of food safety measures on the food industry both in the short- and long-run remains an open question. There is still active debate over how to position food safety strategies to improve competitiveness; the costs and benefits of food safety systems; and the equity impacts associated with these systems,

particularly from a firm perspective. Moreover, implications of a firm's food safety de-certification, which indicates the presence of risk and sustainability issues, are not well elucidated in the literature. Studies have tended to concentrate on the United States (US), European Union (EU), and other developed economies. Only recently has research started in the developing country context, where trade-offs and complexities are expected to be greater.

If the objective is to hasten adoption and ensure sustainability of food safety systems, either for public health or long-run competitiveness, it is of paramount importance to understand the incentives, capacities, trade-offs, and economic implications of these systems for an industry that produces, processes, and trades food products. *How are countries and industries responding in the short- and long-run to the task of managing stringent food safety systems? What are the incentives and capacities faced by firms that influence their decision to adopt and continue adopting these systems? Are there hidden costs, efficiency gains, and equity effects of these systems?* These are questions that need to be addressed to effectively devise strategies to strengthen private and public sector partnerships in the pursuit of safer food.

1.1 Food Safety Regulatory Landscape

At the multilateral level, the Agreement on the Application of Sanitary and Phytosanitary (SPS) Measures under the World Trade Organization (WTO) defines the basic rules for food safety, animal, and plant health standards. Its main goal is to prevent SPS measures from being misused for protectionist purposes with unnecessarily negative effects on international trade (Zarrilli 2004). Within this SPS framework, WTO defines unfair trade and settles disputes among member countries. Member countries are

encouraged to use international standards and guidelines, although countries may use their own measures that result in higher standards, provided those standards are scientifically justified and/or based on risk analysis.

Three international organizations entrusted to formulate international SPS standards and undertake risk analyses are the Codex Alimentarius Commission (CAC or Codex), [1] the International Plant Protection Convention (IPPC), [2] and the World Organisation for Animal Health, previously the International Office of Epizootics (OIE).[3] Standards, codes of practice, guidelines, and recommendations developed by these three organizations are recognized by the WTO–SPS Agreement as the international reference for SPS requirements.

The Codex standards are the most relevant to food safety. The WTO-SPS Agreement states that members who apply Codex standards also meet their obligations for food safety under the Agreement.[4] Since the conclusion of the Uruguay Round in 1994, the role of the standards set by Codex has been strengthened. Although introduced

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[1] Codex, which is relevant to seafood products, is organized jointly by the Food and Agricultural Organization (FAO) and the World Health Organization (WHO) of the United Nations (UN) and is composed of member governments worldwide (166 member countries as of 2004 (Zarrilli 2004)). Its primary function is to protect the health of consumers while ensuring fair practices in food trade. It provides a collection of standards, codes of practice, guidelines, and recommendations on food additives, veterinary drug and pesticide residues, contaminants, methods of food risk analysis and sampling, and hygienic handling of foods.

[2] The IPPC is an international treaty relating to plant health, to which 166 governments (as of 2007) currently adhere (IPPC 2008). The Convention has designated the Director-General of FAO as the administrator since 1951 (IPPC 2008).

[3] The OIE is also composed of member governments and is concerned with the occurrence and course of animal diseases (epizootics) that could endanger either animal or human health (OIE 2007).

[4] In the event the standards adopted by countries are stricter that Codex, countries have to show credible scientific justification and prove equivalence of the imposition of standards between their domestically-produced and imported products.

in 1964, Codex has recently become controversial due to revisions that incorporate stricter food safety standards as safeguards for consumers. This has spurred concerns about additional costs to the industry, potentially higher food prices, and disproportionate difficulties of compliance as a result of uneven capacity to participate in standard-setting processes.[5]

While recommendations from Codex are increasingly followed in international trade, some importing countries currently impose their own distinct food safety requirements and associated procedures to assess conformity. For instance, in Japan, Australia, and Canada, border inspection remains the predominant approach to food safety controls for seafood products; while the US and EU focus more on process standards with less emphasis on border inspection (Table 1). In the US and EU, imports of seafood products must be processed in facilities that have equivalent standards to domestic facilities where use of Hazard Analysis and Critical Control Points (HACCP)[6] systems are mandated. In the US, the importer is required to take "affirmative steps" to ensure imports meet regulatory requirements set by the US Food and Drug Administration (FDA), including HACCP systems. In the EU, inspection is a

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[5] Developing countries often lack financial and technical resources to participate in standard setting, which may lead to disproportionate difficulties in complying with standards set by major export markets. This has potential for negative consequences on trade flows of poorer developing countries. For instance, the Philippines is an active member of Codex but has skipped several Codex sessions due to lack of financial resources to send representatives (Lustre 2004). Without active participation, developing countries are unable to have a strong voice in setting standards.

[6] The HACCP system is a subset of the general quality management system (QMS), which prescribes the different processes to control hazards within the food chain. HACCP is a tool to assess hazards and establish control systems that focus on prevention, rather than relying mainly on testing the end product. The seven principles involved in developing and operating a HACCP program are: (1) assess the "food safety" hazard, list the steps in the process where a significant hazard can occur, and describe prevention measures; (2) determine critical control points (CCPs) in the production process; (3) establish critical limits for each CCP; (4) establish procedures to monitor each CCP; (5) establish corrective actions to be taken when monitoring indicates a deviation from the CCP limits; (6) establish record keeping for the HACCP system; and (7) establish procedures to verify that the HACCP system is working correctly (NSF 2005).

responsibility of a "Competent Authority" which is often a government agency in the exporting country. There are lower levels of border inspection in the US and EU following mandatory HACCP regulation than before the regulation was imposed (Henson and Mitullah 2003).

Table 1. Summary of main food import controls and requirements by key importing countries

Category	Japan	Australia/Canada	EU	US
Codex product standards	Comply	Comply	Comply	Comply
HACCP	Not required	Not required, but if a firm complies with HACCP, there is less strict and less frequent border inspection	Required	Required
HACCP accountability	Na	Memorandum of agreement between the exporting country and Australia/Canada	CA (exporting country); with regular check of the CA by the EU	Importer (provide evidence of affirmative steps); with regular check of importers by US FDA
Key requirements	Health certificate requirement; border inspection; regular plant visits; long-term business relationships	Health certificate requirement; border inspection	Health certificate; HACCP requirements; border inspection	Health certificate requirement; HACCP requirements; and border inspection

Note: na=not applicable
Sources: Author; Henson and Mitullah (2003); CFIA (2006); Kagawa and Bailey (2006)

Despite these differences, food safety control systems in these five markets share a number of elements (i.e., common product standards, issuance of a product health certificate by the exporting country, use of border inspection, extent of border inspection based on records of previous inspections). In many cases, efforts to comply with food safety requirements in one market (for example, the EU) are likely to meet requirements in other markets (for example, the US or Australia). As a result, efforts to implement enhanced food safety controls can improve system-wide efficiency such that the costs of

adoption for distinct requirements in individual export markets are reduced (Henson and Mitullah 2003; Nganje 1999).

Regulations adopted by the public sector are complemented by private standards.[7] Private companies, individually as well as collectively, have implemented measures to prevent food safety scandals, differentiate their products, and compete in quality-defined markets (Henson 2006; Henson and Reardon 2005; Ponte and Gibbon 2005; Busch and Bingen 2006). These efforts have been especially prominent among large food retailers, food manufacturers, and food service operators, reflecting both their considerable market power and competitive strategies based around private brands that tie a firm's reputation and performance to the safety and quality attributes of its products. For example, in 1998, UK retailers cooperating in the British Retail Consortium (BRC) took the initiative to formulate common standards to inspect food suppliers (Willems et al. 2005). The BRC standard and other private "codes of practice" and standards (e.g., Euro-Retailer Produce Working Group's Good Agricultural Practices (EurepGAP; and now called GlobalGAP) and Safe and Quality Food (SQF)), are now applied by supermarkets and importers all over the world to coordinate supply chain activities and control food safety. Third-party certification systems such as ISO[8] are increasingly being adopted by private companies.

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[7] Contemporary food systems are increasingly governed by an array of interrelated public and private standards. Although these public and private modes of governance have distinct institutional forms, they are increasingly alike, and influence one another's content and procedures (Henson and Jaffee 2006; Ponte and Gibbon 2005; Ponte 2005). It is increasingly difficult to discern their separate influences on firm behavior.

[8] The International Organization for Standardization (ISO), a non-governmental organization (NGO) with members from the government and private sector, is a network of the national standards institutes of 153 countries. ISO develops widely accepted standards and procedures for global certification of quality management systems (QMS) and environmental management systems (EMS). The ISO 9000 series of standards contains process standards for quality management and quality assurance, mainly in

Adding to the complexities of food safety are the numerous forms of standards. Main forms are process standards or food safety management systems, often verified through inspection, and product standards, verified by laboratory tests. Among the most commonly cited process standard is the HACCP system, currently mandated by two large markets – the US and EU – in most of their food supply (locally produced or imported). In addition, HACCP has been used as a regulatory tool by increasing number of additional countries to promote food safety and contribute to public health. An advantage of HACCP is that by focusing resources on the most critical stages of production and processing (the CCPs) and their important control measures, resources used to improve safety can be minimized. The system can be applied to control any stage in the food system and is designed to provide enough feedback to direct corrective activities. HACCP is a flexible system capable of accommodating change, such as advances in equipment design, processing procedures, or technological development. It is widely recognized in the food industry as a comprehensive approach to establishing good production, sanitation, and manufacturing practices that produce safe foods (Pierson and Corlett 1992).

Aside from the HACCP system, other food safety management and certification systems have increased in recent years in response to consumer preferences, including greater consumer awareness of food safety. Acronyms, including GAP, GHP, GMP, and SSOP, represent systems associated with food safety and/or quality (Table 2).

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manufacturing (GMP or GHP and HACCP are part of ISO 9000 certification), and the ISO 14000 series consists of standards for environmental management systems.

Table 2. Similarities and differences of common food safety and quality management and certification systems

Category	HACCP	GAP (e.g., EurepGAP or GlobalGAP)	GMP/GHP	SSOP
Type of system	Food Safety Management System	Guidelines of good practices	Guidelines of good practices	Guidelines of good practices
Voluntary or mandatory	Voluntary (although some countries have made HACCP a mandatory regulation in some sectors)	Voluntary (although some countries have made GAP a mandatory regulation in some sectors)	Voluntary (although some countries have made GMP/GHP a mandatory regulation in some sectors)	Voluntary (although some countries have made SSOP a mandatory regulation in some sectors)
Focus	Food safety (Control of physical, chemical, and microbiological hazards)	Farmers' safety, food safety of the farm products	Hygiene and sanitation, with focus on physical structure of processing plants	Sanitation hygiene and sanitation which involves minimum recording of sanitation practices
Stage in the chain	Processing, distribution, retail/wholesale, fishing vessels, food carriers (and recently, at farm level)	Farm level	Processing (GMP), distribution, retail/wholesale and food service establishments (GHP)	Processing, distribution, retail/wholesale

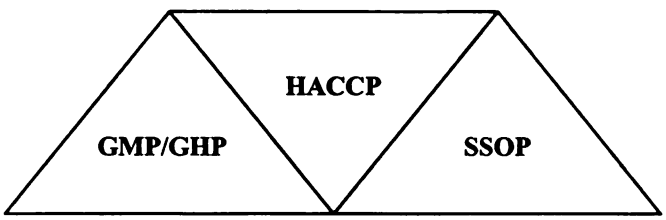
Sources: Author; Henson and Mitullah (2003); Booren (2005a); Booren (2005b)

Good Agricultural Practices and Good Aquaculture Practices (GAP) are sets of standards to reduce risk in agricultural and aquaculture production. A popular example of a third-party certification system for GAP is the EurepGAP (now called GlobalGAP). Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) are often considered the minimum sanitary and processing requirements by food regulatory authorities in both developing and developed countries. These practices take into consideration plant layout, equipment design and operation, and employees' hygiene practices (Booren 2005a). Sanitation Standard Operating Procedures (SSOP) often accompany GMP/GHP as an additional step for advanced quality control.[9] Unlike GMP/GHP, SSOP involves a thorough record keeping, and lays out specific actions or

[9] The definitions of the two systems can vary across context and country. In practice, it is difficult to differentiate between the two systems, and thus, they are often used together.

procedures to monitor hazard controls, establish deviation limits, and implement corrective action requirements (Booren 2005a). GMP/GHP and SSOP are considered as foundations and prerequisites of HACCP system, as illustrated in Figure 1.[10]

Figure 1. Relationship of HACCP, GMP/GHP, and SSOP



Source: Booren 2005b

Product standards such as limits for pesticide and antibiotic residues (in aquaculture), heavy metals, microbiological pathogens, and physical hazards are used to verify the effectiveness of the HACCP systems. As a result, some experts often incorporate all of these standards (product standards, GMP/GHP, and SSOP) as prerequisites or main components of a HACCP system. Throughout this dissertation, the term "HACCP system" refers to this broader definition.

1.2 Literature Gaps and Research Questions

Despite increasing literature on food safety, there are gaps that remain to be addressed. Issues and literature gaps included are grouped into three research themes: (i) industry competitiveness and the role of food safety; (ii) firm behavior towards initial and continued certification of HACCP systems; and (iii) costs and economies of size in adopting HACCP systems. Each of these research themes is followed by specific research

[10] See Chapter 3 for more details on the links between GMP/GHP/SSOP and HACCP.

questions that will be addressed in the following chapters.

1.2.1 Industry Competitiveness and the Role of Food Safety

Proliferation and enhanced stringency of food safety regulation is a source of concern among many developing countries. Reflecting changes in trade policies for various agricultural products, there is a concern that food safety measures can (and will) be used as a protectionist tool (Anders and Caswell 2006; Jaffee and Henson 2005). Even if standards are not intentionally used to discriminate against imports, there is concern that food safety's growing complexity, lack of harmonization across countries, and the difficulty of implementing and monitoring such systems could still impede the trading efforts of developing countries.

Many developing countries simply lack the administrative, technical, and scientific capacity to comply with emerging requirements, presenting potentially insurmountable barriers in the short-run. The combined effects of institutional weaknesses and rising compliance costs could contribute to further exclusion of weaker economic players at various levels (e.g., small/poor countries, small- and medium-sized businesses, and smallholder producers) from high-end export markets.

At a macro-level, a body of research (mostly by the World Bank) examines different levels of standards for agricultural products and effects of these standards on trade of developing countries (Wilson and Otsuki 2004; 2001). A number of these studies are concerned with higher or more stringent standards imposed by the EU on agricultural exports, compared to internationally set standards such as Codex. Quantitative studies based on a gravity model were used to explain trends in bilateral trade. For instance, Otsuki et al. (2001) show a ten-percent reduction in maximum allowable level of

aflatoxin contamination would reduce trade flows from Africa by 11 percent for cereals and 4.3 percent for fruits, nuts, and vegetables.

In many cases, food safety regulations are viewed as very restrictive for most developing countries. For instance, EU banned shrimp imports from Bangladesh which resulted in an estimated cost for the industry of US$ 14.7 million[11] (EEC 1997a; EEC 1998; Cato and Lima dos Santos 2000). In another instance, EU banned imports of fresh fish products from Kenya, Tanzania, Uganda, and Mozambique due to concerns over food-borne cholera[12] (EEC 1997b). The ban resulted in an average monthly trade loss of US$ 60,000 from Mozambique (FAO 1998).

The above cases could be viewed as exclusion from high-end export markets due to weak food safety systems, arising mainly from low priority to food safety concerns or weak capacity to implement food safety regulations in many developing countries. Ignoring food safety concerns may result in large economic losses for countries and industries, impair important livelihoods for their people, and impair foreign exchange-earning capacity. Country-level studies[13] in developing countries suggest that where access to export markets was denied due to SPS issues, the exporting countries incurred

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[11] As of July 1998, only 11 seafood-processing companies in Bangladesh (of approximately 50) were named as approved establishments to ship to the EU (EEC 1998).

[12] Cholera is a major public health problem in developing countries, also causing enormous economic losses. The disease is caused by the bacterium *Vibrio cholerae*. In addition to water, contaminated foods can be the vehicle of infection. Different foods, including rice, vegetables, millet gruel, and various types of seafood have been implicated in outbreaks of cholera. Symptoms, including abdominal pain, vomiting, and profuse watery diarrhea, may lead to severe dehydration and possibly death, unless fluid and salt are replaced (WHO 2007).

[13] See Henson et al. (2000) and Abila (2003) on fish exports from Kenya; Calvin et al. (2003) on raspberries exports from Guatemala; Cato and Subasinge (2003) on shrimp exports from Bangladesh; and Norton et al. (2003) on pesticide residues on snow peas from Guatemala, hot peppers from Jamaica, and horticultural crops from Mali.

substantial costs in terms of lost sales, market share, and investments required to re-enter export trade. With growing availability of institutions to reward safe food producers and punish non-safe food producers, attention to food safety becomes crucial to staying in the food business.

Countries and industries can also utilize evolving standards to their competitive advantage. Many of these standards provide a "common language" within the supply chain and promote the confidence of consumers in food product safety (Henson and Jaffee 2006). Without that confidence, the market for these products cannot be maintained, let alone increased. Compliance with food safety may provide a powerful incentive for modernization of developing country export supply chains and clarify appropriate management functions of government. Furthermore, increased attention to the spread and adoption of "good practices" in fishing, aquaculture and seafood processing may lead to spillovers into domestic food safety and agricultural health, benefiting local population and domestic producers. Thus, rather than undermining the comparative advantage of developing countries, enhancement of capacity to meet stricter standards could potentially create new forms of competitive advantage. Spriggs and Isaac (2001) emphasize the fundamental importance of food safety in the competitiveness of the beef industry in four developed economies —Australia, Canada, the UK, and the US. Henson and Jaffee (2006) emphasize that attention to food safety concerns is important to attaining competitiveness in the long-run, whether the "standards as barriers" or "standards as catalysts" perspective is adopted. Thornsbury (2002), reviewing Spriggs and Isaac (2001), emphasizes the need to include developing countries and/or countries dependent on food imports to allow a much richer comparison of institutional systems.

There is an expanding catalogue of cases where countries have been able to exploit market opportunities because of their greater capacity to comply with food safety requirements (Jaffee and Henson 2005). Jaffee's (1992) review of success stories in exporting high-value food commodities from developing countries emphasizes the ability to compete as long as product quality (including safety attributes) is properly controlled through vertical coordination and public sector support. A recent example is Chile's seafood industry, where a well-coordinated supply chain and an enabling and facilitative public sector have transformed the industry into a source of growth for the country and the region. Thailand and Vietnam have combined attention to food safety and quality with other key elements of competitiveness to become world leaders in the seafood industry.

The latter example of Thailand and Vietnam is one of the most striking trends in the seafood industry. Seafood, being the most traded product worldwide, is heavily affected by food safety regulations. However, Thailand and Vietnam were able to manage the challenges brought about by these regulations and transformed them into their competitive advantage. The story becomes even more interesting when compared to the Philippines, where the seafood export growth has stagnated over the years. These countries have similar geographical location, natural resources, and past level of export performance in the 1970s and 1980s, but achieved very different levels of growth since 1990s. In the context of stricter food safety regulation in international seafood markets, it is crucial to understand what policies and institutions can be adopted by the Philippine government and private sector to improve their seafood industry competitiveness. The Philippines can learn from the experiences of Thailand and Vietnam.

Chapter 2 of this dissertation will trace the policies and institutions that led to different levels of competitiveness and food safety in seafood industries of Thailand, Vietnam, and the Philippines. Food safety is viewed not in isolation, but in the context of broader industry competitiveness. This chapter supports growing recognition that food safety and competitiveness are closely related and mutually complementary. Moreover, these two may be affected by the same pre-requisite political commitment, policies, and institutions in a country. Specific research questions addressed in Chapter 2 are:

(i) What are the policies and institutions that led to different levels of competitiveness in the seafood industries of Thailand, Vietnam, and the Philippines?

(ii) How are the three countries responding to a more demanding international seafood market in terms of food safety?

(iii) What led to the different policies and institutions that affect competitiveness and food safety in the three countries' seafood industries?

(iv) What constraints face the Philippine seafood industry in adopting the same policies and institutions as Thailand and Vietnam?

1.2.2 Firm Behavior toward Initial and Continued Certification of HACCP Systems

The imposition of mandatory HACCP regulation by the US and EU markets created controversy and concerns worldwide, which resulted in growing attention and research. There is a voluminous literature on the principles of HACCP and its use as a measure to improve food safety. Traditionally, the focus has been on meat and dairy industries in the US and EU, although in recent years greater attention has been paid to

concerns of developing countries. A more limited set of studies have addressed how firms behave and react to the presence or absence of economic incentives from HACCP certification. There remains a dearth of research on the sustainability of adoption of HACCP systems in both developed and developing countries.

Most new food safety certification systems in developing countries have been subsidized through technical and financial assistance from the development community. However, there are doubts that these certification systems are actually sustained after initial support has been removed. For instance, HACCP system certification imposed by the EU requires annual or bi-annual renewal. What happens to firms once they are initially certified — whether they remain certified or become de-certified — remains to be explored. For instance, about 50 percent of the seafood exporting firms in the Philippines were EU HACCP certified in 2004, but 60 percent of these firms were de-certified by 2005, dropping from 96 firms in 2004 to only 36 in 2005. While these de-certified firms remain in the seafood business, the large proportion of de-certified firms has economic implications for producers, processors, and the competitiveness of the seafood industry as a whole. To date, no systematic research has been done to investigate this recent phenomenon, which may also reflect concerns in other exporting countries.

Critical to assessing financial incentives are appropriate measures of cost and benefits. In terms of HACCP cost measurement, there is considerable variability among national-, industry- and firm-level estimations, depending on the country and cost components included. A summary of selected studies is presented in Table 3. A large part of the variability in cost estimation is due to the difference in HACCP system cost components, i.e., including versus excluding costs of GMP and SSOP. For instance,

Bangladesh seems to have higher costs of implementing and maintaining HACCP systems than the US (US$ 227,155 per plant start-up costs and US$ 0.04 per pound maintenance costs in Bangladesh compared to US$ 113,305 per plant start-up costs and US$ 0.0090 per pound maintenance costs in the US). This difference is mainly due to the fact that US already had the pre-requisite programs in place, while Bangladesh did not.

Maldonado et al. (2005) and Colatore and Caswell (2000) recognize that HACCP costs vary based on context, and the most important explanatory factor is the existing level of food safety control in a plant prior to introduction of the HACCP system. In this regard, an attempt to estimate the cost of HACCP adoption in a particular industry should be based on conditions in the country, rather than extrapolating or averaging estimates of previous studies. In this dissertation, some adjustments were made to fit a particular context of interest.

Table 3. Summary of HACCP costs from selected studies

Author	Country & Product	HACCP costs	Cost component	Method
Antle (2000)	US meat	US$ 0.03-0.17 per pound*	All costs (start-up & additional recurring costs)	Ex ante model based on secondary data
FDA (1994) and FSIS (1996)	US meat	US$ 0.0011 - 0.0013 per pound	Start-up costs	Ex ante model based on secondary data
		+ US$ 0.0015 - 0.0018 per pound	Additional recurring costs	
Nganje and Mazzocco (2000)	US meat	US$ 0.004 – 0.44 per pound	All costs (start-up & additional recurring costs)	Firm survey
Hooker et al. (2002)	US meat	US$ 0.02-0.20 cents per pound	All costs (start-up & additional recurring costs)	Firm survey
Colatore and Caswell (2000)	US breaded fish	US$ 113,305 per plant	Start-up costs	Firm survey
		0.17 percent of total annual costs (US$ 0.0015 per pound assuming a 10 percent profit margin)	Start-up costs	
		+ US$ 0.0090 cents per pound	Additional recurring costs	
Cato and lima dos Santos (2000)	Bangladesh shrimp	US$ 227,155 per plant	Start-up costs	Firm survey
		US$ 0.32 per pound (or 6.72 percent of average price)	Start-up costs	
		+ US$ 0.04 per pound (or 0.85 percent of average price)	Additional recurring costs	
Henson and Mitullah (2003)	Kenya fish	US$876,000 per plant (or 0.3 percent of total export value to the EU)	All costs (start-up & additional recurring costs)	Firm survey
Henson et al. (2005)	India fish	US$557,000 per plant (or 1.7 percent of total export value to the EU)	All costs (start-up & additional recurring costs)	Firm survey

*Note: *Costs per pound are often estimated as the annual cost (assuming a certain amortization or depreciation rate) per pound of output produced.*

In terms of the HACCP benefits, only a few studies have measured benefits empirically. An exception is Nganje (1999), who studied HACCP implementation in the US meat industry and statistically shows that sample firms with HACCP are more technically efficient than those without HACCP. In addition, firms with HACCP are

shown to be more efficient after adoption than before the HACCP adoption. A second relevant set of studies (e.g., Maldonado et al. 2005; Henson et al. 1999) included categorical rankings among pre-defined benefits to firms from HACCP compliance. These studies have pointed out that the relevance and realization of certain benefits from adopting HACCP systems differ by context.[14]

In the Philippines, seafood processors report that costs of compliance have not been compensated by higher prices or increased demand for their products. There is clearly a gap in quantifying benefits in terms of the effect on price and volume of production faced by firms and the effect on the profitability and exit of firms. Negative private net gains may explain the low and decreasing number of successful EU HACCP adopters, while positive gains would imply a need to find other reasons to explain why adoption is low and HACCP systems difficult to implement.

Chapter 3 of this dissertation will focus on the research gaps identified above. The Philippines is used as a case study. Specific research questions addressed are:

(i) What are the incentive- and capacity-related factors that explain the decision of firms to initially adopt or not adopt EU HACCP systems? What factors affect the rate of initial adoption of EU HACCP systems?

(ii) What are the incentive- and capacity-related factors that explain the decision of firms to continue or discontinue the adoption of EU HACCP systems? What factors affect the rate of EU HACCP de-certification?

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[14] Maldonado et al. (2005), by asking respondents in the Mexican meat industry to rank the factors, reported that the reduction in microbial counts was considered the main benefit (which can be considered a tangible benefit), followed by clientele and product benefits, such as the ability to attract new customers, access to international market, and prolonged product shelf life (which are less tangible than the first benefit). In contrast to the findings in UK by Henson et al. (1999), Maldonado et al. (2005) found that retaining existing customers was not a major benefit, possibly due to the poor awareness of domestic market of food safety.

(iii) What are costs and benefits of EU HACCP adoption among processing firms and the entire fisheries industry?

(iv) What are the difficulties and constraints among seafood processing firms in adopting EU HACCP systems?

1.2.3 Costs and Economies of size in the Adoption of HACCP Systems

Whether HACCP systems generate hidden costs or efficiency gains has been addressed in literature, but the answer remains unclear. The idea of process standards, which potentially induce innovation or crowd-out conventional production processes, was initially applied to environmental regulations (e.g., Gruenspecht 1982; Porter 1991; Nelson, Tietenberg, and Donihue 1993; Porter and Van der Linde 1995; Joshi et al. 1997). It has been argued that complementarities between environmental activities and conventional production, combined with induced innovations associated with environmental requirements, may actually exceed direct expenditures associated with environmental protection. Yet the empirical basis for these claims is quite limited, and more recent studies remain inconclusive with respect to whether the "true" cost of environmental protection is over- or understated. For instance, Joshi et al. (2001) found that true environmental regulation costs are understated, owing to large costs that are not captured in the accounting system and instead are hidden and embedded in other accounts. In contrast, Morgenstern et al. (2001, 1998) ruled out significant understatement and point to a modest, though, statistically nonsignificant overstatement.

Similarly, food safety systems, as a subset of process standards, potentially complement conventional production, and these complementarities may offset part of reported food safety expenditures. Some costs may be saved by producing both

conventional and "safe" food together, lowering the total cost of producing them separately. Once production is stopped to make food-safety-related modifications, other investment projects can also be undertaken, leading to complementarities. Cost-saving innovations may also be induced by changes in the production processes. However, there may be opportunity costs resulting from months or years of disruption in production associated with renovations or building new processing plant. Flexibility in the production processes may be reduced. Due to scarcity of funds and resources, investments in food safety may crowd-out other important investments that a firm has to make.

There is some evidence of the above complementarities and crowding-out effects between food safety systems and conventional production processes. Antle (2000) rejected the hypothesis that product safety does not affect "conventional" variable costs of production, and further concludes that initial estimates of food safety costs may be understated. Nganje (1999) found that HACCP costs may be overstated, because firms with HACCP systems are more efficient than firms without these systems and more efficient than prior to HACCP adoption. There are some problematic assumptions in Nganje (1999), particularly in modeling HACCP costs as independent of the factor prices and quantities of conventional production process. However, since HACCP cost is dependent on factor prices and quantities, it is important to modify Nganje's (1999) approach to better capture the "true" nature of HACCP costs and gain new insights.

In addition, only a few studies exist that systematically quantify cost advantage or disadvantage across different firm categories, especially firm size, as a result of stricter food safety regulations (with the exception of studies of the US meat industry by Hooker

et al. 2002; Ollinger and Mueller 2003; Nganje 1999). Among these latter studies, there is considerable variability in methods and data used, and thus, the findings on costs and equity impacts of HACCP were different. For instance, Hooker et al. (2002), in a study of the US meat processors, finds that even after controlling for scale very small plants incur higher HACCP compliance costs per unit of output. In contrast, Ollinger and Mueller (2003) find that costs per unit of output required for sanitation and process control are about the same for large plants as for small plants, which suggests that larger plants are no more able than small plants to absorb these costs. Several researchers conclude that HACCP system impacts are context-specific (e.g., specific to product, location, and firm); and that most of the variability is due to non-uniform implementation across countries and different stage in the pre-requisite programs before HACCP systems were implemented. Research on this topic in the context of developing countries is limited to a few case studies which looked at examples of excluded small producers and processors from high-value market.[15] The experience of developing countries may provide new insights to the growing attention to the equity dimensions of food safety systems.

For instance, Philippine seafood processors have expressed concerns about difficulties and costs of adopting HACCP systems and other food safety standards. These concerns stem from speculation that small firms will have disproportionate difficulties in compliance. Lack of compliance implies inability to enter and continue exporting to the US and EU and also a reduction of their competitive edge in other markets. Currently, small firms continue to co-exist with medium and large firms in the Philippine seafood industry. However, stringent international food safety regulations raise concerns about

[15] See Farina and Reardon (2000) (dairy farming in Brazil and Argentina); Friedberg (2004) (horticultural exports from Zambia); Okello (2005) (green peas from Kenya); and Henson et al. (2000) (fish from Kenya).

possible change in industry structure, deepening market segmentation where the small firms are supplying to low-value saturated markets and large firms are supplying more lucrative markets, and its equity implications.

Chapter 4 of this dissertation will focus on the research gaps identified above. Specific research questions addressed are:

(i) Does firm size affect the level of costs incurred by Philippine seafood processors in adopting HACCP systems?

(ii) Do HACCP systems affect existing economies or diseconomies of size in the Philippine seafood processing industry?

(iii) Do HACCP costs affect conventional production costs as experienced by Philippine seafood processors?

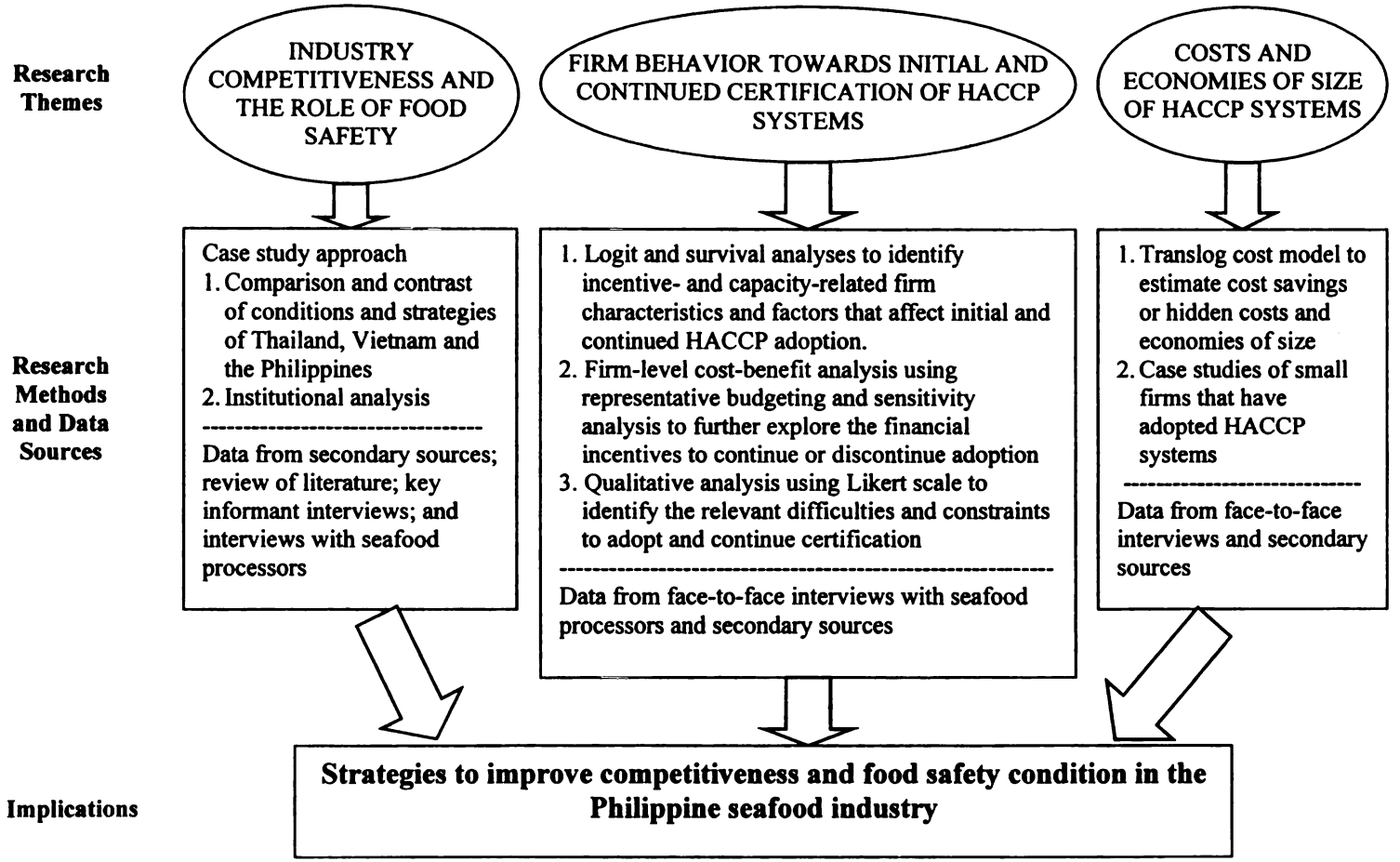
(iv) Are reported HACCP expenditures over- or under-estimated?

(v) Are HACCP systems efficiency-enhancing or –reducing?

2 Overview of the Research Design

Figure 2 presents an overview of the research design. Chapter 2 will explore the first research theme using case study approach, institutional analysis, and data from primary and secondary sources. Chapter 3 will address the second research theme employing logit, survival, and cost-benefit analyses; qualitative approaches; and data from the 59 Philippine seafood processors interviewed in 2005. Chapter 4 will focus on the third research theme using cost functions and data from interviews with seafood processors; company financial statements, and other secondary sources. Chapter 5 integrates the key findings, conclusions, and policy implications from the three research themes.

Figure 2. Research design



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CHAPTER TWO

COMPARATIVE INSTITUTIONAL ANALYSIS OF THE SEAFOOD INDUSTRIES IN THAILAND, VIETNAM AND THE PHILIPPINES

1 Introduction

The seafood industry is important source of employment and export revenue in many developing countries. Fifty percent of world seafood[16] exports are from developing countries. In these developing countries, export revenues from seafood products exceed the combined export revenues from all "traditional" commodities such as bananas, tea, and cocoa.

The international seafood market has undergone rapid changes, which have led to a variety of new challenges and opportunities for producers and processors. First, demand for seafood is growing worldwide, especially among middle-income countries.[17] Globally, per capita consumption of seafood products has increased from 10.5 to 16.5 kilograms (kg) per year over the last three decades (World Bank 2004); and is predicted to increase by 0.4 percent per year (Delgado et al. 2003). Rising incomes in many countries are shifting consumer preferences toward better quality, safer, and more specialized

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[16] Seafood and fisheries are used interchangeably in this chapter. Following FAO, it is defined here as including (a) fresh, chilled, or frozen fish; (b) dried, salted, or smoked fish; (c) fresh, dried, salted, and other forms of crustaceans and mollusks; (d) fish products and preparations; (e) products and preparations of crustaceans and mollusks; (f) oils and fats of aquatic animal origin; and (f) meals, solubles, and similar foodstuffs of aquatic animal origin.

[17] As population increases, total demand for food also increases and as incomes increase, the total demand and proportion of income spent on high-calorie products such as seafood or fisheries products (Bennett's Law) also rises.

products,[18] and consumers are increasingly willing to pay a premium for these attributes. Second, competition among countries is becoming more intense as globalization advances. Market access is largely due to how industries and countries strategically position themselves among their competitors. Technological advances have led to the boom of aquaculture in many emerging seafood suppliers (including Mexico, Ecuador, Chile, Bangladesh and Vietnam), and are shifting cost advantages across countries. Innovations and institutions for food safety and environmental sustainability are also influencing markets. Strategic responses to these market changes determine the degree of competitiveness among individual countries and their industries. This chapter examines actual experiences of three countries, and analyzes varying responses that have led to different levels of competitiveness.

1.1 Dynamics of the International Seafood Market

Seafood is the most heavily traded food commodity and the fastest-growing agricultural trade commodity in international markets (World Bank 2004). World seafood exports reached US$ 65 million in 2006 (from US$ 14 billion in 1980). Japan, the US, and the EU accounted for 80 percent of the total value of seafood product imports in 2006 (FAOSTAT), although developing countries are becoming increasingly important buyers of seafood products. About 30 percent of the world's traded seafood comes from aquaculture production, which has grown nine percent per year since 1970 (World Bank 2004). Shrimp remains the most important seafood commodity traded internationally,

[18] These specialized products include certified "safe" or "healthy" products, fresh, ready-to-eat products, organics, non-traditional species; products catering to growing numbers of migrants to developed countries; and functional foods. The latter include products that influence specific functions in the body and thereby offer benefits for health, well-being or performance, beyond their regular nutritional value (e.g., omega 3-rich fish oil) (Kotilainen et al. 2006).

accounting for 6.4 percent of the volume and 20 percent of the value of world seafood trade in 2006.[19] Tuna is another seafood group important in international trade, accounting for nine percent of the total world seafood value in 2006.[20]

Global seafood trade is governed by a number of factors including: (i) policies, which include tariffs, quotas, and subsidies; (ii) food safety concerns and resulting governing structures; and (iii) standards related to environmental sustainability. These are outlined in Table 4 and discussed below.

Table 4. Factors affecting the international seafood trade

General	Details and examples
Policies	
Tariffs and quotas	1. Tariff levels in developed countries have been reduced to 4.5 percent, but this aggregate level conceals some very high tariffs for selected fish species and products 2. Quota system is also prevalent (e.g., canned tuna). 3. Regional trade agreements are increasingly prevalent
OECD subsidies for fishing	Globally, annual subsidies to fisheries is estimated to be US$ 14-20 billion (Milazzo 1998; WorldWide Fund for Nature (WWF) 2001)
Anti-dumping and countervailing measures	US anti-dumping measures against Thailand, Vietnam, China, Ecuador, and Brazil
Food Safety and Environmental Standards	
SPS measures	Antibiotics in shrimp; maximum residue levels (MRLs) for lead and mercury; mandatory HACCP system; relationship of antibiotic regulation and dumping issue
Environmental regulations	Exploitation of mangroves; turtle issue in catching shrimps; dolphin issue in tuna capture.

[19] The largest producers of shrimp (both capture and aquaculture) are China, India, Indonesia, Thailand, and Vietnam. Half of the shrimp sold in the world market are from aquaculture. Thailand, which accounts for 28 percent of world shrimp aquaculture production, China (20 percent), Indonesia (13 percent) and Vietnam (six percent) are the biggest shrimp aquaculture producers in the world. The Philippines ranked eighth among shrimp aquaculture producers in 2000, but had fallen to 15th by 2006 (FAOSTAT).

[20] China represents 18 percent of total world production, followed by Indonesia (13), Japan (11), the Philippines (7), Spain (5), South Korea (4), Ecuador (3), Mexico (3), and the US (3) (FAOSTAT). In terms of import value, Japan is the top importer of tuna, followed far behind by the US, Italy, France, Spain, UK, Thailand and Germany. In terms of exports, Taiwan is the leading exporter of tuna, followed by Spain, Thailand, France, South Korea, Indonesia, Philippines, and Ecuador. Thailand is both an importer and exporter of tuna - most of Thai tuna imports are unprocessed. These are then processed into canned products and re-exported to other countries for a much higher value.

Historically, tariffs were the principal instrument of seafood trade policy. After completion of the Uruguay Round under the General Agreement on Tariffs and Trade (GATT),[21] average weighted import tariffs on seafood products were reduced to the current average of 4.5-percent in developed countries (Josupeit 2006). This average conceals a number of very high tariffs for selected fish species and products (e.g., processed or value-added seafood products are subject to much higher duties than unprocessed fish). The US has cut tariffs and other restrictions significantly, but the EU and Japan have retained higher tariff rates despites some cuts on their pre-WTO levels.[22]

Quotas are imposed on some products such as canned tuna in the EU and US, and subsidies to the fishing industry and for processing and trading remain common.[23] These subsidies have been an important force driving overfishing. In addition to the WTO, there is a growing use of regional trade blocs and bilateral free trade agreements that aim to reduce trade barriers between their members.[24]

Like many industries, international seafood trade has experienced an increasing use of non-tariff measures such as Sanitary and Phytosanitary (SPS) regulations. Examples include: (i) detention and destruction of shrimp with antibiotics, mainly

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[21] The GATT was a treaty, not an organization. The functions of the GATT were taken over by the World Trade Organization, which was established during the final round of negotiations in the early 1990s.

[22] Average tariff rates on seafood are 4.1 percent in Japan, 10.7 percent in the EU, and 0.9 percent in the US after the WTO agreement (Josupeit 2006).

[23] Fishing industry subsidies are estimated to be US$ 14-20 billion annually in aggregate levels (Milazzo 1998; WorldWide Fund for Nature (WWF) 2001). EU's Common Fisheries Policy (CFP) is one of the most controversial fisheries policies (Roheim 2005).

[24] E.g., Association of Southeast Asian Nations (ASEAN) and China free trade agreement; and bilateral Free Trade Agreements (FTA) between China and Thailand, Mauritius and India, Indonesia and Japan, Japan and Malaysia, and Pakistan with Singapore and Malaysia

chloramphenicol, as defined by the Codex Alimentarius standards – which in some cases are exceeded by standards imposed by the EU;[25] (ii) maximum residue levels (MRLs) of lead and mercury in tuna; and (iii) HACCP regulations governing the processing of seafood exported to the US and EU. There is increasing recognition of the role of food safety in attaining international competitiveness in terms of market entry, especially in high-value markets (Spriggs and Isaac 2001; Henson and Jaffee 2006). Numerous examples exist of economic losses incurred by industries and countries that failed to strategically consider food safety concerns. Several examples also exist of industries that have capitalized on food safety systems and other export promotion strategies to catalyze export growth.[26]

Environmental sustainability is an increasingly important issue that has lead to heightened regulations to protect and manage natural resources. The rapid expansion of aquaculture led to the exploitation of mangroves (Lebel et al. 2002). A number of animal protection regulations (e.g., protection of sea turtles in shrimp fishing and of dolphins in tuna fishing) have also emerged in recent years.

As a result of these changes in policies and institutions, the international seafood landscape has seen the emergence of new players and decline of some traditional suppliers. One of the most striking trends is the sustained expansion of seafood exports in Thailand and the dramatic catching-up by Vietnam. In contrast, the Philippines has

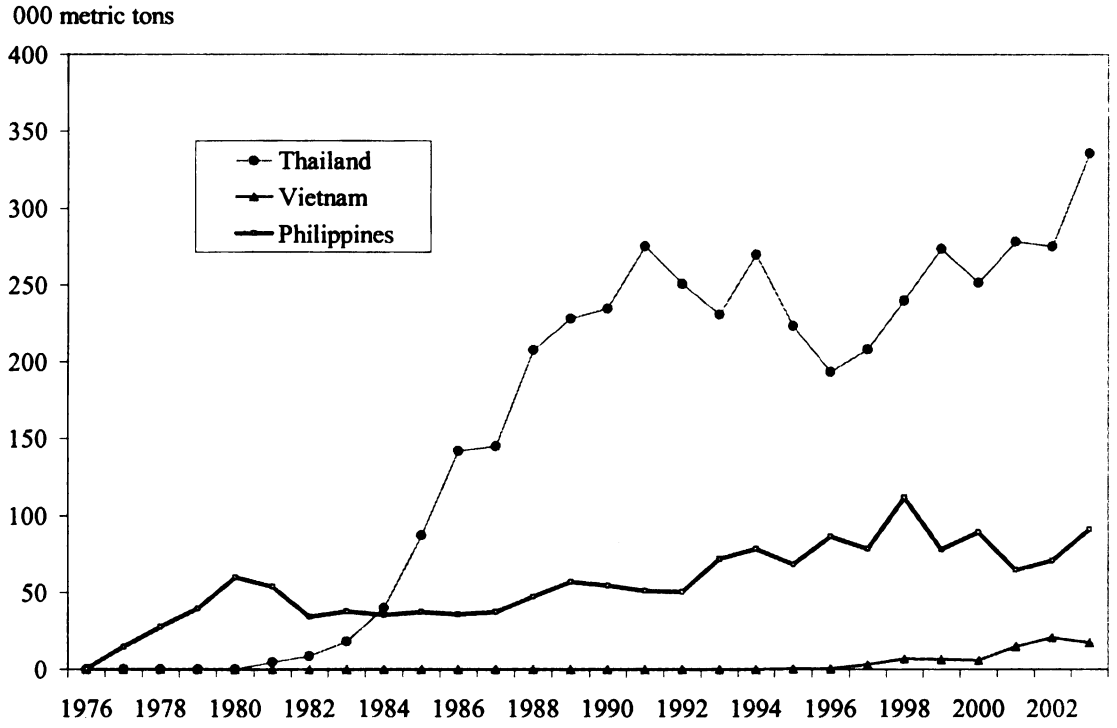
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[25] Recent studies have also analyzed the relationship of zero-tolerance in antibiotics to the dumping allegations of the US. For example, Debaere (2005) showed empirically that the EU policy disrupted the global shrimp market in a non-negligible way and set the stage for the current anti-dumping case in the US.

[26] Examples of the former case are fish exports from Kenya, raspberries from Guatemala, shrimp from Bangladesh, snow peas from Guatemala, peppers from Jamaica, and horticultural crops from Mali. Examples of the latter case are Thailand, Vietnam, and Chile.

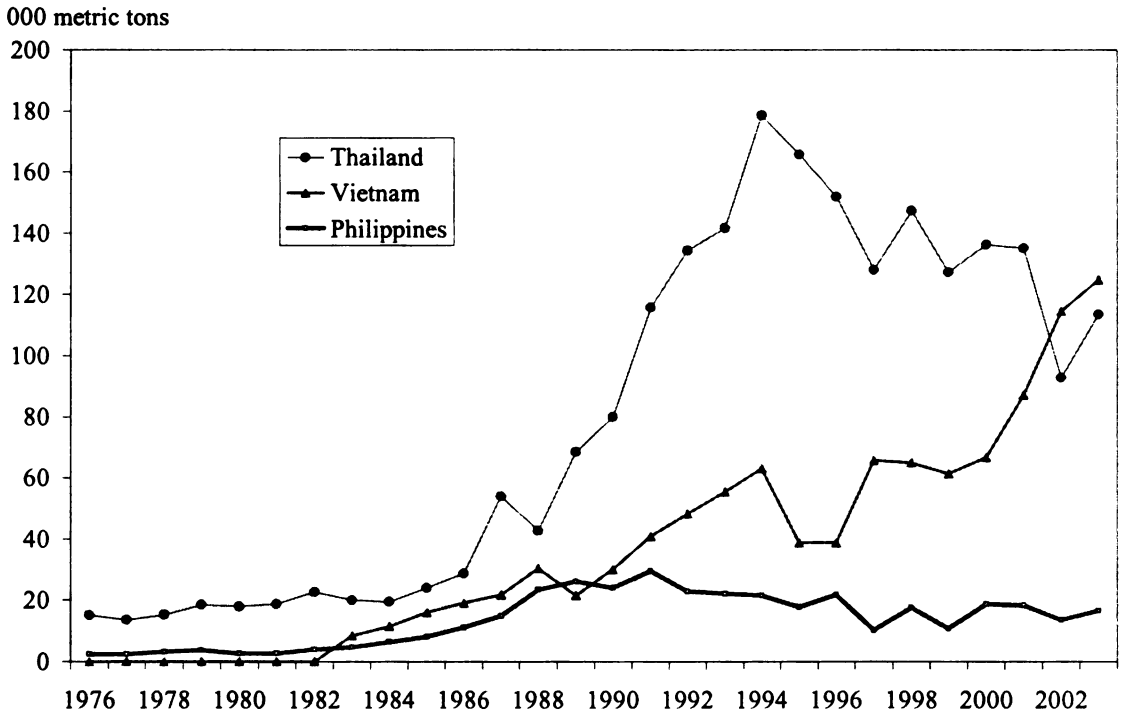
lagged far behind in export market share. The three Southeast Asian countries are similar in geographical location and natural resource endowment, and had comparable export levels through the 1970s and early 1980s. Beginning in the 1990s, however, they have moved in different directions. Figures 3 and 4 show trends in export value for tuna and shrimp in Thailand, Vietnam, and the Philippines. The Philippines is losing competitiveness in the seafood export industry compared to Thailand (particularly in tuna and shrimp) and Vietnam (in shrimp).

Figure 3. Tuna exports of Thailand, Vietnam, and the Philippines, 1976-2003



Source of raw data: FAOSTAT.

Figure 4. Shrimp exports of Thailand, Vietnam, and the Philippines, 1976-2003



Source of raw data: FAOSTAT.

Little research has been devoted to analyzing the dynamics of the Philippine seafood industry vis-à-vis other countries in the face of rapid changes in international policies and institutions, particularly those related to food safety. In the context of stricter food safety regulation in the international seafood market, it is crucial to understand which strategies are available to the Philippine government and private sector to improve the competitiveness of the country's seafood industry. The Philippines can learn from the experiences of Thailand and Vietnam.

1.2 Research Questions

Specific research questions addressed in this chapter are:

(i) What are the policies and institutions that led to different levels of competitiveness in the seafood industries of Thailand, Vietnam, and the

Philippines?

(ii) How are the three countries responding to a more demanding international seafood market in terms of food safety?

(iii) What led to the different policies and institutions that affect competitiveness and food safety in the three countries' seafood industries?

(iv) What constraints face the Philippine seafood industry in adopting the same policies and institutions as Thailand and Vietnam?

2 Conceptual Framework and Method

International seafood trade is a complex process governed by an array of formal and informal institutions. Each country aims to expand its market share in the increasingly competitive international market. "Competitiveness" is used here to denote the ability to profitably create and deliver value through cost leadership or product differentiation, and the sustained ability to profitably gain and maintain market share (Kennedy et al. 1997).[27] Competitiveness is therefore not from the result of a country's natural endowments *per se;* but rather depends on the capacity of industry to continuously innovate (Porter 1998).

Porter (1998) identifies four key factors affecting competitiveness: (i) factor conditions (i.e., cost, availability and quality of factors of production); (ii) demand conditions (i.e., sophisticated customers in home markets, linkages to international markets, quality systems, and capacity to respond to consumer demand); (iii) supporting

[27] In reality, a country will have multiple objectives (e.g., poverty reduction, export competitiveness, food security, and environmental sustainability) with complementarities and trade-offs among objectives at least in the long-run. The focus of this chapter is export competitiveness since there are limited studies in this area. Other authors have focused on the other objectives (e.g., Briones 2006, Israel and Banzon 1997; Israel 2002).

industries (the presence of internationally competitive input suppliers and industries for output market linkages); and (iv) firm strategy, structure, and rivalry/competition (i.e., conditions for market organization and the nature of domestic rivalry). These factors characterize the business environment and cost advantages of an industry, which in turn largely determine the industry's competitiveness.

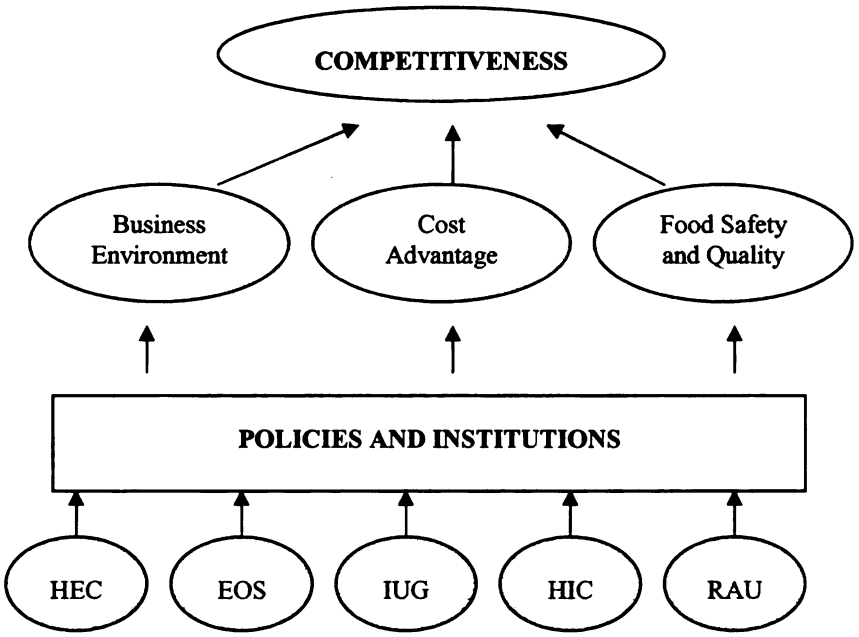
There is growing agreement among experts about the crucial importance of food safety for market access or as a new structure for attaining competitive advantage. Due to more stringent food safety standards, greater ability to measure food safety, and the growing availability of systems to reward "safe" food producers and punish "unsafe" producers, food safety has become critical to staying in the food business. Food safety and competitiveness are closely related and mutually complementary. Thus, food safety is considered here as another determinant of industry competitiveness, along with the enabling business environment and cost advantages discussed above.

These determinants (e.g. business environment, cost advantages, food safety and quality) are influenced by a country's macroeconomic, political, legal, and social characteristics (UNCTAD 2003; Porter 1998). These characteristics are embodied by policies and institutions.[28] The effectiveness of these policies and institutions in attaining certain outcomes depend on how inherent situations that create human interdependencies are addressed. Interactions among these characteristics and determinants of competitiveness are depicted in the conceptual framework presented in Figure 5, which guides the discussion and analysis in the subsequent sections of this chapter.

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[28] Policies are defined as actions or strategies that directly influence prices of goods and services. Institutions are defined as a set of formal rules (e.g., law and regulations) and informal norms, and their enforcement characteristics (North 2005). Institutions are used interchangeably with structure in this chapter.

Figure 5. Framework describing the factors of competitiveness



Note: HEC=high exclusion costs; EOS=economies of size; IUG=incompatibility use goods; HIC=high information costs; and RAU= risk and uncertainty

2.1 Situation-Structure-Performance

The effectiveness of policies and institutions in bringing about a desired level of competitiveness (performance) depends on how these policies and institutions (structure) influence interdependencies and relationships (situation) among the actors involved. Interdependencies among actors are conditioned by the inherent characteristics of the goods or resources (Schmid 2004). These characteristics can be defined in terms of: (i) high exclusion costs (HEC); (ii) economies of size (EOS); (iii) incompatibility use goods (IUG) or rivalry goods; (iv) high information costs (HIC); and (v) risk and uncertainty (RAU). Such a situation-structure-performance relationship conceptualized by Schmid (2004) is applied here to analyze different performance results in the Thai, Vietnamese, and Philippine seafood industries. The seafood industry exhibits several inherent interdependencies and relationships (situation) which interact with national and industry

structures to produce performance outcomes.[29] A historical perspective and evolution of power relations and political structures will also be discussed to analyze why policies and institutions, both public and private, are the way they are.[30]

There are several inherent characteristics of the seafood industry relevant to this discussion above and to performance outcomes developed in the later case studies. First, high exclusion costs (HEC)[31] are embedded in some aspects of international seafood trade including infrastructure; technology; market information; protection of the "image of quality" for a country; food contamination in common water resources (e.g., cholera outbreak, mercury, and lead); and environmental protection and management. These situations create free-riding problem,[32] and different structures can be adopted to

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[29] This approach brings together a number of commonly used paradigms in explaining growth namely: (1) historical institutionalism, which sees actor's choices, interests, and preferences shaped by organizations and institutions which have carried over their own histories and rules, laws, norms and ideas; (2) public choice theory, which conceptualizes the political sphere as a marketplace of transactions among individual politicians, officials, and contending interest lobbies and its product is the appropriation and sale of public policy and public goods in return for political support; (3) social conflict theory, which states that markets and institutions are forged by system-wide level of process of social and political conflict; and (4) path dependence theory, which examines the current power structure (and their inherent preference to status quo and resistance to change) to explain the difficulty of getting radical reforms and stickiness of policies and institutions. For more details on these theories, see Rodan et al. (2006), and Schmid (2004) on path dependency theory.

[30] This approach attempts to bring together state-centered historical institutionalism, which believes that government is the backbone of growth and development; and society-centered historical institutionalism, which focused on non-government and non-market institutions that played important roles in economic success including commercial networks, business associations, and dynamic private sector (Doner and Hawes 1995).

[31] Schmid (2004, p. 94) defined it as a situation where a "good exists for one user, it is costly to exclude others, even if the users can be identified."

[32] HEC is used to describe situations where some individuals take extra gains beyond what they paid for or have rights to, thus they "free-ride" on the efforts of other individuals to provide either goods or a set of rules accompanying use such goods (Becker and Ostrom 1995).

minimize it.[33] Government policies themselves benefit a wide group of constituents and thus create high exclusion costs within this group. While these policies favor some groups at the same time leaving other groups at the losing end, there is potential of free-riding problem among winners.

Second, economies of size (EOS)[34] are inherent in the business environment, infrastructure, market information, technology, legal system, and bulky investments needed to develop a food safety system for processing and trading. EOS poses several challenges for capturing the gains from expanding scale and falling marginal costs; and for devising an efficient system to determine who pays the fixed versus marginal costs and who decides on the quality of investment.[35]

Third, incompatibility use goods (IUG)[36] are prevalent in the seafood industry and bring about competition and rivalry among the various actors involved. Examples include transactions between buyers and sellers; interaction among producers for scarce inputs and other resources; and relations among citizens and groups for political voice. Fierce competition among seafood sellers leads them to devise marketing strategies (including advertising, trade shows, and food fairs) and to nurture trust or long-term relationship with buyers to capture and maintain a larger market share. At a government level, trade and market policies including tariffs, quotas, and subsidies; free trade agreements;

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[33] The structures relevant for HEC are mainly discussed in the business environment section, and partly in the cost advantages and food safety and quality sections of later case studies.

[34] EOS arise from large fixed costs and falling marginal costs.

[35] The structures relevant for EOS are mainly discussed in the business environment section, and partly in the cost advantages and food safety and quality sections of later case studies.

[36] Incompatible use or rivalry goods are the most common source of inherent interdependencies due to the scarcity of resources.

increasing political voice in international policy- and standard-setting bodies can be adopted by countries to improve their competitive advantage. The scarcity of resources used in production, processing, and trade also creates fierce competition among different actors along the value chain. This leads to a number of formal and informal relations to obtain the needed scarce resources. In terms of investment funds, there is fierce competition for resource allocation. Those with the political voice, access to and use of scarce resources get the more desirable outcomes. Thus, an attempt to influence outcomes and distribution of costs and benefits needs to shift rights over resources or change political structures.[37]

Fourth, high information costs (or difficulty of acquiring information) are ubiquitous in the seafood industry. For instance, a traded seafood product is characterized by several attributes that are hard to measure (e.g., quality, nutritional value, and health effects) often leaving producers with more information on production practices than buyers or consumers (information asymmetry). This can lead to potential problems: principal-agent or moral hazard[38] and adverse selection.[39] Key strategies are needed to reduce moral hazard and adverse selection and use information and signaling to create competitive advantage. Several institutions have been adopted to address information

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[37] The structures relevant for IUG are mainly discussed in the cost advantages section of later case studies.

[38] Moral hazard problems arise when the high-quality (or safer) products are more expensive to produce than low-quality products and the buyer cannot directly observe quality (e.g., Holmstrom 1979: Grossman and Hart 1983). Moral hazard arises because an individual (agent) does not bear the full consequences of its actions. For instance, if producing quality products is costly, a producer has an incentive to produce sub-quality products and still claim these as quality products. As such, the cost of "unsafe" food is mainly borne by consumers.

[39] Adverse selection arises from the inability to screen low versus high quality. Information asymmetries between buyers and sellers can lead to the sub-optimal selection of low-quality products instead of the targeted high-quality ones.

asymmetries on food safety and product quality including certification systems, long-term business relationships, traceability systems, collective action, border inspection, labeling or a combination of several of these.[40]

Another example is credit, which also exhibits high information costs among lenders and borrowers. Owing to information asymmetries, competitive market equilibrium may be characterized by credit rationing (Stiglitz and Weiss 1981).[41] A number of structures have been increasingly adopted including the use of collateral, group lending, credit bureaus, monitoring schemes, and an array of private sector and government instruments and approaches. In some instances, government directly or indirectly provides credit, especially to jumpstart the growth of emerging industries.

Fifth, risk and uncertainty characterize the dynamism of the seafood trade. The main sources of risk and uncertainty are unexpected innovations by competitors, food contamination, and environmental factors. For a firm or a country, a number of strategies can be adopted including collective action and partnerships to spread the risks; diversification of suppliers, products and markets; innovative capacity to cope with changes; and guarantee systems.[42]

2.2 Case Studies

Three key seafood-exporting countries in Southeast Asia - Thailand, Vietnam, and

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[40] As illustrated in later case studies, Thailand, and Vietnam to a lesser degree, has capitalized on food safety and quality management and used this strategy to gain competitive advantage over other countries including the Philippines. The structures relevant for HIC are mainly discussed in the food safety and quality section of later case studies; and in the cost advantages section for credit.

[41] Credit rationing is a situation when given loan applicants that appear equal, some receive a loan and some do not even when they offer to pay a higher interest rate.

[42] Structures adopted by Thailand, Vietnam, and the Philippines are discussed in all sections of later case studies.

the Philippines - share similar proximity to major importing countries (Figure 6), seafood exports play a prominent role in their economies, and have similar rich water resources. Even with these similarities, however, they have demonstrated very different patterns of growth and industry development over the years. This chapter will trace what led to this outcome and how things happened.

Figure 6. Map of Thailand, Vietnam and the Philippines



Sections 3-5 present the institutional analysis for each country. Thailand is discussed first. As a model of sustained growth, the case of Thailand is ideal for illustrating "good" policies and institutions likely to bring about success. Vietnam follows, and is illustrative of a country that was not initially successful but subsequently was able to spur growth in the industry. The last case discussed is the Philippines, which illustrates a country that has not performed well. A discussion of policies and institutions will point to the divergence of Philippine strategies from those adopted in Thailand and Vietnam.

Each country case starts with a description of the performance of the seafood industry, the importance of the industry to the economy, and key challenges and opportunities faced by the industry. This is followed by a description of the business environment (or national landscape), in which the seafood sector operates and which greatly affects the industry's performance. Next is a discussion of political economy, which explains the business environment and evolution of specific policies and institutions. Then, specific policies and institutions affecting the industry and their impact on the industry's competitiveness are discussed. This discussion is divided into two determinants of competitiveness: cost advantages and food safety/quality. The three country cases are followed by a discussion section that compares and contrasts the cases, integrates the lessons their experience provide, and discusses implications for improving or maintaining competitiveness in the three countries.

2.3 Data Sources

Key informant interviews, including 57 experts in government offices, trade associations, and industry people in Thailand, Vietnam and the Philippines and task

managers and technical officers at FAO and the World Bank, are the primary source of data (Table 5). All experts from the Philippines, Vietnam, FAO, and World Bank were interviewed face-to-face, while experts in Thailand were contacted by email and phone. Field visit in the Philippines was conducted from September to December 2005, with follow-up communication with relevant experts via phone calls and emails in November and December 2006. Communication with relevant experts at FAO, World Bank and Vietnam via phone calls, emails, and during relevant seafood-related workshops and conferences was conducted from March to December 2006. A follow-up visit in Vietnam was conducted in April 2008 to gather more primary data. Field visits were limited to the Philippines and Vietnam considering relatively more available literature and secondary data on Thailand than the other two countries.

Additionally, secondary data was collected from the World Bank's Doing Business (DB)[43] series and the World Economic Forum's Global Competitiveness Report (GCR. The DB series uses indicators of regulations affecting ten stages of business life: starting a business; dealing with licenses; employing workers; registering property; getting credit; protecting investors; paying taxes; trading across borders; enforcing contracts; and closing a business. GCR provides nine measures of a country's competitiveness: institutions; infrastructure; macroeconomy; [44] health and primary education; higher education and training; market efficiency; technological readiness;

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[43] DB presents quantitative indicators on business regulations and the protection of property rights, which among countries over time. Data are collected through contacts with more than 5,000 country experts, including lawyers, business consultants, accountants, freight forwarders, and government officials. In 2007, a total of 178 countries participated (World Bank 2007).

[44] This is used to describe the macroeconomic condition and policies in the country including indicators of inflation, government spending, government debt, and budget deficit, among others.

business sophistication; and innovation. Production and trade data were collected from World Integrated Trade Solutions (WITS) and FAOSTAT. Other sources of data and information included the FAO, InfoFish, GlobeFish, academic journals, news articles, and relevant industry websites.

Table 5. Number of respondents in the key informant interviews

Country/Organization	Number of respondents
Thailand	8
Vietnam	22
Philippines	16
FAO	5
World Bank	6

Additional semi-structured interviews were conducted with executives and managers of 59 seafood processing firms in the Philippines between September and December 2005 in major seafood-processing areas, including Metro Manila and the rest of Luzon, General Santos, Zamboanga, Dagupan, Davao, and Cebu cities. These firms represent about 30-40 percent of seafood processor-exporters; 20-30 percent of total seafood processors; and 67 percent of the volume and value of seafood exports in 2004 (see details in Chapters 3 and 4 and questionnaire in Appendices 1 and 2).

3 Thailand

Thailand is one of the world's largest exporters of seafood (closely competing with China as the top seafood exporter). The two countries together account for 14 percent of world's seafood export value (FAOSTAT). The largest subcategory within Thailand's seafood industry is canned seafood, with average exports of US$ 1.8 billion per year (FAOSTAT). It is also the largest frozen-shrimp exporter in the world, earning

US$ 1.5 billion from international sales in 2006 (FAOSTAT).

The US, Japan and EU are Thailand's top markets. Thailand has a free trade agreement with the US, making it a preferred supplier. However, recent disputes in seafood trade between Thailand and US have resulted in the levying of tariffs, non-tariff barriers, or product bans, primarily as anti-dumping measures, which had negative effects on Thailand's exports (based on key informants). Economic recession in Japan during the late 1990s resulted in a decline in shrimp imports from Thailand. Sales to the EU market have been hampered by the removal of Generalized System of Preferences (GSP) privileges,[45] ending the preferential tariffs that Thai shrimp previously enjoyed. Other factors that increasingly affect businesses are food safety concerns, environmental sustainability, threats from lower-cost producers from China and Vietnam, and increasing technological innovation especially in aquaculture resulting in emerging new competitors in the international seafood market. The long-run success of the industry in Thailand depends on continuous innovation in high-value products and efforts in product differentiation and market diversification.

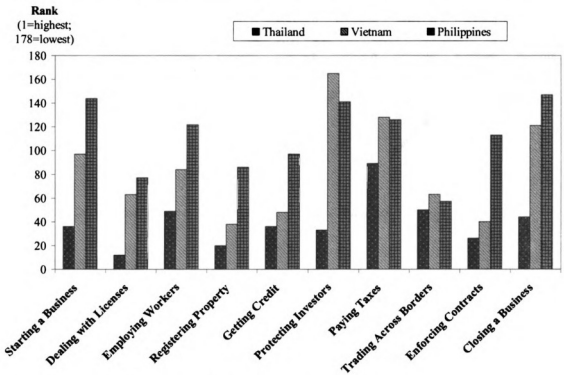
3.1 Business Environment

Thailand's business environment ranks 15th out of 178 countries surveyed in DB (Figure 7). Strengths lie in the legal system and institutions, which have been put in place to protect investors and access to credit. Thailand ranks high in indicators for ease of getting licenses and starting a business (e.g., lower number of procedures, shorter time

[45] Tariffs for Europe bound shrimp jumped from four percent to 14.4 percent over a period of two years, which has resulted in a 75 percent decrease in sales to the region since 1997 (Josupeit 2006). Moreover, preferential tariff granted by the EU to canned tuna producers from the African, Caribbean and Pacific states (ACP countries) undermined the cost and other comparative advantages of Thailand. Thailand currently faces a 24-percent tariff (Josupeit 2006).

required, lower costs, and lower minimum capital requirement). The business environment is also characterized by quick reforms (e.g., reducing the procedures and time required for import and export, including the strengthening of one-stop export-import processing). In 2007, these reforms made Thailand the 50th most favorable country in terms of ease in trading across borders, a large improvement from a rank of 103rd in 2005 (World Bank 2007).

Figure 7. Doing business ranking of Thailand, Vietnam, and the Philippines

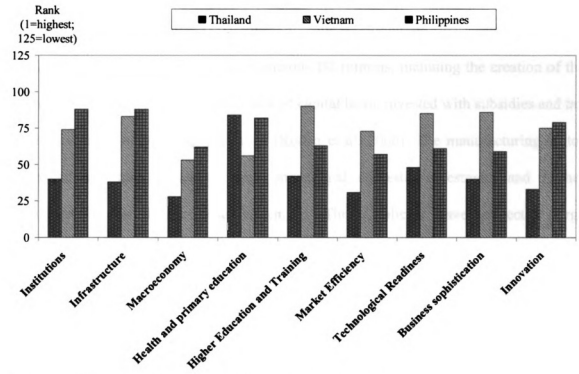


Source: World Bank 2007. Note: Ranks are based on 178 surveyed countries.

Of 125 countries surveyed in GCR, Thailand ranked as one of the highest in all indicators of competitiveness (except primary education and health) (Figure 8). These rankings are far higher than other Southeast Asian competitors in seafood export - Philippines and Vietnam. These indicators consistently mirror a highly healthy

environment for private sector investment and industry growth.

Figure 8. Competitiveness scores of selected Southeast Asian countries, 2006-2007



Source: WEF 2006. Note: Ranks are based on 125 surveyed countries.

3.2 Political Economy

Thailand's economy has exhibited trends of boom, bust, and recovery in the last five decades. Its transformation has been highlighted by a remarkable period of uninterrupted growth from 1957 to 1996; economic crisis in 1997; and economic upturn after 1999.

Thailand has a rich history of political activism and social conflict fuelling numerous episodes of transformation. In 1932, the People's Party overthrew the absolute monarchy and established constitutional rule. Later, two coups took place, with Sarit seizing power in 1958 as a result of social discontent arising from concerns of bribery

and corruption by military and bureaucratic leaders (Rodan et al. 2006). By the time Sarit came to power, many of the state-owned enterprises (SOEs) were in economic crisis; and his government's promise of increased support to the private sector and import-substituting industrialization (ISI)[46] were widely supported. With assistance from the World Bank, Thailand implemented numerous ISI reforms, including the creation of the Board of Investment (BOI), with the bulk of capital being invested with subsidies and tax credits to import-substituting industries (Rodan et al. 2006). The manufacturing sector flourished and high protection rates encouraged domestic investment and further strengthened local finance and banking. These policies have protected large conglomerates (many of them are commercial banks dominated by 15-20 families) (Rodan et al. 2006).

ISI critics have argued that growth and development were limited by the relatively small domestic market and that the strategy created disincentives to export (Hewison 1989). However, there was no strong pressure from businesses and profits were maintained; thus ISI continued. It was not until the mid-1980s when an economic downturn[47] necessitated policy change towards export-oriented industrialization (EOI)[48]

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[46] ISI is a commonly used term to characterize a package of policies and reforms (heavily supported by the World Bank in the 1950s) that aimed to protect local or domestic industries, especially the capital-intensive, manufacturing sector. ISI as a process refers to "situations where regions (more precisely, existing or new economic activities within regions) take up the production of goods or services which formerly were imported, but, for whatever reasons, now can be viably produced within the region (e.g. as a result of population increases leading to increases in demand or as a result of productivity increases resulting in greater competitiveness). Import substitution is often discussed as a policy strategy, e.g. as an attempt to utilize underused capacities, reduce regional unemployment or protect infant industries. This form of economic protectionism helped some countries industrialize in the past but involves economic risks (namely potential inefficiencies and higher prices)" (see http://faculty.washington.edu/krumme/gloss/i.html)

[47] This economic downturn resulted from a confluence of events including devaluation of *baht*, the Thai currency; government seeking more loans following oil crisis; and a military spending spree, which all led to soaring of public sector debt (summarized in Rodan et al. 2006).

strategies. These policies included devaluation,[49] export promotion strategies, creation of the Export-Import Bank, and generous tax and credit incentives for exporters. Since EOI policies were implemented, Thailand has been growing rapidly and has been hailed as a model of East Asian Miracle. There was a rapid expansion of exports: average annual growth rate was six percent in the 1960s and 11 percent in the 1970s, rising to over 16 percent in the 1980s, and remaining above ten percent throughout half of the 1990s (Rodan et al. 2006). Seafood industry exports were a key contributor to this economy-wide export growth (Figures 3 and 4 above).

Despite rapid growth, Thailand's transformation was not perfect and these imperfections were highlighted during the Asian economic crisis in 1997. Rodan et al. (2006) summarized neoclassical theorists' explanation of Thailand's success (prior the crisis) as a product of market liberalization coupled with enabling "good policies." However, these same factors are after cited as leading to the crisis including poor policies, weak state, cronyism, corruption, moral hazard, resource misallocation, and failed liberalization, which were conveniently ignored during the boom periods (Rodan et al. 2006). Hewison (2000) summarized a Marxist explanation of the crisis as overexpansion, over production, declining profits, and the cyclical and crisis-prone nature of capitalism. Most experts point to the central problem, which is the increasingly skewed income and wealth distribution.

Following the flotation of *baht* in 1997, the International Monetary Fund (IMF)

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[48] As opposed to ISI, EOI characterizes a package of policies and reforms that aims to promote export industries.

[49] Devaluation was to make Thailand's manufactured good cheaper, emphasizing the significance of cheap labor for export-oriented industries.

bailed out Thailand and in turn demanded austerity, tightening fiscal and monetary policies, and market-enhancing reforms. However, the economic crisis worsened: large conglomerates weakened, newly-formed business groups collapsed, the banking sector was crippled with non-performing loans, while foreign investments grew rapidly as joint venture partners were bought out. The business sector struggled, but the greatest impact of the economic downturn was worsening poverty, unemployment and inequality.[50] Social discontent intensified due to greater poverty and inequality. The biggest source of opposition and unrest was the weakening local capital due the inflow of foreign capital. This threat to power of local business forced the remaining domestic capitalist class to take direct control of the government and its ministries. They were supported by a broad coalition that felt that Thai society was being torn apart by the economic crisis (Rodan et al. 2006).

The political vehicle for local capital fight was the *Thai Rak* Party (TRT), which represented the interests of domestic businesses and which won the 2001 election.[51] TRT developed an inclusive message and promised a focus on helping the poor. Specific programs were developed and quickly implemented to appeal to rural people: soft loans for every community in the country, a three-year debt moratorium for farmers, universal health program, and a people's bank (called *Thai Rak Thai*). The political outcome was a

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50 Additional seven million people fell below poverty line; unemployment increased to ten percent a year after the devaluation (Rodan et al. 2006).

51 As noted by Rodan et al. (2006), many long-standing rivalries were put aside as big business cooperated to support TRT.

landslide re-election in 2005.[52]

TRT was not a simple case of domestic business seizing the government, but establishment of political legitimacy through a new social contract, focusing on social protection and economic opportunity for the poor majority of the population (Rodan et al. 2006). One important lesson to be learned from Thailand is the importance of taming social unrest to maintain political structure. The remaining rivalries among big local business were able to put aside their economic competition in order to cooperate politically in recognition that a new social contract was needed to re-establish their economic power (Rodan et al. 2006).

Compared to its neighboring countries, one of the key features of the policymaking processes in Thailand is its pluralistic pattern of power distribution at the national level and within the sectors. There is sharp intra-elite competition that prevents the entrenchment of favored interests and no group has the power or the institutions to appropriate all benefits (Akiyama and Larson 2004). Policymaking process is characterized by a healthy competition among various interest groups. New interests have been gradually forming and becoming important parts of the political arena. Stakeholders (producers, traders, processors) have become engaged in the process of policymaking. Civil society has become more organized, more complex, and more vociferous in its demand.

This social organization and sense of collective action in Thailand can be traced back from the institutions and organization at the village level. Villagers often use the

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[52] The obligations to the poor should not conceal the fact that the TRT government was by and for the rich (Rodan et al. 2006). The social contract (social protection and economic opportunities for the poor) used as a strategy to maintain power seems to be effective in taming social unrest and fostering continued growth and development for Thailand.

institution of the administrative village to organize activities related to the indigenous unit; while the administrative unit can mobilize the sense of unity at the indigenous level. From an outside agency's or international organization's perspective, this arrangement is convenient as the administrative village can accept and start organizing local people and supervise management of the organization or project. This contrasts with the Philippines, for instance, where the administrative unit at the village or barangay level cannot organize people. In the Philippines, the role of the barangay head is just to call a village meeting; an NGO is the organizer of local people. In Thailand, NGOs and government agencies expect village heads and other leaders to play the role of organizers.

3.3 Cost Advantages

Thailand's seafood processing industry is the best established in Southeast Asia, developing over the past 50 years on the strength of its marine fishing. Adding to this, the boom in Thai shrimp farming has given the industry a further boost. Thailand has become the main world processing center for shrimp and has also been the world's leading exporter of canned tuna since 1985. Between 300,000 and 400,000 metric tons of fresh, chilled, and frozen tuna are being imported annually, primarily from Taiwan and Japan for further processing (Thai Frozen Food Association (TFFA) 2002). Tariffs and other barriers to importing raw materials for national canning industries have been reduced.

Central wholesale markets play a crucial role in serving the processing and food industries. For instance, Lebel et al. (2002) reported that 62 percent of producers in western peninsular Thailand sell their shrimp directly to a central market. Vertical integration and consolidation have also become increasingly popular. Most large firms have branches or processing plants in various locations to strategically source raw

materials and easily access output markets, take advantage of the abundance of raw materials in some areas, reduce transport costs in procurement, and/or serve large market centers. In terms of product diversification, about half of all processors in the country handle distinct products and diversify in different seafood species and various product forms (e.g., fresh, chilled, frozen, and canned) (based on key informants).

Thailand is the least-cost producer for intensive shrimp farming systems[53] and next to China for extensive systems (surpassing Philippines, Vietnam, and other Asian competitors) (Ling et al. 1999) (Figure 9).[54] One of the major weaknesses of Thailand is labor costs, which are more expensive than Vietnam and China. Another problem is the prevalence of diseases affecting shrimp farms resulting in higher prices for locally-produced shrimp. Thai processors have not been able to compete with Vietnam and China processors in producing frozen block shrimp. To remedy this problem, Thailand had focused on training and skills development of its manpower and capitalizing on them for product differentiation and value-adding strategies.[55] As a result, it has achieved far higher labor productivity than the Philippines and Vietnam (US$ 7,000 output per employee in Thailand as compared to US$ 3,000 in the Philippines and US$ 2,000 in Vietnam) (ADB 2005a).

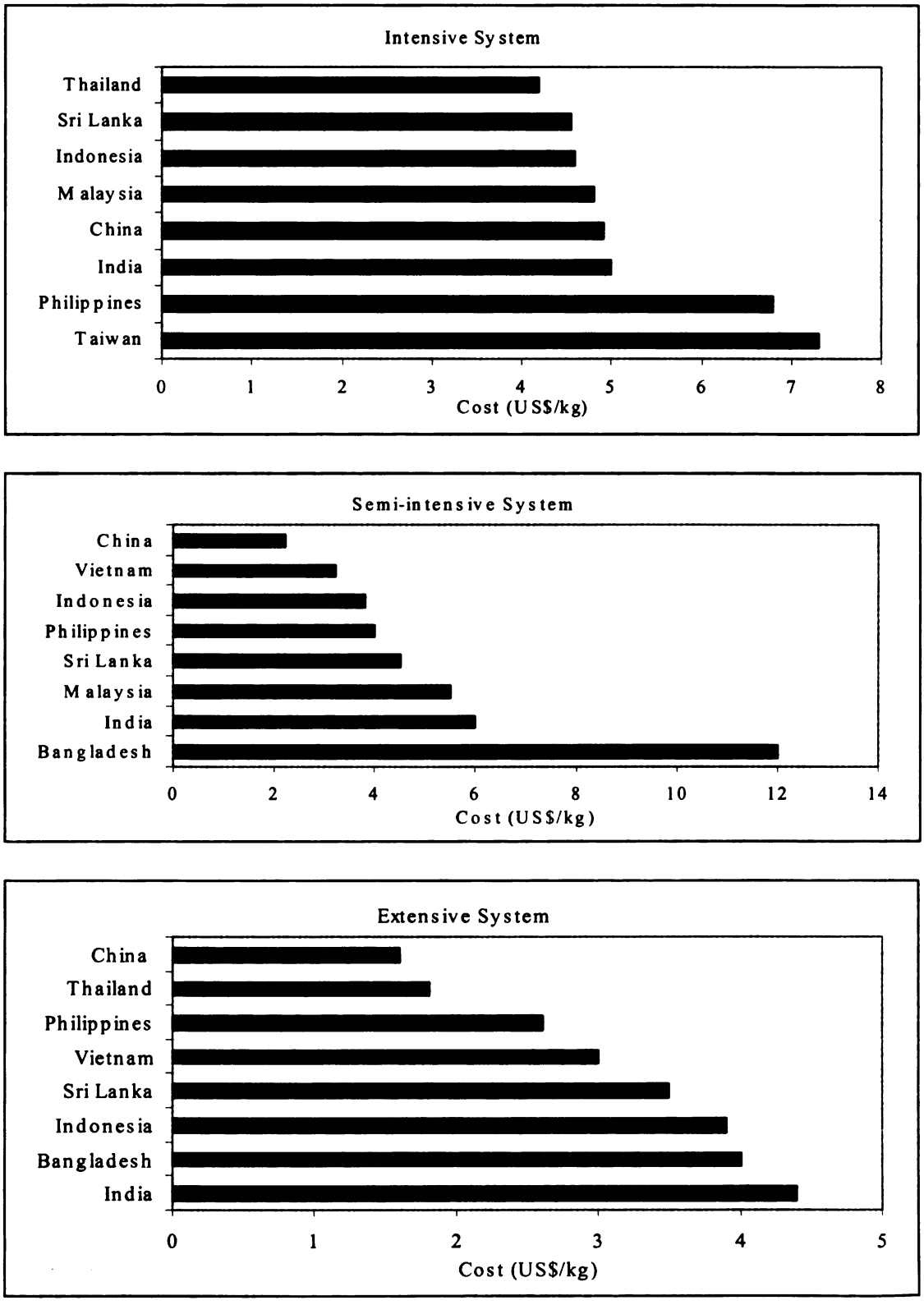
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[53] The three general types of shrimp farming are extensive, intensive, and semi-intensive. Each type use is dictated by pond size, stocking density, level of pond management, investment cost, and potential production. Extensive farming uses large ponds with a low stocking density. Little management and investment are required, but potential production is low. The other extreme is intensive culture, using small ponds with a high stocking density. A high level of management and investment are required, but potential production is quite large. Semi-intensive culture falls between these two extremes.

[54] No data on Vietnam for intensive systems, and no data for Thailand for semi-intensive systems.

[55] For instance, Thailand's *panko ebi* is preferred by Japanese buyers because the specific types of breadcrumbs used in making high-quality products. Special skills and techniques are required to produce the breading used in *panko ebi,* and processors in other countries have to import the breading from Thailand for their product to be of acceptable quality (Kagawa and Bailey 2006).

Figure 9. Comparison of cost of shrimp farming in selected countries



Source: Ling et al. 1999.

As part of the EOI regime, the seafood industry is well supported by the public sector. The Fisheries Industry Development Policy embodies the set of programs and institutions implemented by Thailand to maintain and expand its role as one of the largest seafood producers and exporters. Export policies are guided by the overarching goal to improve competitiveness through efficiency along the production chain; products and quality development; and obtaining greater access to foreign markets through bilateral and multilateral agreements. Concrete policies for the seafood industry include exemptions from machinery import duty and corporate income tax to boost investment and trade; establishment of a one-stop export service center; online trade matching, product development center, and sponsorship and financial support [56] for trade missions/shows. These strategies shift costs (including transaction costs) away from processors and exporters, and thus provide them greater incentive to expand processing and export activities.

Despite important contributions by the government and the key role of the favorable business climate, growth in the seafood industry and other industries was driven by the private sector. Private sector investment in the whole economy was almost five times that of the government following the EOI policies (Rodan et al. 2006). Real gross fixed capital formation grew by an average of 20 percent annually during 1986-

[56] For some trade shows, participation by Thai exporters is encouraged through assistance with booth fees (up to 90 percent of the cost) and shipping of samples (based on key informants). The Ministry of Commerce, through its Department of Foreign Trade (DFT) and The Department of Export Promotion (DEP), has a major role in Thailand's export promotion program. Under its export and packing credit programs, a loan is granted to accredited exporters by commercial banks when the exporter places a promissory note (based on the sales and export documents). The interest rate on the loan must not exceed 10 percent per annum (DEP 2006). The Export-Import Bank of Thailand refinances 50 percent of the promissory note's value to the commercial bank at an interest rate of five percent (DEP 2006).

1991, by 10-15 percent right before the 1997 economic crisis (Rodan et al. 2006), and started growing again since 1999. Key contributors to this growth were local/domestic investors. Although foreign direct investment (FDI) was strategically important, it remained at only at 1-8 percent of gross capital formation and stayed relatively low when compared to other Southeast Asian countries (Rodan et al. 2006).

A major feature of the Thai seafood industry is the level of collective action, used both as an economic and political strategy.[57] The state enterprises[58] have been active in supporting both the public and private sectors' policies and in providing support to small-scale fishing households and communities. Private sector associations[59] make significant contribution to the development of the seafood sectors due to their ability to negotiate successfully with both the Thai and foreign governments. For instance, Thai Frozen Food Association (TFFA),[60] along with the Department of Fisheries, Thai Marine Shrimp Farmers Association, Thai Food Processor's Association, and Aquaculture Business Club, drafted a code of conduct (COC) in 1999 (Nidhiprabha 2002). This COC was critical in establishing Thailand's image as a source of quality and safe seafood products.

Thailand faces risks and uncertainties arising from potential technological innovations in other countries; prevalence of diseases in aquaculture; and environmental

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[57] The former comes as a result of taking advantage of economies of size and overcoming transactions costs among others; while the latter comes from strengthening political voice to influence political processes and institutional change.

[58] Examples are Bank of Agriculture and Agricultural Cooperatives, Fish Marketing Organization, the Government Cold Storage Organization, and Petroleum Authority of Thailand.

[59] These include Thai Marine Fisher Association, Association for Outside Thai Waters Fisheries, Thai Frozen Food Association, Instant Food Producers Association, Fishery Products Export Association, and Thai Marine Prawn Farmers' Association.

[60] Includes 75 percent of seafood processors as members.

degradation threatening aquaculture as a major source of fish raw materials. A current priority for Thailand is strengthening research and development for higher yield and disease prevention. It has also undertaken a number of steps to protect and manage mangroves from aquaculture expansion and improved management of its water resources. It will be critical for Thailand to carefully assess the risk and uncertainties looming ahead and adopt strategies to allow it to continue the competitiveness of its seafood industry.

3.4 Food Safety and Quality

Thailand's exports to the EU declined from 29 percent of total Thai exports in 1990 to 12 percent in 1999, mainly due to a change in the EU Council Directive on using benzoic acid (a preservative) in imported cooked shrimps (from 0.8 percent to less than 0.2 percent or 2,000 milligram per liter) (Nidhiprabha 2002). In 2002, the EU applied stringent sanitary testing requirements that reduced Thailand's shrimp exports to its markets, but lifted this stringent testing in February 2003 (Economist Intelligence Unit (EIU) 2004). Debaere (2005) investigated the impact of EU's zero-tolerance policy for antibiotics on the global shrimp market. This author showed empirically that the EU policy disrupted the global shrimp market in a non-negligible way and set the stage for the current anti-dumping case in the US. EU's zero-tolerance policy, coupled with the loss of Thailand's preferential trade status in EU (in early 1990s), shifted shrimp exports from Thailand, Vietnam and China away from the EU towards the US, resulting to an outcry of foreign dumping by the US. Recently, in order to gain entry into the US market, all Thai seafood exporters are required to pay bonds to US insurance companies, which then guarantee that anti-dumping duties are paid to the US Customs Service (Lee and Logez 2005; Armitage 2005a). This raises concern about small and medium shrimp

exporters being able to afford such bond payments (based on key informants).

Initiated by the benzoic acid incident in 1999, the Code of Conduct (COC) for the industry was drafted by the Department of Fisheries (DOF), Thai Marine Shrimp Farmers Association (TMSFA), TFFA, Thai Food Processor's Association (TFPA), and the Aquaculture Business Club (ABC) (Nidhiprabha 2002). It outlines all operating procedures, including data collection, training, site selection, shrimp health management, waste management, and the application of drugs and chemicals. Although the implementation of the COC is voluntary, the agreement of the market actors confirms their awareness of the importance of food safety and other sanitary standards. These market actors realized that in order to differentiate their products from those of their low-cost competitors, they had to establish their image as producers with high food safety standards (Nidhiprabha 2002).

The emphasis on food safety standards increased after 2000, when Egypt banned imports of Thai canned tuna because it was packed in oil from genetically modified soybeans. Because of the flexibility of its processing firms, Thailand was able to substitute sunflower oil for soybean oil to avoid the genetic modification problem (based on key informants, Nidhiprabha 2002). Most exporting companies have complied with food safety regulations so that Thai canned tuna can be exported to developed countries as well as countries in the Middle East such as Egypt (which received 7.5 percent of Thailand's tuna exports in 2001) (Nidhiprabha 2002).

Thailand realizes that food safety and quality are key ingredients in their EOI policies and developed an integrated approach involving various agencies to ensure the safety of food products (including seafood) consumed locally and for export. To achieve

the national goal of establishing Thailand as the "Kitchen of the World," the Ministry of Agriculture and Cooperatives (MOA) promotes a "Q" logo for food products which have passed quality and food safety certification systems (InfoFish 2007). The Department of Export Promotion (DEP), in cooperation with the public and private sectors, encourages Thai manufacturers and exporters to realize the importance of promoting products under their own brand names in international markets. It also initiated the creation of a unified banner called "Thailand's Brand" specifically designed as a medium for promoting consumer recognition and confidence in the products from Thailand. Since 2006, nearly 1,000 business enterprises have subscribed to the banner scheme in conjunction with their individual brand names (DEP 2006). According to key informants, this scheme has achieved international recognition both in the eyes of importers as well as consumers.

At the aquaculture level, this branding strategy has also been implemented for cultured shrimp, for which the government promotes COC and Good Aquaculture Practices (GAP) labeling, thereby garnering higher prices for producers (based on key informants). Thailand's Department of Fisheries has also established a cooperative program with the Carrefour supermarket group to promote this labeling program (InfoFish 2007).

Thailand acted in a proactive rather than reactive way and invested in nationwide food safety management systems. For instance, in an attempt to increase the number of firms that had at that time complied with the GMP and HACCP standards (300 of 12,000 food processing companies), the Thai Small Industry Finance Corporation (SIFC) allotted approximately US$ 350 million to promote food safety standards in 2002 (Eurofood 2002). This funding was in the form of soft loans and joint-venture proposals that

targeted 200 to 500 manufacturers, aiming to improve their production efficiency and health standards (Eurofood 2002). Compared to the Philippines, and to a lesser extent Vietnam, Thailand has been active in participating in international policy- and standard-setting processes related to food safety (based on key informants).

The government and industry regularly plan, implement, and monitor ways of enhancing competitiveness of food exports by improving and ensuring the product quality, food safety, and cost reduction. The Thai Food and Drug Administration (TFDA) is drafting a new Food Law that will standardize the quality of food exports in order to streamline and centralize the certification process (based on key informants). The National Food Institute (NFI), with the support of the Thai Industries Federation (TIF), started a US$ 57 million program for soft loans (with repayment periods of five to seven years) to help producers improve product quality and food safety and reduce production costs (based on key informants).

The large proportion of seafood producers and processors adopting certification systems signifies the importance given to certification and traceability systems in maintaining industry competitiveness. In a survey of the Thai seafood processing industry, Rohitratana and Boon-itt (2001) found that 94 percent of 120 firms surveyed had obtained at least one quality standard certification, e.g., either ISO9000 (30 percent), HACCP (69 percent) or both (28 percent).[61] This is an impressive accomplishment in food safety control and is evidence of processors' increasingly high awareness of the need to comply with food safety and other sanitary standards. Recently, key informants reported that a number of firms have been implementing traceability systems in their

[61] Rohitratana and Boon-itt (2001) did not mention the other quality standard certification systems that surveyed firms obtained aside from ISO and HACCP.

seafood value chains.

Thai processors know their weaknesses and have devised ways to overcome them. For instance, upon realizing its weakness in labor costs compared to Vietnam, Thailand focused on training and skills development to create differentiated products of known quality and safety (Nidhiprabha 2002; Kagawa and Bailey 2006; based on key informants). When Thai producers observed a reduction in their international market share of frozen shrimp as a result of cheaper products from other countries, they started differentiating into new, high value-added products (e.g., shrimp sushi, shrimp tempura, cocktail shrimp, and shrimp spring rolls) (Nidhiprabha 2002).

With the above policies and institutions in place, it is likely that Thailand will continue its growth. However, the sustained export growth of seafood products will depend on continued high-value production and processing strategies.

4 Vietnam

The seafood industry in Vietnam has attained higher growth compared to other sectors in the country. Seafood products ranked third in terms of export value, after petroleum and textile and garment sectors. Since 1995, Vietnam's aquaculture sector has shown potential for development and has grown by 12 percent annually. Since 2001, the US has become the largest importer of Vietnamese aquaculture products. The Japanese market used to account for 50–60 percent of Vietnamese products, but now accounts for 26 percent, indicating the success of Vietnam in market diversification.[62]

Shrimp is the dominant product and accounts for the largest portion of Vietnam's

[62] China is the third largest market for export of Vietnam's seafood products, accounting for 15 percent, followed by EU, which accounted for only 9.6 percent. Korea, Hong Kong, and Taiwan, import about five percent each of Vietnam's seafood products.

total annual export value. Vietnam is the third largest exporter of shrimp products to US and Japan. However, experts believe that Vietnam still has a long way to go before becoming the largest exporter to the US (must outdo Thailand) and to Japan (must outdo Indonesia); but, with the right strategies and policies, it can surpass India, which is the second largest exporter to the US and Japan (IUCN and IISD 2003). Their major difficulties resemble many of Thailand's, including anti-dumping measures by the US, economic recession in Japan, food safety and product quality concerns, and environmental sustainability. In addition, there is an increasing pressure to pay attention to its domestic market development and food security issues.

4.1 Business Environment

Vietnam is considered weak in its business climate. Based on GCR, indices for higher education and training, market efficiency, technology readiness, and business sophistication are far lower than the Philippines and Thailand (Figure 8 above). However, Vietnam ranks slightly higher than the Philippines in indicators of institutions, macroeconomy, infrastructure, and innovation. Emerging from Communist rule, Vietnam still needs to strengthen its essential structures to support the working of the market. At this point, it has limited industrial capacity and is dependent on other countries for technological and financial support, as well as for market access.

According to key informants, market structures in Vietnam are still relatively underdeveloped, compared to Thailand and the Philippines. For instance, most products are sold at the pond edge to shrimp traders (89-98 percent), who then sell directly to processing and exporting factories. These traders buy largely at outlets along the main canal or from smaller traders who visit individual ponds to collect daily harvests. Without

a central market, development of large processing industries is constrained; and prices and quality do not match market demand as closely. Secondary service industries are relatively undeveloped. Consulting and training services by feed and chemical companies are only just beginning and still do not reach most farmers; state agency capacity for effective extension is very limited; and shrimp farmer and buyer organizations are few and weak (Lebel et al. 2002; based on key informants). Markets and market channels are less developed (especially in the north), and the process and channels for establishing supplier and export contracts and adjusting prices are less flexible and open than in Thailand and Philippines (Lebel et al. 2002). Technological capacity for both production and processing is also limited.

In 2007, Vietnam ranked 91st in terms of ease in doing business (compared to 15th for Thailand and 133rd for the Philippines) (Figure 7 above). Historically, its weaknesses were difficulties of enforcing contract and getting credit. Indices have improved in 2007, as a result of a number of legal reforms being implemented. However, the process of commercialization of the banking system in Vietnam remained slow.[63] Most fishers and processors use the unofficial credit system since the loan procedure is simpler and the amount and conditions of the loan are more favorable than the official credit systems.[64]

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[63] When, in 1992, interest rates were raised, many SOEs were unable to repay their loans and the state bank was forced to provide funds to cover these non-performing. The Agricultural Bank has been under pressure to shift its lending portfolio away from SOEs toward private enterprises. But due to lack of adequate accounting practices in all Vietnamese enterprises, banks have little genuine ability to assess commercial risk and thus continue to prefer SOEs because of greater certainty that they will be bailed out by the government (Alpert 2005).

[64] There are two existing credit systems in the fisheries sector in Vietnam, the official system and the unofficial one. The official system is through the bank system of the government, mainly through the Agricultural Bank system and some by the Bank for Poor and the Funds for Development. However, due to the long process of loan approval as well as the need for collateral, the official credit system is not popular. On the other hand, there are two unofficial credit systems namely the *Nau* and *Vau* systems. These mainly

Regardless of these weaknesses of its reforms, Vietnam's transformation in a span of just a few years is remarkable in many ways. Businesses and trade have flourished providing more jobs and higher incomes for its people. It has opened its doors to private sector investment, both local and foreign, which then boost its industries and economic growth. However, sustaining this growth and continuing the necessary reforms are major challenges that Vietnam has to be face in the coming years.

4.2 Political Economy

Vietnam was under Communist rule until 1986, when the economic crisis reached the breaking point, and the Vietnamese authorities were forced to undertake reforms under the "economic renovation" or *doi moi* program. This program deregulated many elements of Vietnam's controlled economy, allowing currency and some commodity prices to float freely and giving more autonomy to SOEs. Government freed food prices, released farmers from their obligation to work on collective farms, and allowed tilling of small family plots. Within several years, Vietnam became the second largest rice exporter in the world. Both foreign investment and export activity surged; inflation was tamed; manufacturing boomed; and oil revenues poured in. From a very low starting point, Vietnam was growing rapidly. The *doi moi* reforms set the stage for a decade of unprecedented growth with an eight-percent average GDP growth from 1990 to 1997 (Alpert 2005). However, the growth and pace of reforms have slowed. The government has continued to assert a leading role in the economy by continuing to protect state investment in certain key industries and providing limited support to private industries.

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exist for the fisheries sector but can also be used for other sectors in the national economy. *Nau* or *Vau* consists of wholesale buyers of fish or aquatic products in general. The borrower is a regular seller to this *Nau* or *Vau* and the loan condition is that the borrower should sell his/her products to *Nau* or *Vau*. There is no interest, but as expected, the fish/aquatic product price is much lower compared to the market price. (Alpert 2005)

Alpert 2005 discussed the remaining impediments summarized here as: (i) fiscal issues (need more oversight of the national budget; improving tax collection; and comprehensive reforms on SOEs[65] to stop their drain on public finances); (ii) trade restrictions (substantial trade protections are still in place and this is becoming an important issue since exporters face high prices of imports for their raw materials);[66] (iii) weak legal framework (to protect and enforce property rights; and no independent and impartial judiciary capable of ensuring the rule of law);[67] (iv) weak banking system (banking system is dominated by state-owned banks; private investors' access to capital is limited; and state-owned enterprises still benefit from subsidized interest lending by state-owned banks); and (v) official corruption and bureaucratic read tape continued to plague business owners. The 1997 Asian financial crisis highlighted these problems. Today, Vietnam is struggling with stagnating foreign investment and export growth in several sectors (although seafood export continues to grow). In order to sustain growth in the seafood industry and the whole economy, reforms on the lines of the challenges

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[65] The total number fell to around 5,300 in 2000, down from 12,000 in 1990; and industrial output of SOEs fell to 42 percent in 2000, down from 62 percent in 1990 (Alpert 2005). However, subsidies remain substantial, accounting for 2.2 percent of GDP annually. Total debt of SOEs in 1999 was officially estimated at US$9 billion (32 percent of its GDP), a large proportion of which are non-performing, thus contributing to a weakening of the state-owned commercial banks (Alpert 2005). The government has made efforts to reduce SOE subsidies and reform SOEs by granting more autonomy to their management and requiring some financial discipline. These attempts have faced strong resistance from party cadre managing these enterprises, so that reforms could only be superficial (Alpert 2005).

[66] A 100-percent protection in some industries persists. Import restrictions still cover around one-third of imports, and the maximum 50 percent import tariff is considered high by international standards (Alpert 2005).

[67] Property rights, especially landownership rights, still need to be clearly defined and legally protected. Laws to support the functioning of the market system, including commercial and bankruptcy laws, are yet to be enacted. The state continues to prohibit private ownership of land, which is a constraint to development, particularly in agriculture. As it stands, regulations in Vietnam change frequently, and the interpretation of the law is subject to political influence (Alpert 2005).

mentioned above need to be seriously addressed.

The origins of Vietnam's problems are complex and rooted in socialist central planning, inadequate institutions, and inequalities across the country. Despite some reforms, the Communist Party of Vietnam keeps a tight hold on power, rejecting multiparty democracy and free elections. The *doi moi* policies, instead of reflecting interests of the majority, have very much reflected the interest of those groups that rose to dominance during the early part of the transition: SOE managers (often in alliance with the new group of foreign investors), as well as local and provincial kinship networks and political networks (Rodan et al. 2006; Alpert 2005). Many new groups emerged after *doi moi* reforms (including private domestic capitalists and wealthy farmers), but their potential for expansion has been limited by discrimination in policy implementation and lack of capital. Government officials, wanting to protect their power, have imposed these restrictive policy processes and access to capital and land, especially to these new groups. For example, there were ceilings for the rural rich, especially on land use rights (Vu 2003). These restrictions were not necessarily designed for equity purposes, but to protect the power and wealth accumulation of those currently in power. The new groups are unlikely to become a dominant class in the foreseeable future (Rodan et al. 2006).

The political process in Vietnam is still mainly controlled by officials, who are mainly SOE managers and their allies (Rodan et al. 2006; Alpert 2005). The business culture is one where success and profits depended heavily on a company's bureaucratic and political background, whatever the area of activity. Sometimes, the benefits that accrue can be rather indirect, such as being in possession of a large amount of property distributed many years earlier. On other occasions, it can involve a more direct

exploitation of public position, such as channeling contracts to a favored company or using inside knowledge to speculate.

Over the years, democratic centralism has been diminishing. For instance, the appointments processes for government positions were anything but straightforward in practice and a greater variety of interests were being taken into account. There was a shift in power from the centre to the lower levels of districts; and city-level departments have become more powerful. The rise of companies in the 1990s is linked to the local party and government offices, notably the city-level departments and the districts. Business interests appeared most developed at the lower levels – especially in the departments and districts. The downward flow of resources from higher levels to lower levels became less important compared to the Socialist era. Moreover, local party's involvement in business and their emergent business interests impel them towards resisting outside inference and in particular any intervention which threatens these interests. In particular, there is a structure of clientelist networks held together by commercial interests.

Despite a powerful city- or local-level department linked to growing local business sector, some experts also noted the absence of well-developed business interests among the top city-level elite (Gainsborough 2003). This is similar to the pluralistic nature of policymaking processes and power distribution in Thailand. City-level elites have less room to maneuver than those down the chain, given their closer proximity to the centre and the resulting expectations that go with their position. Business interests can be identified quite clearly for officials lower down the formal chain of command, beginning with the city's deputy People's Committee chairmen.

With privatization and decentralization, new interest groups are being forms

(based on key informants). Civil society has begun to be organized to advocate and influence policy. The Vietnam Association of Seafood Exporters and Processors (VASEP) is a good example of private sector-initiated organization with strong influence on policymaking processes. VASEP has been instrumental in lobbying for bilateral agreement with the US on the removal of anti-dumping tariff of its shrimp exports to the US. With the opening up of its economy, social organization has also evolved to adapt to the economic forces and changes.

With advocacy politics severely constrained in Vietnam in the past decades, labor strikes are gradually starting to transform mainstream politics by giving a voice to people outside of Communist Party-recognized organizations. Similar to Thailand, administrative units at the village level, headed by commune leaders, have a strategic role in organizing local people. Most activities, trainings, projects, programs are done at the commune level with the organizing role of the commune. Moreover, every resident of the commune is a member is at least one organization or association, which operate at the commune level but has umbrella organizations at the district, provincial, and national levels. For example, farmers' organization, labor union, or women's union at the commune level are parts of a wider organization at the district, provincial and national levels. This form of social organization creates the foundation of sustained large scale collective action in Vietnam. For instance, Vietnamese peasants have historically managed to press their demands on government. Since the 1960s, the government was pressured informally and indirectly by agrarians to abandon collective farming and allow for more individual family farming instead. Those pressures eventually led to the collapse of Vietnam's collective farming experiment.

In 1997, the *Thai Binh* rural protest was intended to force officials in power to remove restrictions in access to capital and land and give more representation and transparency to the political system (Vu 2003). This protest was largely ignored, but set the stage for some reforms – including more transparent political processes, grassroots democracy, publicized policy documents, and people being given rights to vote for public works plans. More importantly, this protest has led to increased support and investment for agriculture and fisheries development, which is recognized to have been largely neglected in the past. Six priority areas were (i) food security, (ii) structural transformation supporting exports, (iii) employment generation, (iv) environment, (v) fisheries development, and (vi) political stability (Vu 2003). It is too early to gauge the progress of these program areas, but the outcome will contribute to the direction of growth and development of Vietnam's industries.

4.3 Cost Advantages

Vietnam is considered the lowest-cost producer and processor of seafood in general (along with China). Its main advantage is its cheap labor, with a daily wage amounting only US$ 1 per day, compared to US$ 5.2 in the Philippines and US$ 3.4 in Thailand in 2004 (ADB 2005a). Compared to Thailand and the Philippines, Vietnam has a cost disadvantage in both extensive and intensive shrimp aquaculture systems, but has a cost advantage over Philippines in semi-intensive systems (Figure 9 above). Despite cheap labor, Vietnam seafood producers and processors face high costs of other inputs to production due to generally underdeveloped input markets, infrastructure, and transportation sector.

Vietnam's seafood industry can be considered a newcomer in the market,

compared to other countries. Thus, it is still assembling its policies, strategies and infrastructure to support the development of the industry. Many of the processing factories, which also act as export-import companies, are still SOEs. Until recently, all companies in Vietnam were state-owned and the export trade was a state monopoly (ran by Seaprodex). However, since the establishment of the *doi moi* reforms, the Vietnamese government has encouraged the privatization of SOEs. Seafood processors are now able to obtain export licenses from the government and export products directly. As of 2002, there were still seafood processors in the northern part of Vietnam who exported shrimp through Seaprodex. In the southern areas, however, virtually all processors export their products directly. Several joint-venture firms involving Vietnamese and foreign partners were also starting to emerge.

Seen mainly as a major source of economic growth, the seafood industry has recently been provided with growing support from the government. The industry is increasingly becoming a policy area and the stakes are becoming larger for government leaders due to its foreign exchange-earning capacity. The Fisheries Development Program has been specified in the Fisheries Development Strategy Period 2000-2010 of the Ministry of Fisheries (MOFI). MOFI has three economic target programs, including the Fisheries Export Development Program (FAO 2004). With assistance from the Asia Development Bank (ADB), 17 key fishing ports nationwide have been improved with provision of basic logistics for fishing and fish trading onshore (FAO 2004). Recently, Vietnam established a policy to promote contract farming and better link production with marketing and processing. In 2002, a seafood transaction center (or shrimp market) officially opened, receiving supplies from several districts and providing information on

the market, shrimp breeding, feed and veterinary medicine (FAO 2004). These important structures in order for making markets work are slowly being implemented by Vietnam (although it is still less developed than the Philippines and has a long way to go before it reaches the sophistication and maturity of markets in Thailand).

Vietnam still lacks the basic equipment and facilities to support an active fishing industry. In the past, the most important providers of technical assistance were Japanese importers. Japan supplied numerous things in advance, including trucks, freezers and engines, and asking for payment in the form of seafood. Supported by Japanese assistance, the value of seafood exports rose from US$ 11 million in 1980 to US$ 205 million in 1990, and US$2 billion in 2002 (Kagawa and Bailey 2006).

Another important institution for attaining seafood export growth in Vietnam is the Vietnam Association of Seafood Exporters and Producers (VASEP).[68] VASEP was formed in 1998 and is a non-governmental organization whose members include producers, exporters, and companies that service the seafood sector. VASEP aims to coordinate and combine activities of its members from different economic sectors; assist members to improve the value and quality of Vietnam's seafood products; and protect the legitimate rights of its members and of the seafood industry. To date, it has taken part in the promotion of fishing and aquaculture to develop raw material sources and protect the prestige of the industry's products in the media and with consumers. In addition, it provides essential market information (through weekly and monthly Seafood Trade Newsletters with up-to-date information and special reports); watches trends and

[68] VASEP currently has 185 members among fisheries processors and exporters which account for 87 percent of total seafood export (in 2002). Annual budget averages US$ 1 million; and the annual membership fees cover all administrative expenses. The Seafood Market Development Fund was established from the contributions of exporters.

develops national strategies for the seafood industry; supports the business expansion of member enterprises; organizes and implements on-the-job and short-term training and trade-promotion activities.[69]

Partnership between the private and public sectors is notable. For instance, Shrimp Club, consisting of 38 firms (including farmers, hatcheries, and feed producers and suppliers which produce half of the total shrimp production in Lampung) provides technical and marketing support to its members. The Club provides technical assistance to members, establishes partnerships with the provincial government, undertakes productivity-enhancing studies and experimental trials for new shrimp varieties, and establishes long-term contracts with exporters and other market outlets including hypermarkets.

The relatively recent history of private enterprise and the recent rapid growth in shrimp exports put Vietnam in the position of a new player in the global shrimp trade. At present, there is a serious lack of understanding of how the market works. For instance, national programs have led to the development of exportable products in which Vietnam has apparently little comparative advantage, while demand for these products in the domestic market goes unmet (e.g., livestock products (Vu 2003)). Vietnam has to seriously devise structures to understand the workings of the market and position itself to take advantage of its comparative advantage at the same time providing food security to its population.

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[69] For instance, it has arranged for Vietnamese companies to participate in major European exhibitions such as the European Seafood Exposition (ESE) in Brussels and the *Salon International de l'Alimentation* (SIAL) in Paris. Furthermore, VASEP has been assisting exporters in developing markets in countries that include the UK, Netherlands and Italy and is currently looking at setting up representative marketing hubs in a number of additional overseas markets (Armitage 2005b).

An area that Vietnam has to put priority is environmental sustainability. Its co-management system is not yet officially approved by the central government, although it is already being applied in several coastal areas in styles suitable to conditions. This arrangement has a positive effect on resource protection. With support from international donor organizations, MOFI is aiming to integrate research findings, and to systematize and apply the co-management concept into the Fisheries Law of Vietnam. Currently, the concept of "user rights and obligations" has been accepted in the management system, although a national law to the effect has still to be adopted.

4.4 Food Safety and Quality

Coming from a long period of war, Vietnam is just starting to build its national food safety systems. However, its efforts over the past years have been remarkable. As part of its EOI policies, food safety is increasingly becoming a priority in Vietnam, due to growing recognition of food safety's role for market access. The Vietnam Food Administration is responsible for managing food hygiene, safety, and quality and has made significant progress since its establishment in 1999. It is actively working to establish pilot foodborne disease surveillance system in selected provinces and undertaking a range of information, education, and communication activities in food safety for stakeholders at all stages of the food chain. A major event involves the Action Month for Food Safety, which annually promotes food safety nationally, to all consumers. It has demonstrated commitment to the food safety challenges, and has embarked on a comprehensive capacity building activity with technical assistance from the World Health Organization (WHO) and loan from ADB.

Two important food safety events affecting Vietnam seafood exports are worth

noting. First, EU rejected some imports from Vietnam due to noncompliance with their strict food safety requirements that resulted in a 60-percent decrease in its exports to the EU in 2004 (VASEP 2004). Second, the zero tolerance to chloramphenicol and other antibiotics has become a major challenge of Vietnam's seafood export industry.

Vietnam responded fast and put necessary policies and institutions in place. These included: (i) changed legislation and regulatory system to be equivalent to EU standards; (ii) strengthened its CAs at the national and provincial level; (iii) strengthened its laboratory capacity by implementing ISO 17025; (iv) upgraded processing factories to meet EU standards; (v) prohibited use of harmful chemicals and antibiotics, banned the production, importation, and use of 11 chemicals and antibiotics in agriculture and aquaculture; (vi) implemented monitoring programmes for biotoxins in bivalve mollusk harvesting areas and for chemical contaminant residues; and (vii) implemented thousands of training courses for all stakeholders in the food chain. Implementation and enforcement was remarkable, and was not done only on paper. As a result, Vietnam has impressive measurable indicators [70] of food safety control for its seafood industry (VASEP 2004).

In 2005, there were 330 seafood processing facilities in Vietnam; 100 have EU HACCP certification and are approved to export to the EU (although this figure is expected to rise as distribution networks improve) (Armitage 2005b). Moreover, in 2007, six companies in Vietnam are certified with the Global Aquaculture Alliance's (GAA)

[70] These include (i) Food safety and hygiene conditions improved considerably in most of 363 seafood processing enterprises and along the entire value chain; (ii) One hundred seafood-processing establishments received EU HACCP certification in 2004, compared to 18 in 1999; (iii) Two hundred and twenty-two plants meet the requirements of the US FDA; (iv) Twelve bivalve mollusk harvesting areas received EU approval, compared to five in 2000; and (v) One hundred and thirty aquaculture areas are subject to a Residue Monitoring Program, compared to fifteen in 1999 (VASEP 2004).

Best Aquaculture Practices (BAP) certification, an important drive to boost seafood exports of its seafood products (Merrett 2007).

Public and private sector cooperation towards food safety and market development has been noticeable. VASEP and government regularly meet and plan how to strengthen food safety systems in the country. According to key informants, traceability systems are increasingly being developed by many companies.

Another key strategy is international partnership to manage quality, hygiene, and food safety through bilateral agreements with partners and competent agencies in major markets. The first agreement is with the Canadian Food Inspection Agency (CFIA), in which the CFIA recognizes the National Fisheries Quality Assurance and Veterinary Directorate (Nafiqaved) under the MOFI as the authority to control and manage quality, hygiene, and food safety of Vietnamese seafood products exported to Canada (Duc 2006). The second agreement is a technical cooperation agreement between Vietnam and Thailand, which is directed at controlling hygiene and diseases in aquatic organisms.[71] The third agreement is a technical cooperation between Vietnam and Cambodia with the aim of protecting the health of aquatic animals and amphibians and promoting better hygiene and safety of seafood products.[72]

Vietnam is still developing its national capacity. Currently, the prime movers of

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[71] The agreement provides for the exchange of information, knowledge, and experience in hygiene, food safety, and specialized veterinary services for fisheries. The two countries also agreed to provide each other with the certificate forms for quality and for the quarantine of imported and exported aquatic animals and animal products (Duc 2006).

[72] The two countries agreed to cooperate closely in: 1) exchanging safety procedures and quarantining fisheries seeds, live seafood, and seafood products; 2) monitoring and controlling fisheries diseases; 3) exchanging information regarding current disease threats; exporting and importing seafood products; and cooperating with respect to the veterinary medicines, chemicals, and probiotics used in aquaculture (Duc 2006).

controlling food safety in the industry are the companies themselves, which are mainly owned or jointly owned by foreign companies (in contrast with the Philippines and Thailand). The main institution that ensures delivery of safe seafood to consumers is coming from technical assistance and direct supervision/monitoring from these foreign businesses.

As other new local businesses emerge, it is crucial to strengthening the national food safety management capacity to manage the food supply both for export and local consumption. An important strategy would be to utilize and learn from the "good practices" in terms of food safety systems from the above mentioned processors-exporters. The government can utilize these nuclei of food safety systems (Henson and Jaffee 2006) to jumpstart a coordinated value chain systems ready to face the challenges of a demanding international seafood safety landscape.

5 Philippines

Seafood is one of the important industries in the Philippines, accounting for four percent of the country's total Gross Domestic Product (GDP) and 28 percent of the Gross Value Added (GVA) in the agricultural sector (both valued at constant prices). The value of its seafood production[73] amounts to US$ 2.2 billion, representing a 7.4 percent annual growth rate coming mainly from increases in production volume.[74] The industry employs two million workers (FAO 2005) or seven percent of the country's workforce (in 2002). The industry is the country's third largest source of export earnings, following coconut

[73] Commodities included as "seafood" or "fisheries" products vary from country to country. In the Philippines, seaweeds, fish oil, and fish meal are included.

[74] Computed based on available data from 1990 to 2006.

and fruits/vegetables, and contributes one-fifth of total export value. It is included in the Department of Trade and Industry (DTI)'s "Top Ten Revenue" streams on the basis of the sector's consistent positive export performance (compared to its imports), its high probability of success, and its growing global market. The Philippine fisheries sector has also been identified by Asia-Pacific Economic Cooperation (APEC) as one of the 15 sectors that were expected to have a positive impact on trade, investment, and economic growth for the country (Macam 1998). Salayo (2001) identified many forms of seafood products with revealed comparative advantage.

Despite these positive trends from the industry, high export growth has not been sustained. This has been mainly due to a deteriorating business environment that has beset the country, increasing costs of production, and inability to respond strategically to the rapid changes in the international market. These factors are further discussed in the subsequent sections.

5.1 Business Environment

The seafood industry in the Philippines suffers with an overall weak business environment. Of the nine indices of competitiveness used in the GCR, the Philippines has one of the lowest country rankings in terms of institutions, macro-economy, infrastructure, and innovation in the world. It is far lower than Thailand, and even lower in ranking than Vietnam, a country that recently transformed its market economy (Figure 8 above).

In terms of institutions, the most serious constraints to competitiveness (synthesized from the executive survey with GCR) are police and national security issues, organized crime, wasteful government spending, inefficient bureaucracy, corruption, and

lack of public trust in the political and judicial systems (WEF 2006). In terms of macroeconomic indicators, government debt and budget deficit are the main constraining factors. In infrastructure, insufficient telephone lines, high electricity costs, and the poor quality of infrastructure are the major disadvantages for the Philippines. The Philippines has higher electricity costs than Thailand and Vietnam. Despite it having a high rate of electricity supply by regional standards (approximately 80 percent), the quality of the electrical supply (measured by number of interruptions) is low, and transmission/distribution losses remain among the highest in the region at about 14 percent (ADB 2005a).

In terms of the indicators of cost of doing business, the Philippines ranks 133rd (as compared to Thailand, which ranks 15th, and Vietnam, which ranks 91$^{st)}$ out of the 178 countries included in the survey (Figure 7 above). Having a far lower ranking than Vietnam, a newcomer to market economy, indicates a serious structural problems within the Philippines. Philippines is weak in almost all the indices such as on the ease of starting a business, dealing with licenses, employing workers, protecting investors, getting credit, enforcing contracts, and closing business (Figure 7 above). It also has the longest time needed and most costly export and import procedure. All these are evidence of the ineffective bureaucratic processes that increase the cost of doing business in the Philippines. Higher tax rates for businesses in the Philippines are another form of disincentive for businesses looking to invest in the area.

Access to credit and the cost of capital are major constraints faced by processors (based on key informants) with credit for fisheries being even more severely constrained. Banks are reluctant to lend to smallholders due to transaction costs, risk, and the absence

of assets that could be used as collateral (such as land). Within agriculture, fisheries suffer from lopsided allocation. The sector accounts for only a minuscule portion of loans extended by existing agricultural credit programs for small borrowers (Briones 2006; based on key informants). The credit and guarantee schemes mandated under the Fisheries Code have not been funded (Platon and Israel 1999).

The Philippines has the lowest rates of foreign direct investment (FDI) in the region. FDI is an indicator of the perceived risk of doing business in a country and its attractiveness relative to its neighboring economies. While the Philippines benefited from high levels of FDI during the 1990s, with its push to attract investment into the infrastructure sectors (US$ 1.8 billion in 1999), net FDI dropped to just US$ 0.1 billion in 2003, or 0.1 percent of GDP (ADB 2005a). The perceived risks of doing business in the Philippines are rising, deterring foreign investors and encouraging them to seek alternatives such as Vietnam and Thailand. The share of foreign equity in agriculture is 19 percent, while 81 percent is local/domestic capital (ADB 2005a). In fisheries, the average share of foreign equity is only six percent, while 94 percent is local/domestic capital, based on 59 seafood processors surveyed.

To achieve competitiveness in the economy as a whole and not just the seafood industry, the Philippines has to look seriously into challenging the current institutions and macro-foundations of the country. Given the high level of competition for FDI in the region, it is unlikely that the Philippines will see a marked increase of FDI inflows without substantial improvements in its investment climate (ADB 2005a).

5.2 Political Economy

The Philippine economy has shown periods of growth in the 1970s, but failed to

sustain such growth in later years. Past governments followed economic policies that were not in the best national interests and distorted incentive structures (e.g., socially undesirable investments attracted private investors and socially desirable activities became relatively unprofitable) (Power and Sicat, 1971; Bautista et al. 1979; Medalla et al. 1995). ISI policies were adopted by several governments starting from 1950 (adopted almost at the same time as Thailand) up to mid-1990s (much later than Thailand and Vietnam).

Under President Marcos, the government implemented the Investment Incentives Act of 1967, which created the BOI and granted incentive schemes such as tax exemptions and tax credits. However, these incentive schemes remained strongly biased in favor of import-substituting firms, particularly in capital-intensive manufacturing. Despite some efforts in the 1970s, the industrial protection system still highly favored industrial consumer goods over capital goods and penalized export production relative to the import-substituting firms (Medalla et al. 1995). Moreover, despite rapid growth led by Green Revolution in the 1970s, agriculture and economy-wide growth was not sustained.

The situation was made worse by the fact that the currency remained overvalued. Intal and Power (1990) estimated the average overvaluation at 24 percent in 1970-74 and 32 percent in 1975-79, rates higher than those derived for Thailand (16 and 24 respectively) using the same estimating method (Medalla et al. 1995; Bautista 1990). Several studies document the overwhelming negative influence of domestic currency overvaluation on providing production disincentives in the agriculture, seafood, and export sectors (Bautista 1987; Intal and Power 1990).

With external pressure and economic downturn, EOI was formally implemented in the mid-1990s. In 1995, the Export Development Act, which served to partly offset the policy bias against exports by granting fiscal incentives, was signed into law under intense lobbying by exporters for "a more competitive exchange rate." The real exchange rate fell substantially (depreciating by about 30 percent from 1996 to 1998) with *de facto* devaluation being brought about by the Asian financial crisis in 1997. Throughout the 1990s, there were some measures to accelerate policy reforms (including liberalization of foreign exchange markets and trade liberalization) and increased protection for the agriculture and seafood sectors. These events improved the comparative price advantage of the tradable goods sector as compared to non-tradable ones. However, many reforms were partial, the real exchange rate continued to be highly overvalued, and EOI policies were not effectively implemented.

The partial EOI-related policies and persistence of ISI policies was due to the absence of strong counter-balancing groups to influence policy-making (Hutchcroft 1998; Balisacan et al. 2004; Rodan et al. 2006). The Philippine political system is characterized as weak by many experts (Rodan et al. 2006; Hutchcroft 1998; Balisacan et al. 2004). This weakness comes not only from the domination by a powerful few *per se*, but by the inability of the system to produce radical changes to counteract that pattern of domination (Kraft 2003; Hutchcroft 1998). There is a large literature that describes the poverty of politics in the Philippines and international scrutiny of the country's record on governance and poverty (Rodan et al. 2006; US State Department 2005).

The capitalist oligarchy structure of the Philippine corporate sector has a bearing on and influences the political system (Hutchroft 1998; ADB 2005a; Rodan et al. 2006).

The historical dominance of the landed oligarchy, which originated during the Spanish colonial period, has consistently characterized Philippine politics. The ISI policies induced the landed oligarchy to diversify into the newly protected industrial sector. To date, the corporate sector is dominated by large, family-owned businesses operating in diversified sectors (Saldaña 2000; Rodan et al. 2006). At the end of 2003, 62 percent of the market capitalization of the Philippine Stock Exchange (PSE) was composed of 23 family-controlled groups (Philippine Center for Investigative Journalism 2004).

Unlike Thailand, the Philippines is characterized by increasing autocratic centralization – the autonomy of macroeconomic agencies has been substantially undermined and sectoral actors have been largely excluded from sectoral governance, which is dominated by non-sectoral bureaucracy (Akiyama and Larson 2004). It has a narrow circle of benefiting interest groups: traditional landed elite who dominates the Congress. A backward and inefficient but politically assertive sector of highly protected industrialists plays a strong secondary political role. In order to involve producers in political decision-making in agriculture, including fisheries, a number of influential committees have been created which by law require private sector representation. While the scope of groups involved in shaping policies has been widened to include a much broader range of interests in a meaningful way, some interests continue to be more influential than other.

On the other hand, the producers and processors rely much on the government to provide them the things they need. It is a dole-out mentality perpetuated by the system. This mentality would have stemmed from the authoritarian centrality of decision-making leaving no opportunity for sector actors to have a voice and ending up waiting for what

the government would provide them. As the cyclical pattern goes, policies and laws actually enacted would tend to favor the status quo of power distribution and economic rents.

To date, this state of affairs in the Philippine political economy continues despite concerted civil society activism. Progressive civil society organizations have found it difficult to build much needed fundamental reforms, and the government is not particularly enthusiastic or responsive (Walzer 1992). Neither the introduction of authoritarianism in the 1970s nor the overthrow of Martial Law in 1986 nor the ousting of President Estrada altered the basic structure of Philippine politics. Currently, there is no system to shape and consolidate pressures for major reforms in the political processes (Coronel Ferrer 2004), and the present political structure in the country has accommodated a level of social activism (Hutchcroft 1998; Rodan et al. 2006). Some experts analyzed this further and suggested that social activism in itself has contributed to political instability because there is no structure to consolidate the pressures and forces advocating for reforms in political processes (Coronel Ferrer 2004).

There are a very few examples of effective and sustained collective action in the past: Some observers attribute land redistribution during the Ramos administration, in larger scope than any of its predecessors, to some changes in civil society organizations originating in the 1980s. Grassroots organizations during that time had some influence in the local political dynamics. This indicates that small-scale producers and landless laborers who organize and build coalitions mediated by NGOs could make a significant difference at the local level. However, due to unique social and political features of the Philippine society, these cases of sustained collective action are exceptions rather the

rules.

Sustained collective action for advocacy politics is difficult in the Philippines. Several factors can help explain the limits of collective action in the Philippines. First, there are numerous different smaller organizations, but, dispersed geographically across the country's many islands. This is why it is particularly difficult for the large scale collective action to be formed and sustained against the well-organized landed oligarchy. Coordination has been difficult for these smaller organizations. This lack of a sense of collective action may be due to high information costs within groups, organizations or associations and the limits of institutional arrangements to reduce these costs. An institution that works in the Philippine context to reduce the high information costs within organizations and associations is a system similar to the Grameen system known in microfinance. This system is characterized by the dominance of dyadic relationships and not among large numbers of members. It is characterized by small groups with five members which uses social relationships to control one another and to reduce information cost among its members. In the Grameen system, local people choose neighbors as members of the same group. However, this type of relationship and arrangement limits the formation and sustainability of larger groups beyond the dyadic relationships.

Second, dole-out mentality is strong in the Philippines. Many services and needs were historically expected to be provided by the government and producers or processors did not feel an urgent need to resort to types of organizations and associations to supply these services and needs. This has perpetuated the high information cost and free-riding problem that were initially created by the pampering public sector.

Third, structure of power and influence at the local or village level does not

permit easy organization via local government units, rather external agencies or NGOs usually are responsible for organizing village people. When NGOs try to organize people, they tend to bypass barangays. In the beginning, they send their workers to the barangay captain and ask him or her to call a meeting about their project. In the process, the role of barangay captain is just to call a village meeting. NGOs, not the barangay captain, are the organizers of the local people. This method contrasts with the Thai case, in which NGOs and government agencies expect the village headman or other village leaders to play the role of organizer.

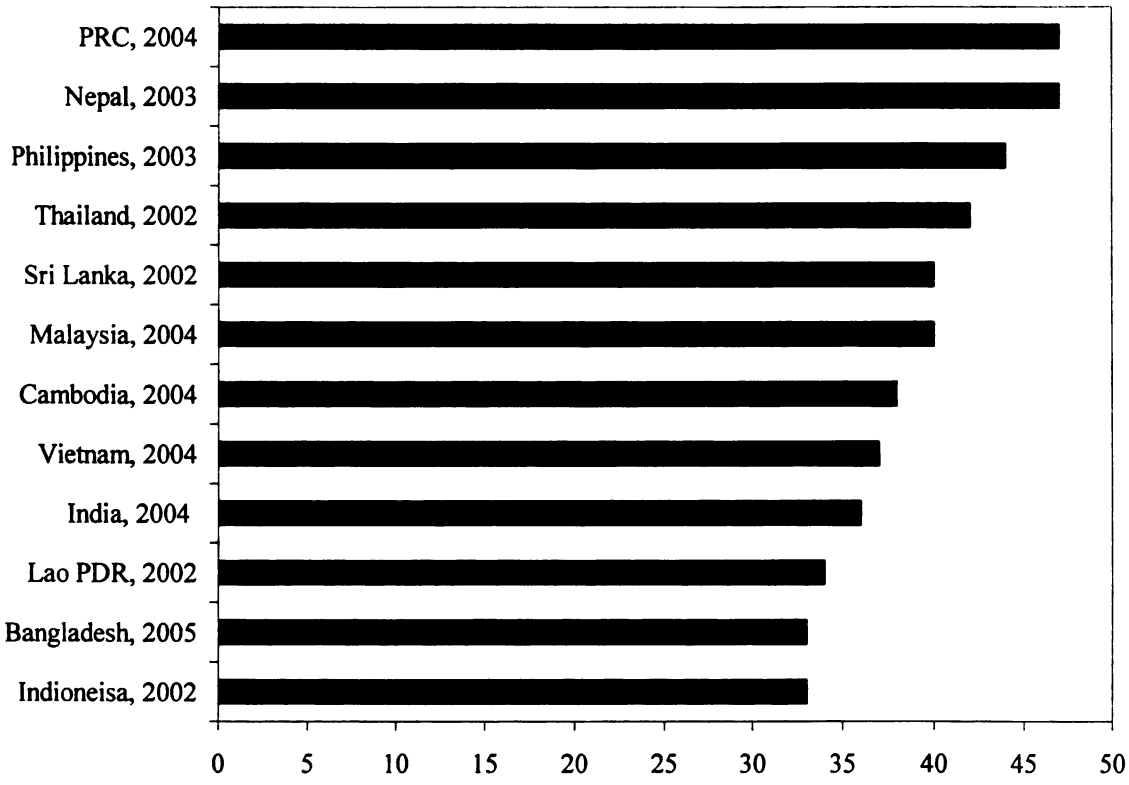
Historically, barangays cannot be used to organize people. Many barangays in Central and Southern Luzon are big, which include more than 400 households, hence social relationships among villagers tend not to be close. No sense of unity has formed at the village level. Barangay chapels, unlike temples in Thailand, do not induce a sense of affiliation or encourage collective action among the villagers. Rather, the barangay has been used by politicians to their own political ends, for example to gather votes or legitimize their authority. Thus, this lack of organization support from the village-level administrative unit limits the creation and sustainability of large scale collective action in the Philippines.

Fourth, several experts also stress that the political processes behind these policies could also be a result of high initial inequality in wealth distribution[75] (Balisacan et al. 2004; Rodrik 1996). Philippines is among the top countries with unequal wealth

[75] Despite the impressive growth in total agricultural production up to the early 1980s, the effect of such aggregate growth on reduction of rural poverty was not very impressive. The pace of poverty reduction in the Philippines (measured by income or expenditure or by non-income dimensions) has been quite disappointing compared to its neighbors (Balisacan et al. 2004). One of the main reasons for such weak effects of aggregate growth in reducing rural poverty can be attributed to the historical processes leading to the social structure of the rural Philippines and the growing incidence of landlessness during the period.

distribution, higher than Vietnam and Thailand, measured in terms of Gini coefficient (Figure 10).

Figure 10. Measure of wealth distribution in selected South and Southeast Asian countries

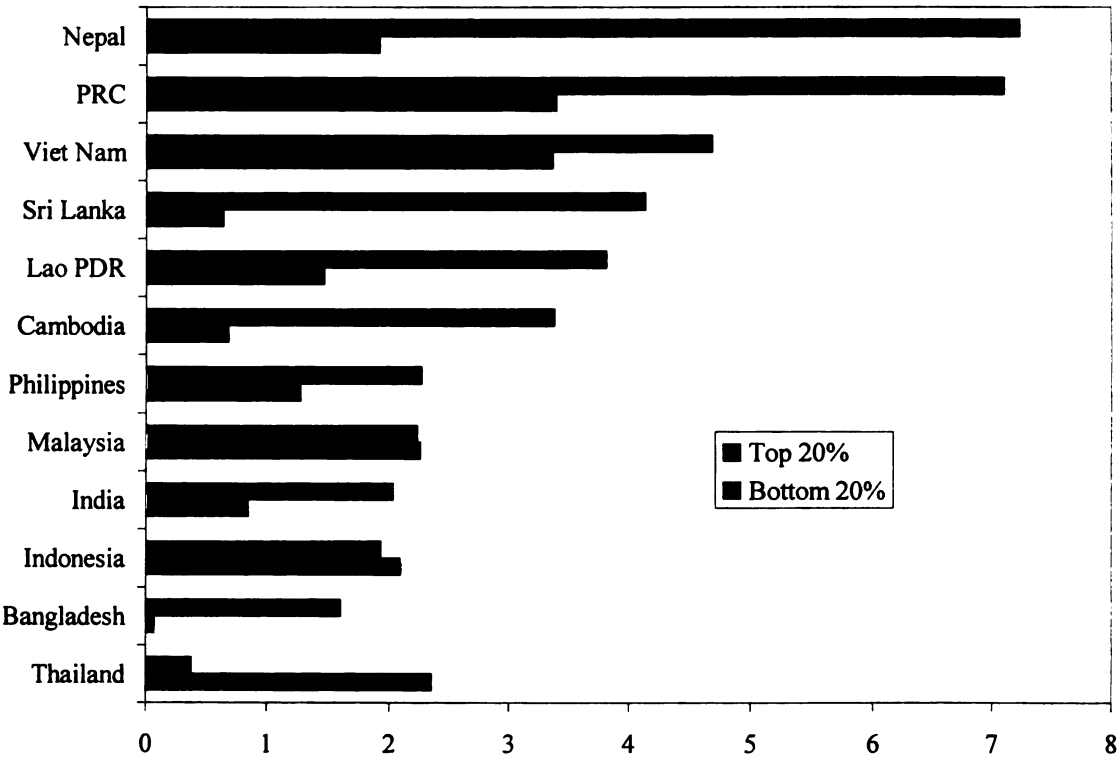


Source: ADB 2007; x-axis is the Gini coefficient.

Another measure is the percentage change in expenditure/income of the top 20 percent and bottom 20 percent of the population. The logic is that increases in wealth inequality are not only a story of the "rich getting richer and the poor getting poorer," but, it is also the "rich getting richer faster than the poor." Following this logic means that if the income of the top 20 percent grows faster than the income of the bottom 20 percent, the inequality is worsening. Figure 11 shows that Thailand has positive trends of greater wealth equality: the bottom 20 percent is growing much faster than their top 20 percent.

Vietnam's top 20 percent is growing very fast and the bottom 20 percent is moving a bit slower, and thus, this provides an indication on worsening wealth inequality. Worst picture among the three countries is the Philippines: it has the highest wealth inequality index to start with (Figure 10) and the highest percentage change in incomes of the top 20 percent as a ratio of that of the bottom 20 percent (Figure 11). This indicates a worsening wealth inequality in the future, much faster than Thailand and Vietnam.

Figure 11. Percentage change in expenditure of top 20 percent and bottom 20 percent of the population in selected South and Southeast Asian countries



Source: ADB 2007; x-axis is in percent

High inequality hinders the emergence of a political process with competitive interest groups and encourages a political process with rampant rent-seeking. The result is a cyclical problem: poor policies from a political process without competitive lobbying,

which in turn is a result of the high inequality in wealth distribution. A study on Vietnam indicates that higher levels of income and education increase participation in an array of social networks, and thus, further development and greater wealth equality are not so likely to exchange on set of social networks for another, but to expand the number and activity levels of the networks that connect individuals to society (Dalton et al. 2002).

Comparing the Philippine political economy to Thailand, Hutchcroft (1998) argues that the Philippine state can be characterized as a "patrimonial *oligarchic* state" as opposed to its Thai (especially in the years 1932-1973) counterparts that are characterized as "patrimonial *bureaucratic* states." In a 'patrimonial *bureaucratic* state' a bureaucratic elite tends to "extract privilege from a weak business class;" while in a 'patrimonial *oligarchic* state' "a powerful business class extracts privilege from a largely incoherent bureaucracy" (Hutchcroft 1998, p. 20). He argues that in a "patrimonial *oligarchic* state" such in the Philippines, it is difficult for policy reforms to succeed given the relatively weak position of state bureaucracy vis-à-vis private business interests. However, no explanation is offered as to how one type of the 'patrimonial' state emerges in some societies, but the other type emerges elsewhere. In addition, if the bureaucrats in a 'patrimonial bureaucratic state' are rational, it is not clear why they initiate policy reforms that eventually lead to the loss of their own economic advantages.

A veteran scholar of Philippine politics has argued that "the two political economies are converging — with Thai elections and political parties, for instance, becoming more like their Philippine counterparts — in turn affecting the role of private interests in state decisions on the economy, and thus reducing the strength of the bureaucracy" (Wurfel 2000, p. 893). Nevertheless, many experts highlight the

fundamental difference in the structure of power distribution and policymaking in the Philippines and Thailand, particularly the absence of social forces challenging control by the oligarchy led the 'patrimonial *oligarchic*' nature of the state to endure (Hutchcroft 1998, pp. 52-54). This lack of social forces challenging the current state may well be attributed to the lack of incentive and interest of creating and sustaining collective action among the people. Citizens know that nothing will happen to their requests since decision-making and its outcomes are already fixed by limited number of politicians and policymakers, and thus, people will not have the incentive to contribute to organizations to lobby for their interests.

5.3 Cost Advantages

The strength of the Philippine marine fishing industry and the boom in its aquaculture sector are critical to the competitiveness of its seafood industry. For instance, 40-80 percent of total costs incurred by processing and exporting firms are costs of raw seafood in the Philippines (see Chapter 3). The Philippines has cost disadvantage compared to Thailand in both extensive and intensive systems, but has a cost advantage over Vietnam in extensive system.[76] The Philippines has a cost disadvantage compared to Vietnam in semi-intensive system[77] (Figure 9 above). This cost disadvantage of the Philippines in shrimp farming has contributed to the decline of shrimp exports over the years.[78]

This cost disadvantage is a result of past policies and institutions rather than

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[76] No data for Vietnam.

[77] No data for Thailand.

[78] Shrimp exports have decreased by four percent per year (1995-2006).

endowments (following Porter's (1998) concept of competitiveness as being created and not inherited). For instance, the Philippines is endowed with 2.43 million square kilometers of marine resources and 750,000 hectares of inland water resources and these figures are far higher than that of Thailand and Vietnam. Figure 6 above clearly illustrates the richness of the Philippines in bodies of water compared to Thailand and Vietnam. Despite having abundant water resources, critical for seafood production, the Philippines now faces several disadvantages over Thailand and Vietnam due to divergence of policies and institutions.

First, the prolonged ISI regime has protected large manufacturing industries at the expense of potentially viable export-oriented firms. An example is the feeds industry where feeds make up 30-50 percent of the aquaculture expenditures. As part of the ISI policies, feeds face higher tariffs, leading to higher costs for aquaculture, which means that these prices are higher than other competing Asian countries.

Second, the innovation capacity through research and extension has been limited. According to GCR, innovative capacity of the Philippines is weaker, ranking only as 75th compared to 33rd for Thailand and 79th for Vietnam (out of 125 countries surveyed worldwide) (Figure 8 above). Key informants from FAO and the World Bank viewed the Philippines as the weakest in research and technical innovation. It was also observed that the Philippines has limited international presence in FAO and other technical and standard-setting bodies as compared to Thailand and Vietnam. Given that the Southeast Asian Fisheries Development Center (SEAFDEC) is based in the Philippines, it is surprising to hear experts' strong opinion of the lack of innovative capacity in the Philippine seafood industry. According to key informants, the lack of innovative capacity

may be a result of the lack of synergy and partnership between the private and public sector research, extension and training systems. This approach has been proven to be strong in both Thailand and Vietnam and is considered to be a major contributor to the growth of these countries' seafood exports.

Gauging the research intensity ratio,[79] funding for agricultural research in the Philippines is limited, and is among the lowest in the Asian region (David et al. 1999). Within agriculture, the fishery sector is even more disadvantaged, receiving less than four percent of the total allocation for agriculture and natural resources, far lower than its 28 percent share in agricultural GVA (Israel 1999; Briones 2006). This limited public funding, coupled with the weak credit system to provide needed investments for research, has led to a weak knowledge and innovation system in the Philippines (Briones 2006; based on key informants). The Bureau of Fisheries and Aquatic Resources (BFAR), the agency of the government responsible of fisheries development, has a number of technology centers and their staff conduct farm visits and provide technical assistance to fish farmers within their respective vicinities. Given their limited geographic coverage, most of the country's fish farmers would have to be served by municipal extension agents; however, few municipalities provide adequate support or assign priority to aquaculture extension (Yap 1999). The result is a persistent problem of low yields in aquaculture (Platon and Israel 2001) and prevalent technical inefficiencies in the production of key commodities such as milkfish, tilapia, and shrimp (de Jesus et al. 2005). In addition, seafood processing firms complain about the absence or limited technical and research assistance provided to them by the government.

[79] Percentage of research and extension expenditure in agriculture GVA.

Third, cost of labor is also a major constraint in the cost competitiveness of Philippine seafood. Rising real wages due to successive rounds of minimum wage increases have not been matched by concurrent rises in productivity, such that unit labor cost[80] rose from 1.0 in 1978 to 1.3 in 2000 (ADB 2005a). In contrast, the unit labor cost of Vietnam and Thailand were less than one for most of the same period (Jurado 2000). Business efficiency[81] in the Philippines was found to be one of the lowest among 49 industrialized and emerging economies (Macaranas and Silva 2002).

This wage-productivity gap is an important impediment to the competitiveness of the Philippine seafood industry. The Philippines is weak in terms of indices on training and skills development services, ranking only 76th compared to Thailand (22nd) and Vietnam (69th) (WEF 2006).The attractiveness of low labor cost in Vietnam makes it suitable for low-value processing, while the high productivity and highly trained and skilled labor in Thailand makes it very attractive for high-value processed products. This cost-productivity gap needs to be addressed in order for Philippines industries to gain competitiveness. This can be done by reducing wages or focusing on value addition and related skills development. The former becomes a socio-economic, cultural and political issue, which is rather difficult to change; while the latter are often easier ways to implement. The Philippines has to expand investments in training, skills development, and human resources to support product differentiation and value-adding strategies.

Fourth, supporting industries and infrastructure are limited, contributing to both

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[80] Unit labor cost measure as an indicator of cost competitiveness. It is measured by the ratio of labor compensation in nominal terms and output volume in real terms. It can also be interpreted as the current cost of labor per "quantity unit" of output produced (van Ark and Monnikhof 2000).

[81] Extent to which enterprises are performing in an innovative, profitable, and responsible manner.

high prices of inputs and services needed for production, processing and trade. Specific to fisheries, wastage in the post-harvest stage is pervasive, owing to insufficient preservation and handling facilities, particularly in fishing ports. Post-harvest losses may amount to as much as 40 percent (Platon and Israel 2001). Municipal ports are burdened by a large demand in excess of their limited facilities. Ice plants or warehouses are small, dilapidated, or absent, particularly in areas where power supply is highly irregular. In some cases, there is no choice but to turn over fresh fish to those undertaking traditional preservation and processing for the domestic market so as to avoid deterioration in the ports. In contrast, regional ports[82] are underutilized due to inadequate commercial catch (Israel and Roque 2000).

A consequence of a long ISI regime and weak EOI described above is a continuously weak export promotion policy in the Philippines. Negative protection (or indirect taxation) of the agriculture and export sectors coming from ISI continues. Within agriculture, the seafood industry was indirectly taxed and neglected the most. While two national programs (Philippine Fisheries Code (PFC) and Agriculture and Fisheries Modernization Act (AFMA))[83] to support the sector were designed and passed into law, they were seriously underfunded every year despite official promises (Platon and Israel,

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[82] A total of seven throughout the country.

[83] PFC reserves aquatic resources in Philippine waters for the sole use of Filipino citizens and clearly defines use rights and responsibilities of Philippine waters to relevant government agencies. For fisheries/seafood marketing, PFC requires prior certification by the government before allowing fish importation (except for raw materials for canning). AFMA (created in 1997) embodies "sustainable development" as a principle in agricultural and fisheries modernization (Israel and Roque 1999) and also mandates the delivery of support services for agriculture and fisheries and appropriates funds for this purpose. Directed credit programs of line agencies were phased out; credit programs are consolidated under the Agro-Industry Modernization Credit and Financing Program (AMCFP), which uses banks and eligible NGOs as loan conduits. Fisheries development is primarily implemented through the Ginintuang Masaganang Ani (GMA)–Fisheries program which is administered by the BFAR. Program components include rural finance, fisheries production, fisheries training and extension services, fisheries information and marketing support, research and development, fisheries infrastructure, and fisheries management.

2001; based on key informants). Overall government support to the seafood industry is generally weak, and the continued existence of the sector has mainly driven by private sector, mainly local businesses. However, bureaucratic processes and high transaction costs provide continues disincentive to some who see a potential to invest in the sector (based on key informants).

According to key informants, active participation and sponsorship of trade/food fairs, export credit, subsidized loans, active associations, and investments by both government and private sector of services and infrastructure are weaker in the Philippines compared to Thailand and Vietnam. Necessary measures have to be initiated to improve the situation. In terms of importance, strategies to reduce costs, especially the cost of credit and taxes, are most frequently mentioned (Table 6). The next most important strategy is to ease transaction costs, as current export document processing is viewed as bureaucratic and inefficient. Another set of strategies that need to be implemented are marketing strategies, including supporting trade/food fairs and trade agreements. Also important are improving the export support systems through strengthening the Export Promotion Council and/or trade associations. Reducing tariffs on production inputs and the need to provide incentives for firms that consistently adopt food safety systems are also mentioned as important strategies.

Table 6. Philippine seafood processors' perceptions of export promotion strategies, 2005

Export strategy	Number of respondents*
Credit incentives for exports	45
Tax incentives for exports	42
One-stop document processing	41
Support for trade/food fairs	40
Trade agreements	37
Partnership with other countries	36
Strengthening Export Promotion Council	35
Strengthening trade associations	30
Tariff rates for imports as inputs to production	10
Tax and credit incentives of consistent food safety system adopters	5

**Average of responses based on interviews with 59 seafood processors in the Philippines; Out of 59 respondents, figures presented here are the actual number of respondents mentioning relevant export strategy as relevant.*

One consequence of the lack of government support for the Philippine seafood industry seems to be weaker enthusiasm to invest and innovate by the private sector. Philippine seafood processors were interviewed about their current industry strategy—specifically about the importance of a list of "good practice"[84] industry strategies based on Porter (1998) and those adopted in Thailand and Vietnam. Processor interviews indicated that, in general, current industry strategies are not helping achieve competitiveness and highlight that the industry tends to rely on public investment and assistance and/or blame the government for the sector's lack of growth. For instance, food safety strategies are not considered to be a priority action for firms since these are costly to implement and crowd-out other investments. From the interviews, it appears that

[84] Porter (1998) and experiences of Thailand point to successful elements of industry competitiveness including: cluster development, value chain coordination, industry-government partnerships, active participation in trade associations and producer/processor organizations, cost sharing, investment in market infrastructure, new product development and value addition, partnership with research organizations, research and development spending, food safety strategies, traceability systems, corporate social responsibility, and optimal marketing strategies, such as group marketing (important for smaller producers).

a sense of individualism rather than partnership or cluster development prevails in the Philippine seafood industry. In the absence of a catalyst from the private sector, the government can act as facilitator or catalyst for cluster development and greater awareness of the need to position food safety and product quality strategies towards international competitiveness. It should create an enabling environment for investments to come in and for innovations and dynamism to start. Lastly, it should cultivate cooperation and partnership among industry players and research and other service providers, and nurture trust among these industry players, especially the food industry, where at present trust is apparently missing.

The sector also lacks strong business associations that would ordinarily help fuel the growth. While there are a number of fisher or processor/exporter associations (for shrimp and tuna) and a few associations for seafood or fisheries in general,[85] many of these are either inactive and limited in membership, or not influential enough to represent the industry's interest in political processes, compared to other commodities and businesses. Among all seafood products, tuna fishers are the most organized and are said to have influence on maintaining a tariff for tuna imports, which provide some protection to the local tuna fishing industry. Other seafood value chains are less organized may be because they are all scattered geographically across the country, making them more difficult to coordinate and organize. However, this protection of the tuna fishing industry creates higher costs for the canning and processing industry. The tuna canning industry is currently underutilized; and lower tariffs would encourage more imports, benefiting the

[85] Examples are Philippine Chamber of Commerce and Industry; Confederation of Filipino Exporters Foundation; European Chamber of Commerce in the Philippines; Foreign Buyers Association of the Philippines; Confederation of Philippine Exporters Foundation, Inc. Cebu (Philexport Cebu); and Chamber of Fisheries and Aquatic Resources of the Philippines (Pabuayon et al. 1998).

tuna processing industry (Briones 2006; based on key informants). Other than this tariff, the seafood industry remains to be a low priority to dominant capitalists and policymakers.

5.4 Food Safety and Quality

Food safety systems are one of the major weaknesses of the Philippine food industry. This situation is a result of a prolonged ISI regime, partial EOI policies, and limited recognition of the role of food safety for long-run competitiveness.

While there are national policies for food safety, the challenge has been implementation. For instance, laws have created and strengthened the role of the Bureau of Food and Drugs (BFAD) for food safety; and all firms are required to follow Good Manufacturing Practices (GMP). However, follow-up inspection, which is supposedly done annually, is rarely done (based on key informants). There is limited budget to reform the food safety system or implement strict rules. As a result, many food safety issues remain unaddressed. Examples include: (i) In 2002, Oman, Saudi Arabia and Kuwait governments banned a whole range of food product including fresh and frozen seafood imported from the Philippines (e.g., clams, mussels, shellfish and shrimps) due to fears that fish, dairy products and vegetables from the Philippines are contaminated with cholera bacteria; (ii) 60 percent of EU HACCP certified firms were de-certified; (iii) EU's zero-tolerance policy for antibiotics caused serious difficulties among processors and exporters; (iv) frequent seafood import refusal cases resulting into loss of profit, which estimated to be three percent of total company profit (on the average), according to FAFST (2004).

There are apparent differences among key seafood exporters in terms of their food

safety focus. Important indications of food safety are refusals at the border, import alerts, and import bans. The Philippines has the highest number of samples refused at US borders, compared to Thailand and Vietnam (Table 7). However, the Philippines has much less total exports to US than Thailand and Vietnam. Thus, if we look at the ratio of the proportion of refusals to the proportion of exports as a measure of the intensity of refusals, Philippines is worse with 3.4 ratio compared to just 1.9 for Vietnam and 0.3 for Thailand.

Table 7. Number of seafood export refusals at the US ports between June 2004 and May 2005 for selected countries

Countries	Number of samples refused*	Country's proportion in total refusal (%)	Value of exports**	Country's proportion in total exports (%)	Ratio of refusal to exports
Vietnam	368	60	2,009,991	32	1.9
Philippines	134	22	408,985	6	3.4
Thailand	109	18	3,887,886	62	0.3
Total - 3 countries	**611**		**6,306,862**		

*Note: *Summarized from list of refusal from USDA website; ** Value (in US$ 000) of total seafood exports and raw data were obtained from FAOSTAT.*

Next to costs of production, food safety issues are a major constraint faced by seafood processors. These issues stem from lack of trust in the public food safety system, the lack of traceability along the value chain, cost of complying with requirements, and lack of monitoring and surveillance systems in the food industry as indicated by respondents from the seafood processors interviewed (Table 8).

Table 8. Processors' perception on food safety-related factors affecting competitiveness, 2005

Food Safety-related Factors	Processors' Rating 3=enhancing, 1=constraining, 2=moderate
Food industry's trust in the food safety regulatory body	1
Government's food safety regulatory systems	1
Cost of compliance	1
Traceability system	1
Monitoring and surveillance systems	1
Industry's current adoption of food safety systems	2
Culture of food safety among firms in the industry	2
Culture of product quality among firms in the industry	2

**Average of responses based on interviews with 59 seafood processors in the Philippines.*

FAFST's (2004) summary of the USFDA refusal report from 1995 to 1999 shows that the number of samples refused averages 214 cases. Based on this information, it can be argued that during the period of June 2004 to May 2005 (in which 134 samples were refused), there was already an improvement over previous years. FAFST's (2004) summary indicated that major causes of refusal were "filth" and "Salmonella," accounting for 80 percent of the total detained samples.[86] Several food manufacturers indicate that product refusal is a regular occurrence, to the point that they build the cost of refusal into their pricing (FAFST 2004). It is estimated that about three percent is the average cost of detention for food companies; but a few also experienced as much as a 25 percent additional cost, although the occurrence is rare (FAFST 2004). Aside from these cases of refusal, there have been a number of import alerts, which result in the automatic detention of products from the specific processor without physical examination.

[86] The most frequently detained products were frozen shrimp (21 percent), salted anchovies/fish paste (14 percent), scallops (11 percent), milkfish (11 percent), other frozen fish (mainly goby, dolfinfish, and swordfish) (ten percent), and frozen octopus (nine percent), which together comprise about 75 percent of all refusal cases. The entire refusal cases are from a total of 44 processing/exporting firms, which indicate a slight concentration of detention among a few number of firms (compared to over 100 firms exporting seafood in the US).

The persistently high incidence of filth, a basic food hazard, in Philippine seafood products indicates carelessness and a lack of due diligence in processing. According to interviews with key government staff, and based on the survey of inspectors done by Trono (2004), there are indications that implementation of basic sanitation practices among seafood processors is the weakest link in the processing chain. Unhygienic practices include not wearing proper clothing on head, hands and feet; unclean equipment and premises (especially the floor); poor pest control; unsafe water and ice used in processing; lack of attention to cross-contamination; labeling, storage, and use of toxic compounds; and lack of deliberate care in receiving, storing, and transporting raw materials. Despite these major problems in controlling food hazards, to date no major efforts have been made to reverse them. Several food experts have emphasized the need for the Philippine food industry to adopt HACCP system (Barut et al. 2003; Azanza 2006), but little progress has been made towards higher adoption rates.

Being dominated by local businesses, the seafood industry has limited sources of technical assistance, technological or systems transfer from foreign companies. This is in sharp contrast to the dominance of foreign-owned or foreign-partner companies in Vietnam. The lack of coordination among the different sectors and agencies of the government, academia, and the private sector continue to hinder the development and effective implementation of food safety management systems in the Philippines. Unlike Thailand, in the Philippines there is no single image of Philippine branding. When Philippine seafood processing firms were asked about COC or unified national brand, they mentioned that their buyers do not pay attention to the image of the country but instead to the image of the company. This mirrors a serious lack of interest or cooperative

behavior among many processors, in contrast to a more cooperative strategy present in Thailand and Vietnam.

There are glaring economy-wide and industry-specific problems that the Philippines has to tackle. These problems appear cyclical and closely interlinked; and only through addressing the power relations and structure will the cycle be broken. At a macro-level, allowing pluralistic decision-making and permitting competition is needed to consolidate social activism leading to a more democratic, healthier political process. In addition, this type of healthy competition is needed to set an enabling environment for the emergence of stronger civil society organizations and industry associations. Changes and reforms will be a slow process for the Philippines, but the country has to start to reduce protection on some less efficient manufacturing industries and shift the support to more promising seafood and other labor-intensive and export industries.

6 Discussion

The data on the global seafood market reveal an increasing demand, as well as intense competition among industries and countries. The contrasting experiences of Thailand, Vietnam, and the Philippines provide an interesting case of analyzing the dynamics of this competition in the international seafood market.

These three countries are similar in geographical location, natural resource endowment, importance of seafood in the economy, and export levels in the 1970s and early 1980s. Several researchers have emphasized the major role of the seafood industries of these three countries in economic growth and employment (and poverty reduction in some studies). These countries are different in political, social, legal, and macroeconomic characteristics and have their own histories, power structures, and institutions that

continuously shape their existence. The following section summarizes the major differences in macroeconomic and sector-specific policies and institutions in these countries.

First, Thailand and Vietnam have pursued an export-oriented seafood industry much ahead and more effectively than the Philippines. As part of their EOI, complementary policies and institutions were adopted in both Thailand and Vietnam including: (i) strong private-public partnerships and industry linkages; (ii) proactive and aggressive export promotion strategies by the private and public sectors including trade policies; undervaluation of exchange rate; creation of government agencies, such as the Board of Investment, to support the needs of growing business enterprises; and tax cuts and/or credit subsidies to businesses; and (iii) crucial facilitative and enabling roles of public sector including promotion of conducive business climate for private sector development and physical infrastructure. For instance, Thailand adopted strategies to help lower costs of doing business for firms to flourish and expand production and export activities. In areas where costs remained higher than competitors, Thailand pursued value addition and product differentiation strategies to capture niche markets. Skills development, food safety, and attention to quality were important pillars of their EOI strategy. In the Philippines, the seafood industry has been heavily taxed, directly and indirectly, by the government, despite being consistently considered as a potential growth sector.

Second, related to EOI, Thailand and Vietnam focused on food safety and quality and strategically capitalized on these attributes to gain competitive advantage over other exporting countries. While similar food safety challenges are being faced by Thailand,

Vietnam, and the Philippines, their varied approaches and commitment given to food safety and quality have contributed to varying levels of competitiveness. Thailand positioned food safety and product quality as important pillars for long-run seafood industry competitiveness. It responded rapidly and strategically to foster strong partnerships and collective action between the public and private sectors. Despite Thailand's high labor costs, it has improved the skills of its labor force and has promoted value-addition and product differentiation. On the other hand, Vietnam, despite being a newcomer in the market economy, adopted EOI policies and encouraged foreign investors, prompting the transfer of technical and institutional information related to food safety and product quality to the seafood industry. In addition, as part of EOI, Vietnam is showing strong commitment to food safety with the belief that food safety is an important ingredient for export market access. It also actively seeks international support to build capacity and expertise in its food safety system. According to key informants, changes and reforms related to food safety management systems have been both rapid and remarkable.

Vietnam and Thailand seafood industries are characterized by strong cooperation between the private and public sectors in their quest for an image of food safety and product quality for long-run competitiveness. Interestingly, one key difference is how stakeholders in these countries view the role of food safety: key informants in Thailand and Vietnam said that the government and private sector put a high priority on food safety in attaining long-run competitiveness; while key informants and processors interviewed indicate an overall lack of recognition of the role of food safety in attaining competitiveness in the Philippines. In Thailand and Vietnam, key informants stressed

their recognition that attention to food safety is crucial in staying in the international seafood market and that they would not have attained high levels of export growth if they had ignored food safety concerns.

Many experts argue, along the lines of neoclassical economics, that poor economic performance of the Philippines in general and the seafood industry in particular is attributed a policy and institutional mix that "misallocates" resources to areas of inappropriate and inefficient economic activity. They include governance-related issues of corruption, poor regulatory performance, and policy incoherence. But, these good governance approaches entail preferred institutional changes without changing existing power structures and relations. Patronage and clientele networks and rent-seeking (i.e., additional returns from government interventions in the market) are common explanations of why policies and governance structures exist in the Philippines. This is also related to state-centered historical institutionalists' description of a "weak state," a condition where the state is being "constantly subject to particularistic demands of a wealthy elite or oligarchy. . . [and that there is] . . . no differentiation of state institutions from the private interests" (Rodan, Hewison and Robison 2006, p. 41). While these explanations provide some answers, they do not explicitly address many facets of power structures and inherent relationships. They do not answer why states are weak, why the wealthy elites are powerful, and why other actors and non-elites are powerless and stay dependent and free-riders of what is to be provided to them.

Key factor to consider why policies and laws are different in these countries can be traced back to the formulation and processes of making these policies: advocacy and interest groups, participation of civil society organizations, and power relations in the

system. Changes in policies are coming from either internal pressure or external forces for the lawmakers to pass the bill/law. For the former (internal pressure), government itself is an organization of the people who have their own motivations and aspirations. People elect them or people elect those who elect them. It is an endogenous player of the game in the polity domain. Thus, the outcome of any policymaking should be understood as determined by the interactions of the strategic expectations among the players, the government, politicians, and private agents. The interplay of groups to lobby for certain interests or to fund and seat political candidates to accommodate these interests determine what gets passed as law or policy.

One of the striking differences among the Philippines, Vietnam and Thailand is the level of collective action, both in terms of grassroots' organizations and industry-wide associations. The three countries are organized differently that enable their people to contribute to or invest in large scale civil society organizations to influence policymaking. In Thailand, there is a mature environment characterized by healthy competition among interest groups. This pluralistic power distribution led to no single interest dominating the policymaking process and necessitated a strong leader who could unite these pluralistic interests and who could give a common direction. In Vietnam, the degree of competition and effectiveness is less, but, their sense of social and political organizations remains, inherited from the Socialist rule. In the Philippines, producers and processors have a history of dyadic relationships and have limited formal larger organizations that are sustained over time. Despite growing social activism to change the political arena, absence of a strong leader and unifying voice to consolidate this activism is often cited as major reason for the lack of effective reforms.

Why are the policies and governance structures different in these three countries? If the policies and governance favoring the seafood industry in Thailand and Vietnam are considered good, why can the Philippines not easily adopt such policies and governance? Why are the institutions that produce these policies the way they are? We look at the inherent characteristics of the situation/good and we examine the role and impact of the institutions and governance structures in addressing these inherent characteristics.

The first situation or good that we examine is the set of policies and investments beneficial to the seafood sector. Three types of power relations occur: competition for funds across the sectors (incompatible use goods); competition of varying interests within the sector (incompatible use goods); and contribution (or free-riding within) to achieve policies favorable to the entire sector (characterized by high exclusion costs). Policies favoring the sector, or lack of, are often a result of economic forces and/or strong sectoral voice in the political arena. Free-riding within the sector undermines powerful advocacy and interest groups to lobby for the sector. Policies themselves affect everyone within the scope of the policy, whether it is national, local or business level, benefiting some groups and causing losses to others. Due to the wide scope of industry-wide policies, free-riders to the benefits of these policies are possible, and if free-riding is rampant, policies are unlikely to be sustained coming from the lack of investment to sustain them. Successful enactment and implementation of industry-wide policies depend on institutions that reduce free-riders and encourage people to contribute to and invest in creating these policies (collective action). For instance, a national program to support the seafood industry could very well be a result of tremendous investments and lobbying efforts of associations and organizations in the seafood industry.

How is free-riding within the sector addressed in these three countries? Table 9 summarizes the differences in these three countries. In Thailand, there is pluralistic power distribution and strong intra-elite competition within the sector, where initial screening and process of natural selection for the "fittest" are done within the sector and the strongest voice from this process is the voice brought to cross-sectoral negotiations. Everybody contributes for their own group within the sector; the strongest voice within the sector wins. In this kind of structure, private sector is willing to fund and contribute for the strength of these groups so that their interests could be heard.

In Vietnam, from a being in a Socialist rule, it has adopted privatization and decentralization strategies where numerous government officials diversified as the business sector. The new business sector forms strong part of the policymaking system. With the seafood sector, there is a strong, unifying association (VASEP) that advocates for the sector. For instance, VASEP was instrumental in the bilateral agreement with US to eliminate the anti-dumping tariff imposed on the Vietnamese shrimp industry.

In the Philippines, the control tends to be concentrated in the hands of executive power holders. As a result, agricultural and seafood sector policies suffer from state predation, while the limited access of sector insiders to sectoral policymaking stunts the entrepreneurial drive for innovation, cost saving and diversification. In the past, there was concentration of trade in an every growing number of agricultural commodities under parastatals controlled by the immediate entourage of the president. While privatization and decentralization have occurred in the Philippines, a few people in the state and their few allies in the private sector continued to dominate the decision-making in the sector and exclusion remained of key sector players – producers, traders, processors, and input

suppliers. The state not only chose winners, but also arbitrarily created losers. Incentives for innovation and diversification were limited.

Table 9. High exclusion cost in terms of policies favoring the seafood sector

Situation	Structure	Performance
High exclusion cost (HEC) related to policies favorable to the entire industry	*How is free-riding addressed?*	*Is free-riding addressed and are policies favorable to the industry passed?*
	T – There is pluralistic power distribution and strong intra-elite competition within the sector; everybody contributes for their own group within the sector; and the strongest voice within the sector wins.	T – Limited free-riding; policies favorable to the industry are easily passed
	V – From a Socialist rule, the country adopted privatization and decentralization strategies; and government officials diversified as the business sector. Business sector then forms strong part of the policymaking. With the seafood sector, there is a strong, unifying association (VASEP) that advocates for the sector.	V – Limited free-riding; policies favorable to the industry are easily passed
	P – Power and policymaking are concentrated in the hands of a few; power distribution is close to authoritarianism; non-sectoral actors control the sector; and sector actors do not participate in the policymaking. Government made provisions in the law to include producers/processors in the sectoral policymaking; at times it is just a token participation. Citizens know that policies and decisions are fixed by the authoritarian and its allies, and that their voices will not be heard, thus, they do not invest and contribute much to strengthening interest groups	P – Free-riding is common; policies favorable to the industry are not easy to pass

Note: T=Thailand; V=Vietnam; and P=Philippines

Another set of institutions pertain to the rule of cross-sectoral allocation. Table 10 summarizes the differences in these three countries. In Thailand, allocation across sectors is closely linked to sectoral performance: the better the sector performs, the more money is allocated to the sector. In this system, there is more incentive for the sector actors to contribute to a better performance to get more allocation. Ministerial control over the use of resources generated within the sector preludes the diversion of sector-specific revenue

to outside interests (Akiyama and Larson 2004). This structure and the earlier structure--pluralistic power distribution and intra-elite competition within the sector—work consistently in favor of Thailand's seafood industry. In Vietnam and the Philippines, the allocation is often not done based on sectoral performance but done through local administrative units: the more income the local unit has, the more allocation it gets from the central government. Then, the local unit allots resources to the different sectors within the unit. As such, it provides less incentive to better sectoral performance and more difficult to have a stronger, unifying voice to lobby for the sector. This unit-based allocation in Vietnam may have hindered Vietnam in passing and implementing much more policies in favor sector despite a strong and unifying association (VASEP) that advocates for the sector. Nevertheless Vietnam is in a better position in institutional terms due to this association (VASEP).

Table 10. High exclusion cost in terms of policies favoring the seafood sector

Situation	Structure	Performance
High exclusion cost (HEC) related to policies favorable to the entire industry	*How is free-riding addressed?*	*Is free-riding addressed?*
	T – Allocation across sector is based on sector's performance	T – Limited free-riding; policies favorable to the industry are easily passed
	V – Allocation is based on local government unit's performance	V – Free-riding is common; policies favorable to the industry are not easy to pass
	P – Allocation is based on local government unit's performance	P – Free-riding is common; policies favorable to the industry are not easy to pass

Note: T=Thailand; V=Vietnam; and P=Philippines

The second situation or good that we examine is the product or service derived from collective action. Why is collective action difficult to create and sustain in the Philippines compared to Thailand and Vietnam? Collective action can be for economic

services or advocacy purposes; and both are susceptible to incentives or free-riding behavior of target members. Both types of collective action are more common in Thailand and Vietnam than in the Philippines. In Thailand and Vietnam, producers and processors see the value of being a member of an association or organization and contribute toward their sustainability; while in the Philippines, most firms do not see the value and they are not willing to contribute. Similar to Table 9, the same structures address or perpetuate free-riding problem in these countries.

In Thailand, the pluralistic nature of power distribution makes it conducive for building interest groups to lobby for policies and services in their favor. In general, the civil society became more organized and complex. New interests were gradually woven into the political discourse and new civil, political, and economic institutions were created to accommodate these increasingly diverse interests. In the 1970s, trade association proliferated, becoming instruments of political pressure on the government. In the years of democratic rule from 1973 to 1977, producer associations began to play a role as an organized force capable of affecting resource distribution. By the 1980s, businessmen were no longer lobbying the government, but became part of it –majority of the government officials came from the business circles. The thickening of counterbalancing interests led to the gradual democratization of both social and political institutions. There is also increased participation by new political actors, such as provincial business leaders, NGOs, and students. To date, almost all commercial farms, fishers, processors and exporters in Thailand are part of at least one association or organization. These producers' and processors' associations and groups are created mainly to provide economic services, such as technical assistance, research and

development, credit, and market linkages, to their members.

In Vietnam, VASEP is a large organization of more than 60 percent of commercial seafood processors across the country. It advocates for policies and investments favoring the sector and instrumental in the creation of smaller clusters and clubs of producers, input suppliers and processors to better coordinate the value chain and provide needed services to relevant actors. There has been increasing number of these clusters and clubs in Vietnam (example of such club is the Shrimp Club in Lampung).

In the Philippines, there is an obviously lower level of sophistication and maturity of collective action than in Thailand and Vietnam. The institution of authoritarianism and power concentration to limited few have perpetuated the free-riding problem and dole-out mentality among the citizens. Services and other investments were historically expected to be provided by the government and citizens did not feel much need to resort to producers' or processor's organizations and association to supply these needs.

In addition to free-riding problem, creating and sustaining associations and groups are often associated with high information costs (HIC). Table 11 summarizes the differences in the three countries. Information on whether the other members will abide by the terms of the group and contribute to the performance and sustainability of the groups is inherently difficult to obtain. Especially in larger groups, monitoring and evaluating the activities and contribution of every single member are difficult unless institutions for self-regulation and self-enforcement are enforced.

Table 11. High information cost in group formation and sustainability

Situation	Structure	Performance
High information cost (HIC) related to members' relations and behavior in the group	*How is information obtained? How groups are formed and sustained?* T – In microfinance, savings-based large groups are common and there are hardly any "receiver" type groups; in value chain coordination, numerous large cluster, clubs, and larger producers' and processors' associations are common	*Is the information asymmetry addressed?* T – Having start-up savings and contribution to the group makes loan default more difficult; being part of a larger organization does the necessary screening and self-selection, which minimizes incentives and chances of default and free-riding among members
	V – In microfinance, "Bank of the Poor" is the main institution; many "receiver" type groups; in value chain coordination, there are increasing number of small-sized clusters and clubs, often initiated and facilitated by processors/exporters; VASEP is the unifying organization and strong voice for the sector.	V – There are incentives to default; being part of a larger organization (VASEP) does the necessary screening and self-selection, which minimizes incentives and chances of default and free-riding among members
	P – In microfinance, small groups with dyadic relationships as "receiver" type groups; in value chain coordination, there are a few interlinked transactions along the stages of the chain; a few dyadic relationships of firms horizontally with a stage/note of value chain	P – There are incentives to default; Information asymmetry is solved only in small and peer-type groups, but, large groups cannot thrive well because of the inability of the system to device ways to solve these asymmetries. As a result, potential EOS cannot be taken advantage of due to limits of group formation and collective action.
	Who forms? T – local government unit at the village level	*Is the information asymmetry addressed?* T – faster and more lasting group formation
	V – local government unit at the village level	V – faster and more lasting group formation
	P - NGOs	P – more difficult to organize, monitor, sustain, and expand

Note: T=Thailand; V=Vietnam; and P=Philippines

Trust is closely linked to HIC. There is seems to be a systematic lack of trust and HIC in the Philippines as illustrated by the perpetuation of dyadic relationships rather than larger groups. Lack of trust with other producers and/or processors leads to disincentives to cooperate and form organizations. Another explanation would be the highly dispersed regions and islands in the Philippines which make organization and coordination very difficult. Maturity of the industry also comes with the sense of discipline; reduced interest in short-terms gains and prioritizing the long-term interest of the industry. Often, presence of a leader or champion to initiate and facilitate industry collective action is crucial. These are apparently weak or lacking in the Philippines compared to Thailand and Vietnam.

In microfinance, savings-based large groups are common and there are hardly any "receiver" type groups in Thailand; while peer-type or "receiver"-type groups are common in the Philippines and Vietnam. In Vietnam, the "Bank of the Poor", a government-financed bank, is a dominant institution. Having start-up savings and contribution to the group makes defaulting more difficult in Thailand, and thus information asymmetry is addressed more easily in this country than in Vietnam and the Philippines. In Thailand, the government adopted guarantee scheme and have been allotting regular funding of these scheme. These schemes reduce the risk and vulnerability (RAU) related to the inherent HIC faced by producers and credit suppliers in the sector. However, these schemes themselves are subject to HIC and RAU when not properly managed. For instance, while the Philippines has this credit and guarantee scheme in its policy documents, it is not funded and not well managed, and thus, the inherent HIC and RAU in the sector is not addressed.

In value chain coordination, numerous cluster and clubs within the value chain and several larger producers' and processors' associations are common in Thailand to help address information asymmetries in product and transaction quality at the same time take advantage of economies of size (EOS). These clusters, clubs, and associations are starting to mushroom in Vietnam. VASEP is the unifying organization and a strong voice for the sector in Vietnam. Being part of a larger organization (e.g., VASEP) does the necessary screening and self-selection, which minimizes incentives to and chances of default and free-riding behavior among cluster/club members. Defaulting as a cluster member would have implications as a member of VASEP.

In the Philippines, there are a few interlinked transactions along the stages/nodes of the value chain and a few dyadic relationships of firms horizontally formed in a specific stage/node of the chain. Information asymmetry is solved only in small and peer-type groups, but, large groups cannot thrive well because of the inability of the system to device ways to solve these asymmetries. As a result, potential EOS cannot be fully reaped due to limits of group formation and collective action.

In terms of group formation, local government units at the village level are responsible for formation and organization of groups in Thailand and Vietnam; while NGOs are the prime organizers in the Philippines. Organization by local administrative unit can be more stable and easier from the point of view of logistics, monitoring, and buy-in with the community. On the other hand, NGOs can be key in civil society organizations and for political mobilization of non-elite actors, but, logistical and monitoring issues can be more difficult compared to groups organized by the local administrative units. Community people often can associate themselves to local

administrative units more than with NGOs. It is the sense of ownership or buy-in that facilitates formation, monitoring, self-regulation, and sustainability of these groups in Thailand and Vietnam. Despite progressive NGOs in the Philippines, much frustration over the ability to achieve regime change from a civil society base. Political events around President Estrada departure from office in 2001 have highlighted class divisions in civil society over democratization priorities that stand in the way of the emergence of broad-based political parties.

One important manifestation of the difference in policies and institutions is on food safety, an important element of international competitiveness of seafood products (Table 12). Thailand has invested in making their products known to the world for its quality; Vietnam has started to brand itself as the seafood basket of the world. On the other hand, the Philippines has not come up to make significant efforts to make a name in the international seafood market. Without this image-building and branding, consumers will not recognize and acquire the information they need to make their purchases.

Table 12. High information cost in branding and labeling

Situation	Structure	Performance
Branding and labeling involve high information costs (HIC) with the industry	*How are moral hazard and adverse selection addressed?*	*Is moral hazard and adverse selection addressed?*
	T – Combination of several institutions: (1) Signaling - Unified brand and national logo--branding Thai food products as "Kitchen of World" -- which signals commitment and seriousness in terms of food safety and quality; (2) Industry awareness campaign; strong collective action; creation of Code of Conduct (COC); (3) Skills development in the food safety and partnership with training institutes on food safety systems; (4) Strengthening the legal system to enforce product liability; (5) Intensified the inspection and monitoring system; and (6) government and industry associations partner in intensifying the certification systems within the industry (HACCP, ISO, GAP)	T – has an installed self-selection; self-monitoring and self-regulation through its established clusters, clubs, and associations; has the legal, institutional, and manpower development support the quality and safety system
	V – attracting FDI to provide technical know-how and financial assistance to implement food safety; VASEP advocates with the industry and in the government on investment in food safety; government partners with VASEP in intensifying efforts for HACCP, ISO and GAP certification	V – VASEP coordinates the food safety concerns in the industry; through VASEP, self-selection; self-monitoring and self-regulation are imposed via clusters, clubs, and associations; government and industry partnership in has the legal, institutional, and manpower development support the quality and safety system
	P – Individual companies' marketing and product promotion; government inspects and certifies firms of HACCP, GAP	P – Information asymmetry is not addressed; harder to coordinate and more difficult for information to flow with the industry

Note: T=Thailand; V=Vietnam; and P=Philippines

While the institution of image-branding and labeling can help reduce the high information costs (HIC) between producers and consumers, they themselves create HIC among actors in the industry. For branding and labeling to work, effective control and monitoring or self-regulation are required among all the relevant actors in the value chain;

otherwise, the credibility of the system breaks down.

The apparent success of the unifying national brand for Thai seafood products is likely due to its institutions that reduce the information asymmetry in the system. A combination of several complementary institutions makes branding work in Thailand. A key element is the presence of established and well-organized collective action already existing in the industry. The government of Thailand, in partnership with the private sector, promoted awareness within the industry of the importance of food safety. As a result, a code of conduct (COC) on food safety and protecting the environment was developed by industry people. The government, in partnership with training institutes, developed a system to develop skills and train employees working in the food industries. The sustainability of the numerous producers' and processors' associations, clusters, and clubs in Thailand in reducing HIC among their members works in the same logic as reducing information asymmetry within the industry in terms of complying or defaulting with the rules of labeling. A very important institution supporting branding is strong legal system that promotes product liability and punishes those who default. Lastly, the government, in partnership with the associations and organizations, strengthened their surveillance, monitoring, and inspection system in support of food safety management.

In Vietnam, attention to food safety and developing a system to effectively manage it is rather more recent than in Thailand, but, Vietnam is adopting this system very swiftly. Initially, it relied to attracting foreign investors in the industry to supply most of financial, technical, and food safety control needs of the sector. With growing importance of food safety for competitiveness, VASEP has been proactive in partnering with the Ministry of Fisheries in providing assistance and intensifying support to the

industry for certification systems. VASEP was also instrumental initiating better coordination in the sector via its clusters and clubs.

All these are weak or non-existent in the Philippines. The individualistic and dyadic relationships rather than large scale collective action dominant in the Philippines make enforcement of labeling and branding more difficult in the Philippines. There is lack of organization and coordination so that information to flow more easily and effectively within the industry. The lack of a unifying voice in the industry on the crucial importance of food safety is apparent in the Philippines.

The prospect of sustaining growth in the seafood sector is brightest for Thailand, and to a lesser degree for Vietnam. Due to the complexity and advancement of Thailand's institutions, established buyers and suppliers, strong collective action, and consistent drive for quality and safety, it will take a long time and concerted efforts for the Philippines to catch up with Thailand. However, the experiences of radical policy and institutional changes throughout the history of Thailand and Vietnam indicate that reversing the trend being experienced by the Philippines is possible.

The existing power structure and limited competition among interest groups constrain any potential opportunity and competitiveness of the Philippine seafood sector. Collective action could not prosper due to free-riding and individualistic attitude of the sector actors. Without collective action and coordination, individual parts of the industry could not function harmoniously and collaboratively to supply the ever stringent demands of the market. These constraints are structural and would not happen overnight. Radical policy changes will only be realized through a change in power structure and institutions.

Of fundamental importance to the Philippines is to reverse the trend in its

business climate and the country's ability to support and develop its business sector, which will benefit not only the seafood industry but all industries in the economy. Once this is in place, confidence-building for the private sector and facilitative role of the public sector are necessary next steps. For the seafood industry and other food businesses, another necessary next step is building capacity to manage food safety.

Both the private and public sectors have vital roles to play in overcoming constraints in the Philippine seafood industry (as seen in Thailand and Vietnam). Rather than relying on the public sector, the private sector should be more proactive towards providing essential services and enriching themselves (Vietnam's example). Strategic considerations for the private sector could focus on vertical coordination and industry linkages and other forms of collective action to take advantage of economies of size, pool resources and expertise, and share costs, benefits and risks along the value chain. In some cases, firms do not recognize the value of food safety and product quality as a long-term competitiveness strategy, and at times, focus more on shorter-term gains. The public sector can assist in promoting awareness of the long-term value of fostering a culture of quality and food safety.

7 Conclusion

The competitiveness of Thailand and Vietnam are due to the policies and good governance favorable to the seafood industry present in these countries and non-existent in the Philippines. A much earlier adoption and stronger commitment to export-oriented industrialization (EOI) policies in Thailand and Vietnam (compared to the Philippines) are key to the differences in export performance in these countries. Collective action and partnerships were a crucial factor in the growth experienced by Thailand and Vietnam.

These were used as economic strategies and also serve as political or advocacy strategies.

The public or private sector can be a catalyst for collective action (as seen in Thailand and Vietnam). Structures to manage food safety and quality (e.g., intercountry partnerships, public-private partnerships, certification systems, branding and labeling, long-term business relationships, encouraging foreign companies for effective and equitable transfer of technological and institutional knowledge to manage food safety) contributed to the competitiveness of Thailand and Vietnam.

The above strategies were made possible through the favorable political environment created in Thailand and Vietnam. Radical changes in the power structure and allowing a healthy competition of interest groups were crucial in the economic performance of Thailand and Vietnam. These structural changes have happened in the course of Thailand's and Vietnam's histories, which indicate some hope for the Philippines. Political commitment in Thailand and Vietnam has consolidated social activism and set the stage for an environment favorable for the emergence of dynamic and coordinated industries, strong civil society groups, and remarkable food safety management systems in these countries. However, since the problems are structural, it will not be easy and fast for the Philippines to catch up.

Dole-out mentality and dependency attitude can be detrimental as in the case of the Philippines. Public sector's action to alter the playing field in their favor and to distort market forces can work against the sectors that are efficient or promising as in the case of the Philippine seafood industry. Providing an environment favorable for healthy competition and efficient collaboration to take advantage of information gains and economies of size would constitute an effective short and medium term strategy for the

Philippines. The successes of Thailand and Vietnam have demonstrated actions that must be taken to achieve competitiveness and the Philippines has to try harder to implement these lessons and strategies over the long term.

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CHAPTER THREE

CAPACITY OR INCENTIVE? REASONS AND IMPLICATIONS OF INITIAL AND CONTINUED ADOPTION OF FOOD SAFETY SYSTEMS AMONG PHILIPPINE SEAFOOD PROCESSORS

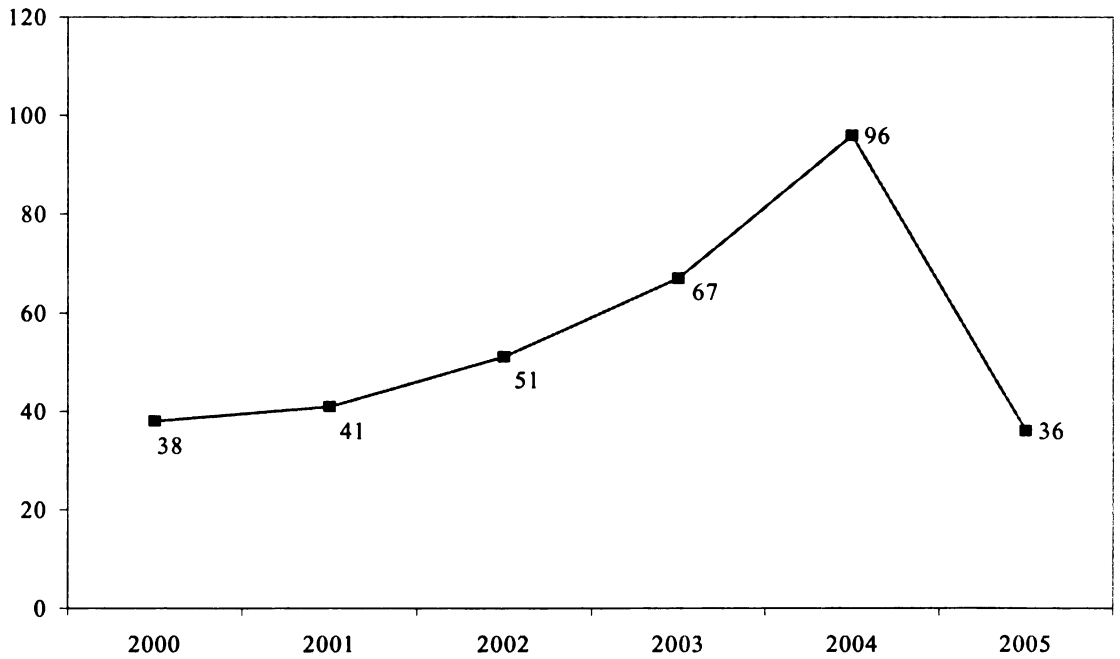
1 Introduction

Hazard Analysis and Critical Control Points (HACCP) is an internationally accepted system of food safety management. HACCP is recommended by Codex Alimentarius, an international body that sets food standards, as an effective system to control food safety. Implementation remains voluntary, except for a number of countries that require HACCP to be used in their food systems. The food safety literature indicates that adoption of HACCP systems has been limited, and food producers and processors are not embracing it with the anticipated enthusiasm (Herath and Henson 2006; 2005; Ehiri et al. 2005; Panisello et al. 1999; Taylor 2001; Panisello and Quantick 2001; Taylor and Taylor 2004). Since food safety is indispensable to public health and long-run competitiveness, and HACCP is accepted as one of the most effective (if not the most effective) method for assuring food safety, it is paramount to understand the incentives and capacity for attaining higher levels of HACCP adoption.

There is voluminous literature on the principles of HACCP, its use as a measure to improve food safety, and its adoption (largely in the meat and dairy industries of developed countries, though more attention has recently been given to adoption in developing countries) (Chapter 1). There remains a dearth of research on the sustainability of HACCP adoption in developing countries. In the Philippines, for

example, the large number of firms in the seafood industry that have recently been de-certified from the EU HACCP certification (60 percent) (Figure 12). This raises questions about the causes and implications of this de-certification on access to EU markets and other lucrative export markets, and wider impacts to the economy.

Figure 12. Number of EU HACCP certified seafood processors in the Philippines, 2000-2005



Source: Bureau of Fisheries and Aquatic Resources (BFAR).

These issues have largely remained unexplored in the literature on HACCP systems. This chapter addresses three gaps in the research to date. First, understanding the causes of de-certification is of crucial importance to the food industry and policymakers, both regulators and trade promoters. This chapter investigates the recent phenomenon of de-certification in the Philippine seafood industry, reflecting emerging concerns in the food industries of other exporting countries. Second, the lack of

harmonization of HACCP implementation across countries and industries (Chapter 1) poses questions about the complementarities of these varied certification systems. For instance, there is limited understanding on whether EU HACCP certification can be used by exporting firms as justification for HACCP compliance for the US and other markets. This chapter looks at the processes and experiences of exporting firms in the Philippine seafood industry in order to achieve a greater understanding of this knowledge gap.

Third, while development support is usually targeted at improving the *capacity* of national governments and firms to adopt HACCP systems, it is equally important to explore the potential lack of *incentives* for many firms to adopt. Related to these incentives are the firm-level financial benefits of adopting HACCP systems, an issue dealt with by only a few studies, as the major focus has been on the costs associated with adoption. What happens to prices, production levels, exports, border rejection, product wastage rates, and related cost savings after adoption is crucial to sustainability of HACCP systems. This chapter offers new empirical evidence of whether net firm-level benefits are associated with HACCP certification.

1.1 Adoption and Certification Defined

Adoption of HACCP systems involves a multi-period investment. In general, it takes two to three years for a firm to make the needed investments to fully implement the system and to receive certified approval from a potential importer. If a firm decides to adopt HACCP systems, in Year 1, start-up and capital investments are required; in Year 2, the HACCP plan is tested and implemented; and in Year 2 or 3, the firm applies for certification. This multi-period nature of HACCP systems indicates that there are many different levels and stages of adoption. In this chapter, the term "adoption" indicates the

full implementation or certification of HACCP systems (unless specified otherwise).

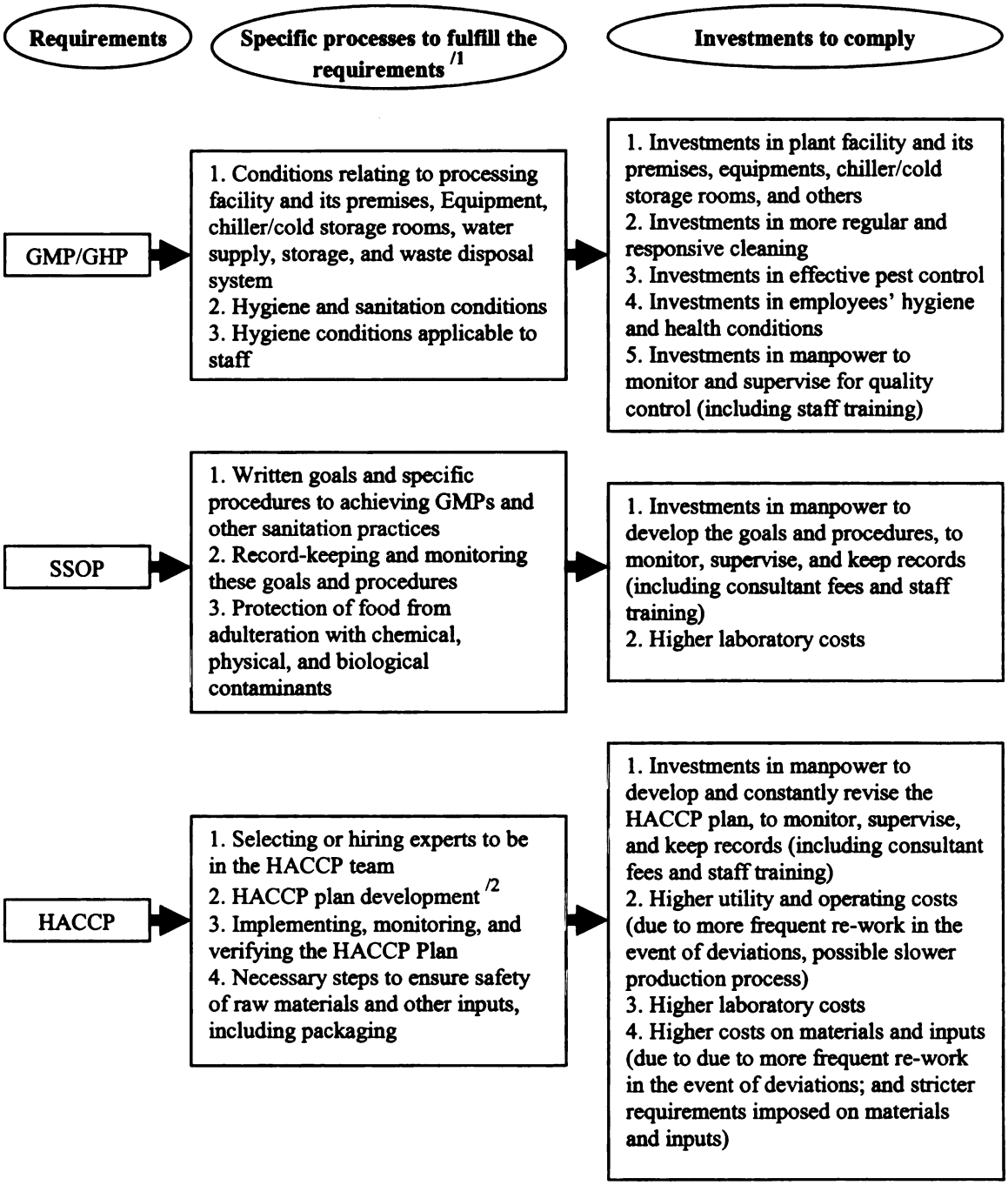
1.2 Requirements for HACCP Certification

HACCP is a food safety and quality management system, which involves multiple processes, activities, and requirements. Thus, compliance of or certification on HACCP system entails several investments and expertise (Figure 13).[87] Good Manufacturing Practices (GMP) and Sanitation Standard Operating Procedures (SSOP) are prerequisites of a HACCP certification. In addition to GMP and SSOP compliance, a HACCP system requires a written plan, which specifies a systematic understanding of the production process, analysis of potential hazards, critical control points and deviation limits, monitoring procedures, and regular feedback mechanisms to ensure that the system works effectively.[88] Furthermore, a HACCP system requires establishing a team of experts to develop, implement, and regularly monitor and verify the written plan. Lastly, a HACCP system requires processes to ensure safety of raw materials and other inputs to production (including packaging). This often entails stricter requirements imposed to input suppliers and/or strategies to tightly control production and distribution of raw materials and inputs.

[87] See Appendix 3 for a draft checklist of BFAR's Plant Inspection Checklist for EU HACCP Certification.

[88] See Appendix 4 for a list of the steps used in HACCP plan development.

Figure 13. Requirements, processes, and investments or HACCP certification



Sources: Author; BFAR (2005); NSF (2005); JMC (1997)

1.3 De-certification Defined

De-certification (also called "delisting" or "discontinued adoption") refers to the non-renewal of HACCP certification for a firm during a specific period. Regular inspections (usually bi-annual or annual) are performed by a regulator or third-party certification body, and firms have the option to comply or not with the requirements and renew certification. For instance, seafood processing firms in the Philippines are inspected by the Bureau of Fisheries and Aquatic Resources (BFAR), which is the Competent Authority (CA) for EU HACCP certification. Firms are inspected once or twice a year depending on the rating of the firm. Only firms that are granted certification after each inspection are able to continue exports to EU markets. Requirements to enter the US market are less clear. Some firms can use the same EU/BFAR HACCP certification as proof of HACCP certification for the US market, whereas others claim that their US buyers require a different set of HACCP certification procedures or require none at all.[89] Thus, exporters must sustain their accreditation and plant ratings, if they wish to export to the EU and (to some extent) to the US. Failure to sustain plant accreditation is grounds for de-certification.

In this chapter, de-certification refers to discontinued EU HACCP certification. The analysis extends to potential spillover effects of this EU HACCP certification and de-certification on the HACCP certification for the US and other countries.

1.4 Why Understanding De-certification is Important

Seafood is one of the important industries in the Philippines (accounting for four percent of Gross Domestic Product (GDP), employing seven percent of the labor force,

[89] Based on the interviews conducted with seafood processors.

and considered by researchers as a major potential growth sector (Chapter 2). An important strategy in achieving this growth potential is by strengthening the export subsector. In 2006, 23 percent of total seafood production was exported (30 percent to the US, 24 percent to Japan, and 12 percent to EU). As EU HACCP de-certification has major implications for market access to EU and other markets, understanding the causes and effects of de-certification is important. As the HACCP system is first and foremost a recommended international process standard for ensuring food safety (based on Codex), de-certification signals a firm's inability or unwillingness to meet international standards. If a large proportion of Philippine seafood processing firms choose not to adopt the standard, there could be negative implications for the image of Philippine seafood products and the country's long-term competitiveness in the industry.

1.5 Incentive versus Capacity

Lack of capacity by the government to enforce and by firms to comply with the requirements of HACCP certification has been emphasized in the literature. In these studies, the common theme is the lack of technical and financial resources to comply with the standards (World Bank 2006, Henson and Loader 2001). These structural deficiencies in developing countries are well recognized. As a result, international agencies, including FAO, UNIDO, and the World Bank have undertaken projects in developing countries to improve the capacity to adopt standards and to facilitate trade.

De-certification may signal that the CA has regulatory capacity and a functional system to segregate the "good" versus "bad" firms in terms of producing safe seafood products. Yet from a firm-level perspective, being de-certified may not necessarily be involuntary but part of an economic strategy. Firms choose the right balance of inputs

and outputs to maximize their profits across multiple markets, including those where certification is not required. It is important to look closely at the incentives that affect this firm decision towards certification or de-certification in order to assess the different policy options available.

There are two relevant levels of analysis when discussing capacity and incentives – the national level and the firm level. While the national level is important, this chapter focuses on the firm level, because previous research has already emphasized national capacity to implement HACCP systems and given only limited attention to firm-level capacity building. This chapter seeks to improve the understanding of firms' decision-making processes, given existing incentives and capacities to move towards HACCP certification and de-certification.

One possible explanation for de-certification is the lack of capacity to continue the process of HACCP adoption. There are two types of firm-level capacity – capacity to access financing for needed resources (high capital investment, highly technical know-how and manpower crucial to running food safety systems) and capacity to manage and regulate these resources once they are in place (inherent high information asymmetries in food safety management) (Chapter 2). The first type of capacity relates to asset-based capacity, including human resources, physical infrastructure such as laboratories, and financial resources to run and maintain the system. These highlight the need for developed capital and credit markets to gain access to the large capital investments required of a HACCP system. The second type of capacity relates to firm-level monitoring capacity to deal with high information asymmetries. This highlights the need to have better institutional and information mechanisms to manage these asymmetries.

Another potential reason for de-certification is a lack of incentives for firms to continue with certification. A major source of incentives is the net benefits (financial and non-financial) that firms derive from HACCP adoption. Additional costs to maintain certification may be higher than additional benefits firms would derive if they continued. In such cases, de-certification from the HACCP system would be sound economic strategy. The potential gains from certification – increase in price and quantity of sales, reduction in rejection rate, and cost-savings due to lower production wastage - may not accrue in reality, and, if so, continued adoption will not be an attractive option for firms. Therefore, it is essential to identify reasons that have led to de-certification; understand firms in terms of their incentives *and* capacities with respect to certification and de-certification; and analyze the changes in indicators on these incentives and capacities brought about by food safety standards.

1.6 Research Questions

The specific research questions addressed in this chapter are:

(i) What are the incentive- and capacity-related factors that explain the decision of firms to initially adopt or not adopt EU HACCP systems? What factors explain the rate of initial adoption of EU HACCP systems?

(ii) What are the incentive- and capacity-related factors that explain the decision of firms to continue or discontinue the adoption of EU HACCP systems? What factors explain the rate of EU HACCP de-certification?

(iii) What are costs and benefits of EU HACCP adoption among processing firms and the entire fisheries industry?

(iv) What are the difficulties and constraints among seafood processing firms in

adopting EU HACCP systems?

The Philippine seafood industry is a good case study to answer these questions because it highlights: (i) the recent phenomenon of de-certification, which has caused alarm in the seafood industry and other food and export industries; (ii) a small, developing country case that can demonstrate the priorities needed in a developing country setting; and (iii) the co-existence of heterogeneous firms, ranging from very small to very large, very old to very new, and from exporters and local suppliers to mixed-market-oriented firms.

2 Conceptual Framework

The guiding principle in analyzing the issues and questions raised in this chapter is that choices made by firms are governed by profit maximization. Given a certain production function, firms will weigh the costs versus the benefits derived from adoption, including the opportunity losses associated with non- or discontinued adoption and those derived from continued adoption.

2.1 Effect of Food Safety Systems on Price and Quantity

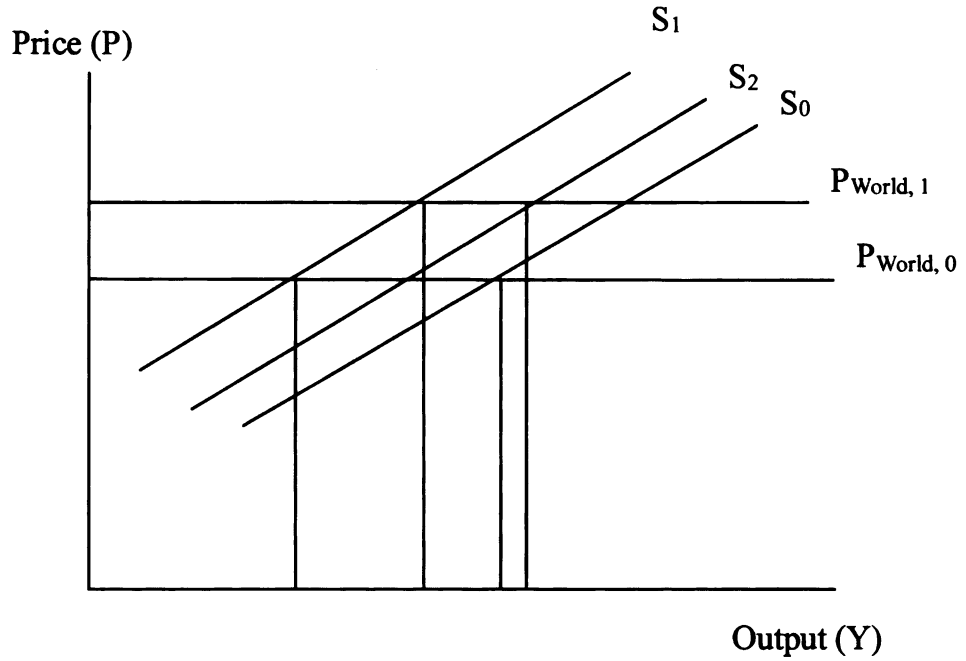
The effect of food safety systems, particularly the mandatory requirement for HACCP systems imposed by key export markets, depends on the magnitude of firm-level costs and benefits. Regulation can be viewed as a "shock" to individual firms and to the industry as a whole, as it affects market access and profitability. If the proportion of sales to regulation-imposing countries is large, the regulation will significantly impact the

firms' business operations.[90] Initially, a firm will increase the costs of production to accommodate the changes and investment required (from S_0 to S_1) (Figure 14). This will reduce the quantity of production. Since the Philippines is a price-taker in the world seafood market, prices will not be expected to rise. An accompanying effect may be an increase in demand, due to improved confidence of consumers in the safety of seafood products as a result of greater adherence worldwide to food safety standards. In this case, prices would rise (from $P_{world,0}$ to $P_{world,1}$). However, there may be upward price rigidities in which increased cost of production may not necessarily be compensated with increased prices.[91] For example, there was no significant increase in price received after HACCP implementation for small firms in the US meat industry (Nganje et al. 1995).

[90] While a regulation on production/processing impacts both consumers and producers, no discussion on the effect on consumers was included, since this chapter focuses on the firm-level impacts.

[91] This is induced by other competing countries that have also implemented HACCP systems at the same time.

Figure 14. Effects on prices and quantity of production from HACCP regulation of an average Philippine seafood firm



Due to potential price rigidities, it becomes essential to analyze cost-cutting incentives or areas of higher leverage that may be associated with HACCP systems to provide incentives other than increased prices (Nganje and Mazzocco 2000). The source of incentives may come from possible lowered rejection or detention rates at the importing countries' border; reduced production wastage; and/or improved product shelf-life, all of which can lead to additional cost savings and more output produced and sold (from S_1 to S_2). Changes in the quantity of production due to tighter control in the production process remain ambiguous, depending on the net effect on cost of production and the induced demand and changes in the willingness to pay among consumers.

Relative effects will also depend on the availability of alternative markets and the ease of shifting supply to these markets. While the EU and US require HACCP systems,

other seafood-importing countries still do not. Several options are then available for exporting countries in terms of where to market their products. In the presence of such alternatives, the firm faces not only a mix of inputs and outputs but also has the markets as a decision variable. Depending on output and input prices, firms will maximize profits by choosing the right combinations of these different decision variables.

2.2 Profit Maximization Assumption

Following Rosen's (1974) model of a competitive industry with product differentiation,[92] let product demand be described by the function:

$$Y^d = f(P, S, \boldsymbol{Q}, \boldsymbol{Z}), \tag{1}$$

where P is price of Y, S is level of food safety, $\boldsymbol{Q}$ is vector of product quality attributes other than food safety, and $\boldsymbol{Z}$ is vector of other demand variables. Market supply is given by the function:

$$Y^S = f(P, S, \boldsymbol{Q}, \boldsymbol{W}, \boldsymbol{K}), \tag{2}$$

where $\boldsymbol{W}$ is the vector of factor prices, $\boldsymbol{K}$ is the vector of other supply variables, and other variables remain as defined above. Equating demand and supply, and solving for S yields the function:

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[92] This model is also used by Antle (2000) as the starting point in estimating the cost of food safety regulation in the US meat industry.

$$S = F(\boldsymbol{Q}, P^*, \boldsymbol{W}, \boldsymbol{K}, \boldsymbol{Z}), \quad (3)$$

where P^* now is the equilibrium price of Y. P^* can be decomposed into P_Y and P_S, where P_Y is the price level of product sold and P_S is the price of S. However, measuring P_S is not straightforward. One way of putting a value to P_S is by measuring the cost of food safety systems and using this as an approximation of P_S. When looking at the part of P^* that is attributable of S, one can use the output price differential between buyers who are willing to accept safer products and those who accept products that are less safe. For instance, we assume buyer 1 demands safer products (S_1) and pays p_1 and buyer 2 who accepts less safe products (S_2) pays p_2. The price differential of these two buyers is $(p_1 - p_2)$ *is* equated as the price of $(S_1\text{-}S_2)$. This is not the same as P_S *per se*, but will be relevant in later discussion of factors affecting firm choice of the level of S.

With HACCP systems (H) as an internationally-known system for attaining food safety, H enters through $\boldsymbol{K}$ and as $\boldsymbol{Z}$ in S. H is not exogenous, and its adoption is determined by both supply- and demand-related factors. Both S and H are simultaneously estimated as given in equations 4 and 5 below:

$$S = F(\boldsymbol{Q}, P_Y, P_S, \boldsymbol{W}, \boldsymbol{K}, \boldsymbol{Z}, H) \quad (4)$$

$$H = F(S, \boldsymbol{Q}, P_Y, P_S, \boldsymbol{W}, \boldsymbol{K}, \boldsymbol{Z}) \quad (5)$$

Individual firms will maximize profit (π) by choosing S and H given by the equation 6 below:

$$Max\ \pi = P^*(S,H).Y(S,H) - C(S,H) \qquad (6)$$

where C is the total costs and other variables are as defined above. Once S and H are chosen, firms will choose the combination of Y, which is the output level, and $\boldsymbol{X}$, which is the vector of input levels. From an empirical perspective, the difficulty arises due to the unobservability of S. Antle (2000) included observed "product quality," using a measure of management intensity and proportion of processed product in total product, as proxy variables for the unobserved food safety in analyzing the cost of HACCP systems in the US meat industry. Ollinger et al. (2000) studied process control and sanitation compliance and used microbial count and/or defects of intermediate and final products in the US meat industry as measures of food safety (or its absence). However, even these types of data are often nonexistent in many countries. To overcome this lack of observability of S and difficulty of measuring Q, we assume that H is a proxy for S and Q. Thus, instead of solving for equations 4 and 5, we estimate equation 7 below:

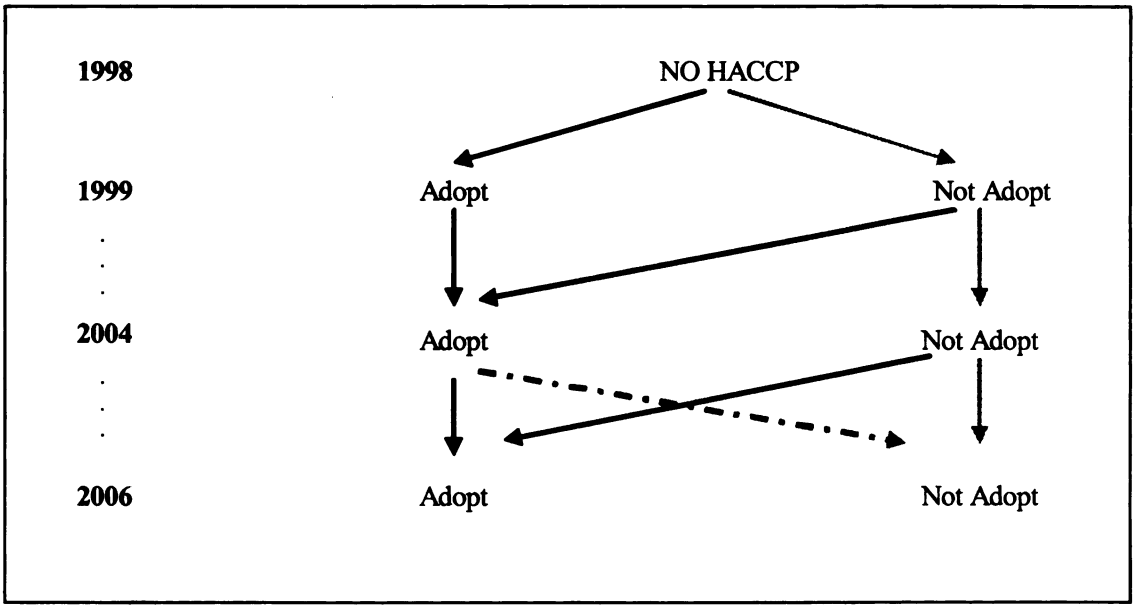
$$H = F(P_Y, P_S, \boldsymbol{W}, \boldsymbol{K}, \boldsymbol{Z}) \qquad (7)$$

Here, H is a certification system, i.e., either firms have certification or not.[93] Thus, H can be represented by a dummy of either zero for "no certification" or one for "with certification." In each period, a firm has to decide whether to have H or not. Due to the multi-period investments required, the decision to adopt occurs prior to the period when

[93] There are several certification bodies for HACCP systems, both private and public, including the Competent Authority (CA) for EU and the US Department of Commerce for the US. The credibility issues of these certification bodies are not the focus of this paper but rather take the HACCP certification systems as given.

the actual adoption is undertaken or observed. For instance, the observed adoption or non-adoption of *H* by firms in 1999 (the year the mandatory regulation on all seafood suppliers in the EU and US was implemented) is the result of the decision made by firms whether to adopt or not adopt *H* in 1998 (or even earlier). Two main categories of firms are apparent from the observed adoption of HACCP systems as shown in Figure 15: (i) firms that were certified at least once (represented by the darker solid arrows) and (ii) firms that were never certified (represented by the lighter solid arrows). Within the first category are firms that are "certified" (represented by darker solid arrows) and "de-certified" as of 2006 (represented by the lighter broken arrows). In addition, firms that were certified at least once have different years of initial adoption, and this imply varying rates of initial adoption.

Figure 15. Observed outcome of firms' decision on HACCP adoption over time



Given these descriptions of *H,* equation 7 can be interpreted and estimated in two ways. First, *H* can represent whether firms had initially adopted, i.e., *H=1* for firms

certified at least once and $H=0$ for firms that are never certified. A complementary estimation can be performed on the rate of this initial adoption, as firms have initially adopted H at different periods. Second, for those firms certified at least once, H can represent whether firms have remained certified or discontinued, i.e., $H=1$ for certified firms and $H=0$ for de-certified firms (as of 2006). Again, a complementary estimation can be performed on the rate of de-certification.[94]

Second, we can trace changes in profit through changes in P, Y, and C to explain the choice of firms to continue or discontinue H. In each period t, a firm's choice between $H=1$ or $H=0$ will depend on which option provides a higher profit (equation 6). For $H=1$ option, profit changes come from actual increase in revenue associated with HACCP adoption (through changes in P and Y) less the costs incurred to comply with the EU HACCP certification requirements, but adding any cost savings (through potential reduction of product wastage and rejections rates among others) (equation 8). For $H=0$ option, profit changes comes from actual reduction in revenue associated with HACCP non-adoption (through changes in P and Y) (equation 9).

$$\Delta\pi_{i,t,H=1} = (PM_{i,t} \cdot \Delta Y_{i,t,H=1}) + (P_{i,t,S1-S2} \cdot \lambda\Delta Y_{i,t,H=1}) + (Y \cdot \Delta P_{i,t,H=1}) + \Delta C_{i,t,H=1} \quad (8)$$

$$\Delta\pi_{i,t,H=0} = (PM_{i,t} \cdot \Delta Y_{i,t,H=0}) + (Y \cdot \Delta P_{i,t,H=0}) + \Delta C_{i,t,H=0} \quad (9)$$

where PM is the profit margin, measured as P_y - c, and $C=cY$ is total cost (equation 7

[94] Estimation models will be discussed in sections 3.2.1 and 3.2.2 and results in sections 4.2.1 and 4.2,2 below.

above).[95] The first term on the right-hand side of equations 8 and 9 is the profit contribution of output level changes; the second term in equation 8 is the profit contribution from the price difference between existing markets that do not require HACCP and newly-captured markets that require HACCP (where λ represents the proportion of quantity increases from capturing new markets); the third term in equation 8 and the second term in equation 9 are the profit contributions of the price level changes in existing markets; and the fourth term in equation 8 is the profit reduction due to additional expenses required to implement HACCP or profit increases due to lower product wastage and other cost savings.

In period *t*, a firm will choose *H=1* if $\Delta\pi_{i,t,H=1} > \Delta\pi_{i,t,H=0}$ or $\Delta\pi_{i,t,H=1} - \Delta\pi_{i,t,H=0} > 0$, and will choose *H=0* otherwise. Since HACCP requires a multi-period investment, a firm chooses with expected stream of profit changes over time. In periods *t=1-n*, a firm will choose *H=1* if $\Sigma_{t=1-n}\,\delta_t(E\pi_{i,t,H=1}) > \Sigma_{t=1-n}\,\delta_t E(\pi_{i,t,H=0})$ or $\Sigma_{t=1-n}\,\delta_t(E\pi_{i,t,H=1}) - \Sigma_{t=1-n}\,\delta_t E(\pi_{i,t,H=0}) > 0$, and will choose *H=0* otherwise. The latter is called net benefit/cost (NBC) of HACCP adoption for period *t* henceforth (equation 10):[96]

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[95] From equation 6, where $C=cY$, changes in profit in the case of $H=1$ will come from changes in P, Y, and c given as:

$$\Delta\pi_{i,t,H=1} = (P_{Y,i,t} \cdot \Delta Y_{i,t,H=1}) + (P_{i,t,S1-S2} \cdot \lambda\Delta Y_{i,t,H=1}) + (Y \cdot \Delta P_{i,t,H=1}) + (Y_{i,t} \cdot \Delta c_{i,t,H=1}) + (c_{i,t} \cdot \Delta Y_{i,t,H=1})$$

[96] Computational details will be discussed in section 3.2.5 and estimation results in section 4.3.4 below.

$$NBC_i = \Sigma_{t=1-n} \delta_t (E\pi_{i,t,H=1}) - \Sigma_{t=1-n} \delta_t E(\pi_{i,t,H=0}) \qquad (10)$$

3 Methodology

This chapter primarily uses qualitative research to analyze the research questions, combined with quantitative analysis to strengthen the findings and recommendations. This section discusses the data used in the estimation and methods of collection; categories of HACCP costs, benefits, and difficulties used; and the estimation models used to analyze the research questions.

3.1 Data and Sources

Face-to-face interviews based on a semi-structured questionnaire were used to collect data for addressing the research questions since secondary data are not available. Instead of mail surveys, which have been used in similar studies, face-to-face interviews were undertaken with the plant manager, HACCP team leader, and/or finance personnel of seafood processing firms.[97] This method made the data collection process more personal, and further helped in gaining trust, confidence, and cooperation from the respondents. A number of production site tours made by the author/interviewer also reinforced the interactive nature of the data collection and provided better mutual understanding of HACCP systems and accounting of costs between the author/interviewer and the responding firm representatives. In cases where respondents

[97] From the list of sample firms, the operations or production managers of the firms (or assistant manager or HACCP team leader in cases where the manager was not available) were contacted by phone to introduce the research study and receive permission to fax or mail the questionnaire. Based on willingness to participate, interview appointments were set. A tour of the production site was also requested. While most respondents replied to the questions during the interview, some firms had already completed the questionnaire before the scheduled interview and a few faxed their responses, citing their lack of time for an interview. All responding firm representatives were asked if they could be contacted for follow-up questions and for clarifications (which the author has done).

were not able to provide estimates on costs in Philippine pesos, the respondents were instead requested to provide their best estimates in terms of percentages or ranges (either of total costs or total value of production). An extensive and careful process of designing and pre-testing the questionnaire within the industry was undertaken to elicit relevant and meaningful responses.[98] The objective was to design a questionnaire that was easy to comprehend and answer, with minimum difficulties for the respondents. The questionnaire was about ten pages in length and the face-to-face interviews lasted approximately 30 minutes to one hour.

The population is 185 processors that were potentially affected by food safety regulations.[99] From among these 185 processors, cluster sampling was used to select firms for interviews, based on the geographic concentration of seafood processing, and money and time constraints. First, three main clusters were identified, based on the main island groups in the Philippines: Luzon, Visayas, and Mindanao. In Luzon, all firms in the population were included in the sample, due to proximity to the capital city and ease

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[98] The questionnaire was pre-tested and checked by four HACCP team leaders and managers from the seafood processing industry in the Philippines, two experts from government agencies in the Philippines, and a Michigan State University (MSU) professor who is a former HACCP auditor of firms in the Philippines and China.

[99] No complete database contains the number of firms involved in the processing subunit of the industry. To define the population, we used the list of processors from Philippine Bureau of Food and Drugs (BFAD). BFAD inspects processing firms according to sanitation standards and issues the license to operate (LTO) only if the firms have complied with these standards. In 2005, BFAD maintained a database of 500 "fish" processors. The disadvantage of this database is that it may not have been updated and some of the firms who had applied for LTO may not be in business anymore. Despite the weaknesses, the database is the most comprehensive list available and thus was used as a starting point in the interviews.

Of the 500 firms listed under BFAD, a total of 248 processors are classified as very small cottage operations processing dried small fish, fish paste and sauce, *kikiam*, squidball, and fishball—products that are targeted for low-income domestic markets and are often not considered "seafood." Thus, the population considered in the study includes the remaining 252 firms involved in tuna, shrimp, milkfish, sardine, octopus, shrimp paste, and other frozen/chilled products. These firms are the ones potentially affected by more stringent EU and US standards. In the process of searching for intended respondents, additional firms were identified as no longer in operation and could not be traced. The population, therefore, was further adjusted from 252 to 185 firms.

in reaching multiple firms. In Visayas and Mindanao, due to greater dispersion and long distances between firms, the sample was chosen based on the concentration of firms in major producing cities. For instance, all firms in Cebu City were included in the sample for Visayas and all firms in Davao, General Santos, and Zamboanga cities were included in the sample for Mindanao. As confirmed by key government and industry informants, the firms in these cities are representative of other firms in the regions. The sample represents 74 percent of the total population in the three original cluster regions (from [a] to [f] in Table 13).

Table 13. Distribution of population and respondents by HACCP certification status and location

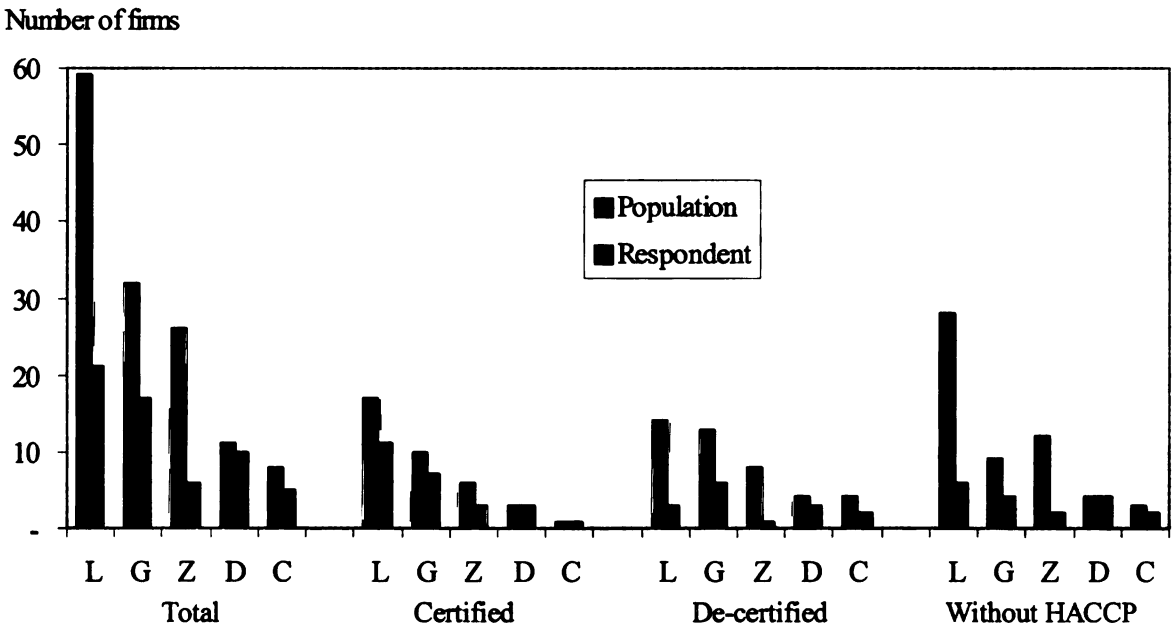
Location	Total			Certified		De-certified		Without HACCP		
	P/1	R/2		P/1	R/2	P/1	R/2	P/3	P/4	R/2
Metro Manila (a) /5	46	14		13	9	13	3	38	20	2
Other Luzon (b)	13	7		4	3	1	-	17	8	4
General Santos City (c)	32	17		10	7	13	6	18	9	4
Zamboanga (d)	26	6		6	3	8	1	18	12	2
Davao (e)	11	10		3	3	4	3	14	4	4
Cebu (f)	7	3		1	1	4	2	14	3	2
Other Visayas	30	-		1	-	5	-	28	24	-
Other Mindanao	19	-		3	-	1	-	15	15	-
Total population	**185**	**59**		**41**	**26**	**49**	**15**	**162**	**95**	**18**
		(32)	*		*(63)*		*(31)*			*(19)*
Total sample (a-f)	**136**	**59**		**37**	**26**	**43**	**15**	**119**	**56**	**18**
	(74)*	*(43)*	*	***(90)***	*(70)*	***(88)***	*(35)*		***(59)***	*(32)*

*/1 Population (P) (based on BFAR's record); /2 Respondents (R) (based on author's interviews); /3 Population based on the list from BFAD; /4 Population based on the list from BFAD less the firms that have been confirmed to be closed when the interviews were conducted. /5 Rows highlighted or marked with "(a)" to "(f)" are those included in the sample. * Figures in parenthesis and italics (and below the total population row), are the response rates (measured in relation to the population). **Figures in parenthesis and italics (and below the total sample row), are the response rates (measured in relation to the sample).*

The sampling method and reliance on willingness of firms to be interviewed may lead to selection bias in the results. The distribution of total population and respondents is shown in Figure 16. As expected, more certified than de-certified firms were interviewed.

In terms of geographic location, Zamboanga and Luzon are somewhat under-represented among the de-certified firms and those firms without HACCP systems. Based on reports from key informants, conditions in Zamboanga (in terms of raw material supplies and prices) are believed to be similar to other cities in Mindanao like Davao and General Santos. There are no specific regulations pertaining only to Luzon, Visayas, or Mindanao that would limit generalizations from the data.

Figure 16. Distribution of the total population and respondents by location



Note: L=Luzon, G=General Santos, Z=Zamboanga, D=Davao, C=Cebu
Source of raw data: Author's interviews

Primary field data collection was conducted between September and December 2005.[100] The final number of respondents included 59 firms: 26 certified firms, 15 de-

[100] During this period, sample firms were contacted and interviews were conducted. Four completed questionnaires were received by fax between March and April 2006 and these were followed up with a telephone conversation. Initially a category called "Applicants" as of 2005 was included, but BFAR confirmed that these firms were certified by the end of 2006. Thus these firms are included as certified

certified firms, and 18 firms without HACCP systems. These firms represent 32 percent of the total population (Table 13 above); eight percent of total seafood production; and 67 percent of the volume and value of exports in 2004 (Table 14). Across the entire sample, the response rate was 43 percent (59 firms out of 136 sample firms). Response was highest among certified firms (70 percent) compared to de-certified firms (35 percent) and firms without HACCP systems (32 percent).

Table 14. Proportion of production and export volume among respondents, 2004

	Production (tons)	Exports (tons)
Respondents	150,221	97,273
Population	2,000,000*	145,000
Percentage of respondents to population (%)	8	67

** The figure is production of the fishing/aquaculture sector No data is available for volume of production from only the seafood processing sector.*
Sources of raw data: Author's interviews; Department of Trade and Industry (DTI) - Tradeline database

The respondents are distributed in terms of size: 15 cottage firms,[101] 14 very small firms, six small firms, 15 medium firms, and nine large firms (Table 15). In terms of product form, the largest category of respondents is frozen tuna processors (which comprise 17 firms). Ten firms had milkfish as their main product; nine had shrimp; eight firms mainly produced canned tuna; and the rest produced octopus, shrimp fry/paste, or other seafood.

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firms as of 2006, although in some instances, e.g., in modeling "when to adopt" and in the net benefit/cost estimation, the distinction between those certified earlier than 2006 and those certified just in 2006 (still "applicants" during the interview period) is adopted.

[101] Firm size is based on the Philippine Department of Trade and Industry's (DTI) classification: cottage firms are those under 10 full-time equivalent employees, small firms are those with fewer than 100 employees, medium firms are those with fewer than 300 employees, and large firms are those with 300 or more employees. Due to high heterogeneity observed among small firms, this paper divides the "small firms" category into (i) very small firms, with fewer than 33 employees (average of the small firms groups); and (ii) small firms, with 33 and more employees.

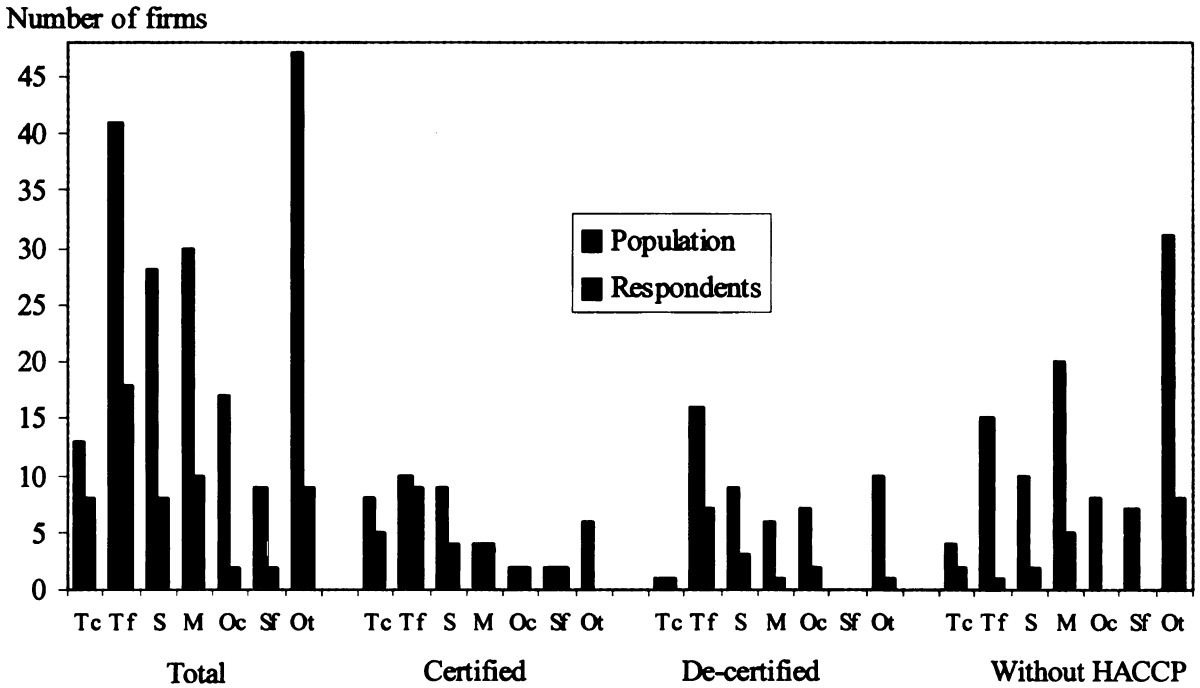
Table 15. Distribution of respondents by HACCP adoption status

Categories	Certified	De-certified	Without HACCP	Total
Size				
Cottage	4	-	11	**15**
Very small	6	3	5	**14**
Small	3	2	1	**6**
Medium	6	8	1	**15**
Large	7	2	-	**9**
Product form				
Frozen tuna	9	7	1	**17**
Milkfish	4	1	5	**10**
Shrimp	4	3	2	**9**
Canned tuna	5	1	2	**8**
Octopus	2	2	-	**4**
Shrimp fry	2	-	-	**2**
Others	-	1	8	**9**
Total	**26**	**15**	**18**	**59**

Source: Author's interviews. Note: Figures are the number of firms.

A relatively small number of actual respondents that produce "other seafood" in all the firm categories were interviewed compared to firms producing major product forms (e.g., canned tuna, frozen tuna, shrimp, and milkfish) (Figure 17). However, there are no special regulations pertaining to these other seafood products that are different from those pertaining to canned tuna, frozen tuna, shrimp, and milkfish, which would limit generalizations from the data.

Figure 17. Distribution of the total population and respondents by product form



Note: Tc=Canned Tuna, Tf=Frozen tuna, S=Shrimp, Oc=Octopus; Sf=Shrimp fry, Ot=Other seafood; the figures include all firms in the population including those firms in Other Visayas and Mindanao not included in the sample.
Source of raw data: Author's interviews

3.2 Analytical Tools

Given the nature of data available and the research questions, a number of complementary analytical tools are used. Logit modeling and survival analysis are used to identify significant incentive- and capacity-related factors explaining behavior of firms toward initial adoption, speed of this adoption, continued certification, and the length of time between certification and de-certification. These methods are complemented by descriptive analysis of data from the field interviews using the mean comparison test (MCT). To further explore the presence or absence of financial incentives among seafood processing firms and the entire fisheries industry in continuing adoption of HACCP

systems, a financial cost-benefit analysis of five representative firms (of different sizes) was performed for both certified and de-certified firms and the entire fisheries supply chain. Likert-scale scoring and a descriptive analysis of the responses from open-ended questions were used to identify and analyze difficulties and constraints in adopting and continuing the EU HACCP certification.

3.2.1 Logit Models

Two binomial logit models (LM) are estimated: (i) to analyze the incentive- and capacity-related factors that explain the likelihood of initially adopting HACCP systems; and (ii) to analyze the incentive- and capacity-related factors that explain the likelihood of staying certified or being de-certified, conditional on having adopted HACCP in the previous period.

While MCT provides initial indications of relative patterns among variables, LM results can be used to compute partial effects resulting from the model's ability to hold other variables constant. Second, LM offers a more sophisticated estimation that can overcome some of the limitations of the simpler models, e.g., a linear probability model, in which fitted probabilities can be less than zero and greater than one and the partial effect of any explanatory variable (appearing in level form) is constant (Wooldridge 2003). LM assumes a logistic cumulative distribution function of the error term, which ensures that the estimated response probabilities are strictly between zero and one and at the same time makes it possible to compute varying partial effects of explanatory variables (Wooldridge 2003).[102]

[102] Probit models (PM) can be used as an alternative to LM and the results would yield similar results. LM was used for this analysis, however, as it converges fairly well and much more quickly than PM (Greene

In general, LM can be derived from an underlying latent variable model, where y* is an unobserved variable determined by:

$$y^* = \beta_0 + X\beta + e, y = 1[y^* > 0] \quad (11)$$

where 1[.] defines a binary outcome and the other outcome is zero if the function is $y^* \leq 0$ (Wooldridge 2003). Given $y=H$ and explanatory variables $\boldsymbol{X}$ in equation 7 above, the latent variable model is given as:

$$H^* = \beta_0 + \boldsymbol{X\beta} + e, H = 1[H^* = 0] \quad (12)$$

Because of the binomial distribution of the data, estimation and analysis cannot be done the same way as simple regression models. For LM, the response variable is the logit of the probability of $H=1$ (logarithm of the probability of $H=1$ over probability of $H=0$, also called odds ratio). This is modeled as a linear function of $\boldsymbol{X}$, instead of the value of H itself (equation 13):

$$logit\ (p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = f(\boldsymbol{X'\beta}) \quad (13)$$

Where p_i is the probability of success (probability of $H=1$ or $Pr(H=1/X)$). Equation 13 can also be expressed as equation 14 below:

2000).

$$p_i = \Pr(H = 1/X) = \frac{1}{1+\exp(-f(X'\beta))} \qquad (14)$$

The unknown parameters $\boldsymbol{\beta}$ are estimated by maximum likelihood.[103] However, coefficients of LM, $\boldsymbol{\beta}$, cannot be directly interpreted as the partial effect of X_i on the response probability. The interpretation of the parameter estimate β_i is as the additive effect on the logarithm of the odds ratio for a unit change in X_i. The magnitudes of each $\boldsymbol{\beta_i}$ are not, by themselves, especially useful for estimating the effect of X_i on the probability of success, $Pr(H=1/X)$. Estimation results can be evaluated to calculate marginal impacts of certain factors affecting the response variable. The marginal effects (partial derivatives of probabilities with respect to the set of characteristics), are calculated at the mean from logit results using the equation 15:

$$\left[\frac{\partial P(H = 1/X)}{\partial X_i}\right] = g(\beta_0 + X\beta)\beta_i \qquad (15)$$

where g[.] is the probability density function. In the case of a dichotomous explanatory variable, the odds ratio or exponentiated coefficient, $\exp(\beta_i)$, is the estimate of the odds ratio of having the outcome.

3.2.2 Survival Analysis

The LM, discussed above, is a useful method in analyzing the binomially

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[103] The estimation is done in Stata using *logit* commands. The *logit* performs maximum likelihood estimation for logistic regression.

distributed data and can be used to model multiple explanatory variables simultaneously in the prediction. However, these models assume that the probability of an event occurring in period *t* (hazard rate) is independent of how long the event did not occur (survival time). This is referred to as a constant-hazard-rate assumption. In the context of HACCP adoption, LM assumes that the probability of initial HACCP adoption is not dependent on the time a firm operated without HACCP. But, one could think that the longer a firm operated without HACCP over several periods, the greater is the likelihood that it will not adopt HACCP in the next period. Moreover, LM assumes that the probability of de-certification is not dependent on the time a firm operated with HACCP. But, there is a possibility that the longer a firm was certified, that greater the likelihood that this firm will not be de-certified in the next period. Thus, if there is a potential relationship of the time of non-adoption and the probability of adoption in the next period, then survival analysis would be the more appropriate method to use (Clark et al. 2003; Wooldridge 2003, StataCorp 2003; Hosmer and Stanley 1999) or at least another method to use to verify LM results.

Survival analysis (also called duration or hazard analysis, and is henceforth referred to as SA) relaxes the implicit constant-hazard-rate assumption of LM. SA attempts to answer questions such as: *What fraction of a population will not initially adopt past a certain time (i.e., survival rate)? Of those that did not initially adopt, at what rate will they adopt it in the future? How do particular circumstances or characteristics increase or decrease the rate of initial adoption or de-certification?*[104]

Due to the multi-year investment related to HACCP systems, which requires firms

[104] Wooldridge (2003) uses the example of a felon released from prison and explained the number of days before he gets arrested again (p. 580).

to decide yearly whether to adopt or not, there are different times when initial adoption and de-certification occur. This intertemporal nature of HACCP adoption is modeled by analyzing the factors that may influence the rate of initial adoption and de-certification through SA. The outcome can be a positive event (e.g., initial adoption) or a negative event (e.g., de-certification); and the time from the point of interest to the event occurrence is called survival time. For initial adoption, the survival time is the number of years before a firm adopts HACCP systems from the year the system was imposed by the EU markets (Table 16). For de-certification, the survival time is the number of years from initial certification to the year that a firm is de-certified (Table 17).

Table 16. Distribution of respondents based on year of initial adoption

Length of time before initial adoption since 1999	Number of respondents
7	7
6	0
5	5
4	8
3	6
2	8
1	1
0	6
Later or never	18

Source: Author's interviews

Table 17. Distribution of respondents based on the length of time before de-certification

Length of time before de-certification since initial adoption	Number of respondents
2	4
3	4
4	4
5	1
6	2
Later or never	26

Source: Author's interviews

A significant portion of seafood processing firms had not initially adopted

HACCP systems (Table 16). However, among those that did adopt, a majority consisted of firms that have not been de-certified (Table 17). In the future, some firms may either decide to adopt or to discontinue adoption, but *when* these decisions will occur is unknown. Unobservability of a segment of the population and analyzing continuous variables (e.g., time before initial adoption or time between initial adoption and decertification) with significant proportion of one category warrants the use of SA with censored data.

Three functions can be used to characterize the distribution of the survival time: the density function, the survivor function, and the hazard function. The density function is characterized by:

$$f(t) = \Pr(T = t_i) \tag{16}$$

where T is a non-negative random variable that takes values t to measure the time spent in a particular state. The survivor function is defined as the probability that the event of interest has not occurred by duration t, i.e. the random variable T exceeds (or at least equals) the specified time t. For the discrete case, it is given by:

$$S(t) = \Pr(T \geq t_i) = \sum_{j \geq i} f(t_j) \tag{17}$$

where j denotes a failure time. $S(t)$ is a nonincreasing function with a value one at the time origin and a value zero as t goes to infinity. The opposite of survival function is the hazard function, which is the relationship between the hazard rate and the time already spent in that state (equation 18).

$$h(t_i) = f(t_i)/S(t_i) \qquad (18)$$

The hazard function emphasizes conditional probabilities: It describes the probability of an event occurring at the next time point, given that the event has not occurred up o a certain time point. It depicts the conditional probability that the event occurs after t_i, given that it has not occurred until t_i. The estimation in this chapter is focused on the hazard function.

In order to understand the significance of particular circumstances or characteristics that increase or decrease the occurrence of an event (initial adoption or de-certification), two approaches in estimating a hazard function can be used: semi-parametric and parametric. [105] Semi-parametric models appeal more widely to researchers than parametric as they allow for more flexibility in the shape of the baseline hazard function. Parametric models, on the other hand, allow only for a monotonic shape of the underlying baseline hazard function. To illustrate, a key feature of semi-parametric models is that the baseline hazard $\lambda_0(t)$ is left completely unspecified.[106] The hazards are made dependent on a vector of explanatory variables $\boldsymbol{X}$ with coefficients $\boldsymbol{\beta}$ that are to be estimated and the baseline hazard λ_0 (equation 19):

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[105] There are several parametric models to be used based on the distribution of the hazard/risk: exponential, Weibull, Gompertz, log-logistic, log normal, and generalized gamma models. The common approach in selecting among these parametric approaches is to use the Akaike information criterion (AIC) (StataCorp 2003). Akaike (1974) proposed penalizing each log likelihood to reflect the number of parameters being estimated in a particular model and then comparing them. AIC is defined as: $AIC = -2(\log likelihood) + 2(c + p + 1)$, where c is the number of explanatory variables and p is the number of model-specific ancillary parameters, i.e., two ancillary parameters for generalized gamma and one for the other models. The preferred model has the smallest AIC value.

[106] It is often preferred especially in applications to social sciences, in which there is not enough theory to make a strong case to assume constant, increasing, or decreasing baseline hazard.

$$h(t, x, \beta, h_0) = h_0(t)\phi(\boldsymbol{X}, \boldsymbol{\beta}) \tag{19}$$

where ϕ is a positive function of $\boldsymbol{X}$ and $\boldsymbol{\beta}$, and $h_0(t)$ characterizes how the hazard function changes as a function of time. The baseline hazard depends on t, but not on $\boldsymbol{X}$, meaning that it captures individual heterogeneity that is unexplained by the explanatory variables. Alternatively, the baseline hazard can be interpreted as the probability of an event occurring if the explanatory variables are equal to zero.

The most commonly used semi-parametric procedure was developed by Cox (1972), and is the model adopted in this chapter. Cox model equates $\phi(\boldsymbol{X},\boldsymbol{\beta})$ into exponentiated $(\boldsymbol{X},\boldsymbol{\beta})$ given in equation 20:

$$\phi(X, \beta) = \exp(X, \beta) \tag{20}$$

To estimate the hazard function, observed time periods of the event occurring are ordered by length from smallest to largest, $t_1 < \ldots < t_n$. The conditional probability that the event happens to the first observation at time t_1, given that any of the n observations could have been failed at t_1, is

$$\frac{\exp(x_1, \beta)}{\sum_{i-1}^{n} \exp(x_i, \beta)} \tag{21}$$

This quantity is the contribution of the shortest observation to the partial

likelihood. Generally, the contribution of the *j*th shortest observation to the partial likelihood is given by:

$$\frac{\exp(x_j, \beta)}{\sum_{i-j}^{n} \exp(x_i, \beta)} \tag{22}$$

Translating this technique into that of HACCP adoption, the numerator is the conditional probability of the *j*th firm that initially adopts (or de-certifies) at time t_j, while the denominator is the sum of the partial likelihood for all other firms which have not initially adopted (or who have not been de-certified) just prior to time t_j. The likelihood is formed as the product of these contributions and may be written as:

$$L(\beta) = \prod_{i-1}^{n} \frac{\exp(x_j, \beta)}{\sum_{i-j}^{n} \exp(x_i, \beta)} \tag{23}$$

The likelihood function depends only on the unknown coefficient vector $\boldsymbol{\beta}$ and can then be maximized using standard methods. The functional form of the hazard rate does not need to be specified. The Cox log likelihood function is then as follows:

$$\ln L(\beta) = \sum_{i-1}^{n} \left\{ \ln \phi(x_i, \beta - \ln \left[\sum_{j-i}^{n} \phi(x_j, \beta) \right] \right\} \tag{24}$$

where $\phi(x_i, \beta) = \exp(x_i, \beta)$.[107] In terms of interpreting the coefficients, the hazard ratio

[107] The estimation is done in Stata using *stset* and *stcox* commands. The *stcox* performs maximum likelihood estimation for parametric regression survival-time models.

(*HR*), which is *exp(β)*, is easier to interpret than the coefficient β itself.[108] *HR* is interpreted as the change in the rate of the event occurring for every unit change in the explanatory variable X_i. For a dichotomous explanatory variable, the difference in the rate of X_i=1 and X_i=0 is equal to *HR*. HR that is greater than one (*HR*>1) increases the rate of the occurrence of an outcome by $100*(HR-1)$ percent; while *HR* that is less than one (*HR*<1) decreases the rate of an event occurring by $100*/HR-1/$ percent.

3.2.3 Variables and Hypotheses

This section presents the dependent and explanatory variables used in estimation models described above. First, LM estimation is used to determine the relative significance of incentive- and capacity-related variables in affecting the likelihood of a firm to initially adopt or not adopt EU HACCP certification. The dependent variable here is a dummy variable equal to one if the firm is certified at least once and zero otherwise. Second, another LM estimation is used to determine the relative significance of incentive- and capacity-related variables in affecting the likelihood of a firm to continue or discontinue EU HACCP certification. Here, the dependent variable is a dummy variable equal to one if the firm is de-certified and zero otherwise. In both the above dependent variables, the analysis is of firms with EU HACCP certification and firms without EU HACCP certification. The latter consists of those without any HACCP certification and those that have US HACCP certification and other types of HACCP certification.

Third, SA is used to determine the relative contribution of incentive- and

[108] The hazard ratio has a similar interpretation as odds ratio in LM; and the only difference is that the ratio is in rate0s for SA and odds or likelihood for LM.

capacity-related variables in affecting the rate of a firm in initially adopting HACCP. The dependent variable here is the number of years between 1999 (when the EU and US imposed the HACCP requirement on seafood exports) and the year of the firm's initial HACCP certification (Table 16 above). Fourth, another SA is used to determine the relative contribution of incentive- and capacity-related variables in affecting the rate of a firm in de-certification. The dependent variable here is the number of years between the year of initial adoption and the year of de-certification (Table 17 above). These four models use the same explanatory variables; and these variables and the hypotheses are presented Table 18.

The relationship between the dependent and independent variables are interpreted here with caution. The models above may not capture a casual relationship between the dependent and independent variables. For instance, there is a possibility that the models just capture a cluster of characteristics between better managed and entrepreneurial firms (which use certification, association membership, market and product diversification as part of their strategies) and firms that are less well managed. In this case, the dependent and independent variables could just be correlated of with unobserved managerial quality rather than having casual relationship. Due to difficulties of modeling this unobserved managerial quality, the models above are still used and the results are interpreted as correlation and association between the dependent and independent variables rather than causal relationships.

Table 18. Explanatory variables used in the logit and survival analyses

Variable	Proxy	Definition	Hypothesis for LM	Hypothesis for SA
Incentives				
Output price level (P_Y)	*price*	Average price of products sold. Price measured as value of exports divided by the volume (US$/kg)	The higher the price level, the higher the incentive to adopt and continue HACCP.	The higher the price level, the higher the incentive for earlier initial adoption and de-certification at a later period.
Output price differentials (P_S)	*pdeuus*	Difference in export price between EU and the US as received by the processors. Price measured as value of exports divided by the volume (US$/kg)	The higher the price differential between EU and the US markets, the higher the incentive to adopt and continue HACCP.	The higher the price differential between EU and the US, the higher the incentive for earlier initial adoption and de-certification at a later period.
	pdeuoth	Difference in export price between EU and other markets as received by the processors. Other markets include the local Philippine markets and other importing countries (aside from EU and the US). Price measured as value of exports divided by the volume (US$/kg)	The higher the price differentials between EU and other markets, the higher the incentive to adopt and continue HACCP.	The higher the price differentials between EU and other markets, the higher the incentive for earlier initial adoption and for de-certification at a later period.
Input price (W)	P_L	Three-fourths of the minimum wage rate by region (US$/day). The adjusted minimum wage reflects the variability of costs of goods across regions. Location can reflect the differences in the cost of factors of production including labor and other inputs needed for HACCP. /1	The higher the wage, the higher will be the cost to hire more labor as usually needed for HACCP system adoption. Thus, higher wage rates faced by firms would translate to lower incentive to adopt and continue HACCP.	The higher the wage, the higher will be the cost to hire more labor as usually needed for HACCP system adoption. Thus, higher wage rates faced by firms would translate to lower incentive for earlier initial adoption and likely earlier de-certification.
	P_M	Weighted average of the prices of fish/seafood raw materials. (US$/kg)	Effect is ambiguous. The higher the price of materials implies higher costs, thus lower the incentive to initially adopt and continue HACCP. On the other hand, higher price implies higher product value, thus higher incentive to initially adopt and continue HACCP.	Effect is ambiguous. The higher the price of materials implies higher costs, thus lower the incentive for earlier initial adoption and likely earlier de-certification. On the other hand, higher price implies higher product value, thus higher incentive for earlier initial adoption and de-certification at a later period.

Note: /1 The adjustment to three-fourth of the minimum wage reflects the fact that minimum wages are not actually followed in the Philippines, as in most developing countries based on the personal communication with J. Price Gittinger on November 15, 2006 during the "Workshop on Cost-Benefit Analysis of Agricultural Projects," World Bank, Washington, DC. The minimum wage rate is from Philippine Department of Labor and Employment (DOLE) and National Statistics Office (NSO).

Table 18. cont'd

Variable	Proxy	Definition	Hypothesis for LM	Hypothesis for SA
	P_K	Weighted average of the tax-adjusted interest and dividend (as a ratio of the long-term debt and equity) plus the weighted economic depreciation rate of fixed assets (US$/unit of capital) /2	The higher the price of interest and depreciation costs, the lower the incentive to adopt and continue HACCP.	The higher the price of interest and depreciation costs, the lower the incentive for earlier initial adoption and likely earlier de-certification.
Market diversification	*nmarket*	Number of markets, in terms of country of product destination, the firm has.	The greater the market diversification, the less the incentive to adopt and continue HACCP. Greater diversification in markets, in terms of country of destinations, will provide the firms with flexibility to continue business even without the HACCP system required by some markets.	The greater the market diversification, the less the incentive for earlier initial adoption and likely earlier de-certification.
Product diversification	*nform*	Number of distinct product forms in the production line. For instance, frozen shrimp is distinct from frozen octopus or frozen deboned milkfish.	The more diversified the firms is in terms of products, the lower their incentive to adoption and continue HACCP because: (i) its is harder to control for cross contamination due to multiple product lines, and (ii) greater diversification in products would allow the firms flexibility to continue business even without the HACCP system required by some markets.	The more diversified the firms is in terms of products, the lower their incentive for earlier initial adoption and likely earlier de-certification because: (i) its is harder to control for cross contamination due to multiple product lines, and (ii) greater diversification in products would allow the firms flexibility to continue business even without the HACCP system required by some markets.
Capacity Access to capital	*credit (=0,1)*	Dummies for reported difficulty in accessing credit by firms (1=difficult; 0=not difficult)	Firms that experience difficulty in accessing credit (higher value for *credit*) are less likely to adopt and continue HACCP.	Firms that experience difficulty in accessing credit (higher value for *credit*) are less likely for earlier initial adoption and likely earlier de-certification

Note: /2 Rates of economic depreciation per asset class was adopted from Hulten and Wykoff (1981).

Table 18. cont'd

Variable	Proxy	Definition	Hypothesis for LM	Hypothesis for SA
Years in business	*yrbus*	Number of years in business, which represents length of experience in terms of dealing with buyer and negotiating with input suppliers and it represents the period to develop trust and long-term relationship with buyers.	Effect is ambiguous. The longer the years in business, the higher the human and social capacity to adopt and continue HACCP. On the other hand, the longer years in business, the less need for HACCP.	Effect is ambiguous. The longer the years in business, the higher the human and social capacity for earlier initial adoption and de-certification at a later period. On the other hand, the longer years in business, the less need for HACCP, and thus less likely for earlier initial adoption and likely earlier de-certification.
Number of association memberships	*member*	Number of producer, processor or exporter associations of which the respondents are a member	The more associations in which a firm is a member, the more support it gets, and thus the more capacity it has to adopt and continue HACCP.	The more associations in which a firm is a member the more support it gets, and thus the more capacity it has for earlier initial adoption and de-certification at a later period.
Involvement in association	*active (0,1)*	Dummy representing active membership of respondents in associations. "Being active" means actively joining the activities of the associations and/or actively seeking advice, assistance, or support from these associations	It is not enough to be a member of association. In some cases, "being active" in these associations is what adds to the capacity of firms to adopt and continue HACCP. If a firm is active in the association, the more likely that it will adopt and continue HACCP.	It is not enough to be a member of association. In some cases, "being active" in these associations is what adds to the capacity of firms to adopt HACCP systems. If a firm is active in the association, the more likely for earlier initial adoption and de-certification at a later period.
Physical capacity	*age*	Age of plant facility	The older the plant, the less physical capacity to adopt and continue HACCP considering the amount of money required for renovation or building a new facility needed for HACCP adoption.	The older the plant, the less physical capacity for earlier initial adoption and likely earlier de-certification. This is considering the amount of money required for renovation or building a new facility needed for HACCP adoption.
Size of production (Y)	Y	Volume of production (in tons)	The higher the volume of production, the greater the capacity to adopt and continue HACCP as firms will be able to distribute the potentially large capital investment across their products.	The higher the volume of production, the greater the capacity for earlier initial adoption and de-certification at a later period. This is because firms will be able to distribute the potentially large capital investment across their products.

3.2.4 Endogeneity Problem

An econometric concern is the potential endogeneity of the explanatory variables. For instance, the size of production *(Y)* can be a simultaneous decision factor along with the level or speed of HACCP adoption. Size of production can affect a firm's decisions about whether or not to adopt and when to adopt. At the same time, decisions about HACCP adoption may also affect the size of production through market access.

To handle the endogeneity problem in the models described above, a two-stage regression is estimated. The *Y* model is based on a simple production function, where quantity of production is expressed as a function of output prices, input prices, and other firm characteristics (equation 25). Due to the high correlation of most of the input prices with output price per unit,[109] which is computed based on a formula of profit margin allowance on top of the input prices, profit margins (*pm*) were used as an explanatory variable for output in this model instead of distinct output and input prices. In addition, other firm-specific factors are included in the model, such as a dummy for corporation (*corp*), as a proxy for capital availability; year of business operation (*yrbus*),[110] as a proxy for years of experience; and dummies for product form (*shrimp, milkfish, tunacan, tunafroz*) (Table 19).

$$\ln Y = \beta_0 + \beta_1 pm + \beta_2 corp + \beta_3 yrbus + \beta_4 shrimp + \beta_5 milkfish + \beta_6 tunacan + \beta_7 tunafroz \quad (25)$$

[109] Appendix 14 shows the correlation coefficients among the input and output prices.

[110] This variable is also used in LM and SA models, however, it should still be included in the *Y* model that potentially explains changes in output level. As this variable is included in both models, this will not be used as an instrumental variable.

Table 19. Explanatory variables used in the *Y* model

Variable	Proxy	Definition	Data source	Hypothesis
Dependent variable				
Size of production	*Y*	Volume of production (in tons)	Interviews	
Explanatory variables				
Profit margin	*pm*	Measured as average unit output price less average unit costs expressed as percentage of total value of production (%)	DTI, DOLE & NSO	The higher the profit margin, the higher the incentive for firms to produce more.
Years of experience	*yrbus*	[as defined in Table 18]	Interviews	The older the business, the more established the firm is with buyers, input suppliers, networks, and the more likely that it will produce more.
Corporation	*corp*	Dummy if the firm is a corporation (1=corporation, 0=not a corporation)	Interviews	Corporation has more equity, and more capacity to pool the needed resources to produce more products. Thus, corporation, as compared to non-corporation, is more likely to have higher production levels.
Product form	*shrimp, milkfish, tunacan, tunafroz; others*	These represent dummies for product form: tunafroz=frozen tuna; shrimp=shrimp; milkfish=milkfish; tunacan=canned tuna; others=other seafood products	Interviews	The product form, which may reflect consumer demand, can dictate the level of production. Tuna and shrimp are often the more internationally demanded commodities. Canned tuna processing firms often require a certain minimum size of production to recoup large start-up investments to be made.

The two-stage approach is similar to finding instrumental variables (Wooldridge 2003). Potential instrumental variables are *pm, corp, shrimp, milkfish, tunacan,* and *tunafroz.* Price of output and input prices are assumed to be exogenous in the *Y* model. The variable *corp* can potentially be endogeneous in the *Y* model, but interviews with processors confirmed that a shift from or to being a corporation has not happened before or after HACCP, and especially, not because of HACCP adoption. Thus, *corp* is also

assumed to be exogenous in the *Y* model. For these variables to be valid instrumental variables, *Y* model has to be "identified" and different from the *HACCP* model (i.e., any coefficient of *pm, corp, shrimp, milkfish, tunacan*, or *tunafroz* is significantly different from zero (or the joint significance of these variables is different from zero) in the *Y* model, but these coefficients are zero in the *HACCP* model). The predicted *Y (yhat)* was then plugged into the estimation models above (equations 14 and 23) in place of *Y* to come up with unbiased and robust estimates. Stata software was used in estimating the two-stage model. Test results in Appendix 5 indicate that we reject that there is no joint significance among the above explanatory variables and thus conclude that these variables can be used as instrumental variables (IV) for use in the *Y* model.

We used the Durbin–Wu–Hausman test (DWH or augmented regression test) for endogeneity, which was performed by including the residuals of the *Y* model (expressed and estimated as a function of all exogenous variables described above) in the LM or SA model. The decision rule is that if the residual is significantly different from zero in the LM or SA model, then *Y* is endogenous. DWH tests show that the null hypotheses (that *Y* is exogenous) in the LM and SA models and for initial and continued adoption are rejected at 0.03, 0.04, .03, and .02 levels of significance, respectively (see Appendix 6 for Stata results). Thus, output is endogenous in all models, and not accounting for this endogeneity would lead to biased estimates.[111]

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[111] One fundamental assumption of regression analysis for unbiased estimates is that the explanatory variables must not be correlated with the error term. If an explanatory variable is endogenous, this means that it is correlated with factors that are assumed to be encapsulated by design in the error term, thus, this endogenous variable becomes correlated with the error term.

3.2.5 Net Benefit-Cost Analysis

Actual financial costs and benefits as they enter income statements of firms are not captured in the LM and SA. Thus, financial costs and benefits are also estimated and analyzed to draw a more comprehensive picture of financial incentives for firms leading to their decision to continue or discontinue HACCP adoption. Cost and benefit categories adopted in this chapter are drawn primarily from Nganje (1999) and Maldonado et al. (2005). Cost categories are adjusted, depending on the specific context in the Philippine seafood processing industry (see Appendix 7 for more details on categories used and computational notes).[112] To assess benefits, this chapter goes beyond the qualitative approaches used in the earlier studies (see Appendix 8 for more details). Respondents were asked, using pre-determined choices, for more quantitative information on changes in (i) price of output; (ii) price differentials; (iii) quantity of output; (iv) rejection rate at inspection sites; and (v) reduced in-plant production wastage.[113] For instance, respondents were asked "*Were you able to negotiate a higher price after HACCP*

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[112] For instance, no managerial changes were experienced by the Philippine processing firms (although a few firms hired additional quality control/assurance staff). These costs were already captured in the HACCP plan development and labor associated with data management and supervision. Hours spent with inspectors (included in Nganje [1999]) were included in this paper as additional labor or staff time for data management and supervision. Materials and utilities (due to more frequent corrective action and product re-work, and due to more expensive raw materials from suppliers, who often must align their production with HACCP systems) were included as a cost component by Nganje (1999) but not by Maldonado et al. (2005); they were included in the analysis described here. Lastly, additional costs to comply with the requirements of the prerequisite sanitation programs (e.g., GMP) were included here, unlike the other two studies. One would expect that the US food industry, in general, may already have more sophisticated food safety and quality systems and better enforcement of sanitation requirements than the Philippines. The food processing firms in general in the Philippines have to invest in these prerequisite sanitation programs before they can comply with the HACCP system requirements. Higher HACCP costs per unit of production per firm in the Philippines are therefore expected largely due to these additional GMP costs.

[113] Other categories were asked to the processors, but they were unable to quantify these categories (see details in Chapter 4). Chapter 4 presents an estimation performed to determine the extent of the under- or overestimation of the HACCP expenditure reported by firms. The result in Chapter 4 is used as a scenario in the sensitivity analysis in later section of this chapter.

compliance?" to determine benefits related to price change. If the response was "yes", a follow up question was asked about the percentage change: 1-3 percent, 4-6 percent, 7-9 percent, 10-12 percent, 13-15 percent, or other. Aside from actual changes in price and quantity, respondents were also asked about future expectations, i.e., expected changes in price and quantity associated with HACCP adoption.

Net benefit-cost (NBC) estimation was performed to compare and analyze costs and benefits. NBC is a common method used to determine feasibility of a project or impact (*ex ante* or *ex post*) of government policy or firm strategy. Financial analysis, using actual inflow or outflow of funds, allows assessment of firm actions in response to a food safety requirement and the impact.[114] The NBC analysis used in this chapter is based on the "with project" and "without project" approach. Changes in certain variables after the project has been implemented are compared to before the project (the "with project" approach); and estimates of changes in the same set of variables, if the project was not implemented, are also incorporated in the analysis (the "without project" approach). Here, a mandatory EU HACCP system is the project that is analyzed and evaluated with two scenarios: "with adoption" and "without adoption." The analysis extends to the effect of EU HACCP adoption on the actual HACCP compliance in the US and other markets. Firms were specifically asked about changes that have or would occur that are attributed mainly to EU HACCP adoption. Despite having been specific to EU HACCP adoption, it is difficulty to segregate changes into those attributable to HACCP adoption and those mainly due to other factors (e.g., changes in management capacity, changes in marketing strategy, changes in preferences). As such, the benefits and cost of

[114] Another tool to use is economic analysis using shadow prices and excluding transfers and price distortions. However, the research questions are more appropriately answered by financial analysis.

HACCP adoption will be interpreted with caution because as they might be over- or underestimated. Rigorous analyses will be done to determine the sensitivity of results to changes in certain key assumptions and to test the robustness of the results.

The NBC estimation was performed for ten representative firms of five different firm sizes (for each certified and de-certified firm group); for the Philippine seafood processing industry; and for the Philippine fisheries supply chain (i.e., from fishing or farming, to input production and supply, processing, distribution, and handling). The ten representative firms are defined across the size categories defined earlier. These processing firms are considered "representative," as they embody the central tendencies of the firms belonging to each category through the use of the means of response for key variables. Median values are also used in the sensitivity analyses.

Aside from the processing firms, the other players along the fisheries supply chain (from fishing and aquaculture to processing and distribution) would also be affected by adoption or non-adoption decisions of the processing firms. A supply-chain perspective was incorporated to capture costs and benefits to the entire fisheries supply chain. For instance, in the event of EU HACCP non-adoption, the entire exports to EU (and some of those to the US and other markets) will be lost due to loss of market access. This loss of market access would accrue not only to the processing firms but to other players of the fisheries supply chain, including the traders and owners of factors or inputs of production used in the processing sector. The effect on other players depends on how easily their goods and services can be absorbed and used by other sectors of the economy. For instance, the economy-wide losses could be large in the event of price rigidities in the factor markets and difficulties for the factors to get absorbed by the other productive

sectors. The magnitude of this loss is often hard to measure, but rough estimates can be computed. In the particular case of EU HACCP non-adoption, the size of the market that would be lost is equal to the export value to EU (in addition to any additional loss of exports to US and other markets as a negative spillover effect of EU HACCP non-adoption). The actual loss to the fisheries industry and to the whole Philippine economy is much more complicated to measure. One rough measurement is by estimating the net value added (NVA)[115] that would be gained by the industry from increased demand in both existing and new markets due to EU HACCP certification (or that would be lost by the industry in the event of EU HACCP non-adoption). Including analysis of the entire supply chain may reflect larger potential gains from HACCP certification and larger losses from not adopting such certification. The processing industry may be incurring a net financial loss from HACCP adoption, but other players along the chain could lose if the industry does not adopt. Moreover, it is important to identify which players along the value chain benefit from HACCP. The potential loss for the whole value chain illustrates a potential role for cost sharing and compensation measures across the value chain or a role for the public sector to facilitate the process of addressing potential rigidities and institutional failures along the value chain. This illustrates a need for concerted efforts by both the private and public sectors to strengthen the food safety capacity of the country.

Results of the field interviews indicate that the life cycle of investments averages nine years, so the NBC analysis runs for a nine-year span; beyond which firms would face a totally different set of opportunities and challenges. Investments are assumed to

[115] NVA refers to the gross value of production less total value of inputs (both primary and intermediate) used. NVA rather than gross value-added (GVA) provides a more appropriate measure to capture industry- and economy-wide gains or losses associated with adoption or non-adoption of HACCP systems.

begin in Year 1, and benefits start in Year 2. In terms of costs, a major portion is incurred in Year 1, and amortization and interest costs are assumed to start in Year 2. In Years 2-9, the firms would have very similar annual HACCP costs, except interest costs would be lower in later periods. As noted, it is assumed that no benefits accrue to firms in Year 1. For Years 2-4, where actual data from field interviews are available, the mean of profit changes are used in the estimation.[116] For Years 5-9, the mean of expectations about changes in prices and quantity of production as a result of HACCP adoption over the next five years are used in the estimation.

4 Results and Discussion

This section presents the findings of the MCT performed; LM and SA to explain a firm's decision to initially adopt or not HACCP systems; LM and SA to explain a firm's decision to continue or discontinue adoption of HACCP systems; NBC analysis to trace the financial costs and benefits of HACCP adoption that may help explain de-certification; and qualitative analysis of the non-financial incentives and disincentives associated with HACCP adoption.

4.1 Factors Explaining Initial Adoption

This section focuses on firms that have been certified at least once and those that have not been certified once. This section presents the MCT results between certified firms (at least once) and firms with no EU HACCP system; and the relative significance of incentive- and capacity-related variables in explaining firms' decision to continue adoption or not (LM) and factors affecting the change in the rate of initial adoption (SA).

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[116] Most respondents had been implementing their HACCP systems for 1-4 years when the field interviews were conducted.

4.1.1 Mean Comparison Test

Proxy variables representing incentive to adopt include output price differential, input prices, number of market destinations for product, and number of distinct product forms (as defined in Table 18). While the average output price level is US$ 3.44/kg, this differs between certified firms and those that were never certified. For instance, average output received by certified firms is US$ 4.12/kg, but US$ 2.90/kg for those that were never certified (Table 20). This difference is mainly explained by the dominant product forms in each group, i.e., all of the shrimp processors (highest value products) were certified at least once, while most of those without HACCP certification have low-value seafood as their primarily products. Across all respondents, output price differences across markets, particularly the HACCP-requiring countries, including EU countries and the US, and the non-HACCP-requiring countries, are apparent (Table 20).[117] The average price received from EU markets is higher by US$ 1.29/kg (30 percent) than in other markets (including Japan, other export markets, and domestic markets). The average price received by respondents from US buyers is higher by US$ 0.25/kg (7 percent) than the price from EU buyers.

[117] The responses by firms were compared with the secondary data available at DTI (Philippines). The results of the interviews with firms were generally consistent with the patterns based on secondary data, with a few notable exceptions. See Appendix 9 for details.

Table 20. Results of the mean comparison, logit, and survival analyses to explain initial adoption

	Mean	Mean comparison			Logit		Survival	
	All respondents	Certified once	No HACCP		Model /a		Analysis /b	
Incentive								
Output price (US$/kg)	3.44	4.12	2.90		0.32	*	1.44	**
EU-US price difference (US$/kg)	-0.25	-0.35	0.00		-0.03		0.99	
EU-Others price difference (US$/kg)	1.29	1.25	1.37		-0.10		0.86	
Price of labor (US$/day)	2.93	2.95	2.87		-0.03		1.03	
Price of materials (US$/kg) /c	2.14	2.46	1.32	*				
Price of capital (US$/unit of capital)	0.19	0.21	0.14	**	0.06		0.00	
Number of markets (number)	3.00	4.00	1.00	***	0.02		1.11	
Number of product forms (number)	2.00	2.00	3.00	*	-0.06		0.74	*
Capacity								
Difficulty in credit access (dummy=0,1)	0.52	0.30	0.63	**	0.04		0.81	
Years in business (number)	10.40	11.25	7.00	***	0.01		0.96	
Active in associations (dummy=0,1)	0.58	0.70	0.11	**	0.07		2.08	***
Number of associations (number) /d	1.40	2.00	0.22	**				
Age of plant facility (number)	9.30	10.20	8.30		0.02		0.96	
Output (000 ton/year)	2.60	3.60	0.10	**	0.09	*	1.01	**

**** Significant difference in averages at < 0.01 level of significance; ** at < .05 level of significance; * at < .10 level of significance*

Note: The test of difference in means was performed using a mean comparison test (ttest) of unequal variances (using both Satterthwaite's and Welch's formulas) in Stata program

/a Figures presented here are odd ratios or marginal effects

/b Figures presented here are hazard ratios

/c Due to multicollinearity problem from the high correlation between output price level and price of materials, we were only able to use one of these variables at a time in the models. However, the two models showed similar results. The one presented here is the one using output price level.

/d Due to multicollinearity problem from the high correlation between "number of association membership" and "being active in these associations," we were only able to use one of these variables at a time in the models. However, the two models showed similar results. The one presented here is the one using "being active in these associations."

The price difference between the EU and US varies by product form. However, the price difference between these two HACCP-requiring markets and other markets is evident, irrespective of product form. For instance, average prices from the EU are 2-5 percent higher than those from the US for milkfish, shrimp fry, and canned tuna, while average prices from the US are 8-15 percent higher than those from the EU for octopus, shrimp, and frozen tuna (Table 21).

Table 21. Summary of price differences reported by respondents, across product form

Product Form	EU-US price difference (US$/kg)	Proportion to price level (%)*	EU-other markets price difference (US$/kg)	Proportion to price level (%)*
Milkfish	0.04	2	1.30	57
Octopus	-0.37	-9	1.60	39
Shrimp	-0.70	-8	1.88	22
Shrimp fry	0.09	3	0.74	30
Canned tuna	0.11	5	0.43	18
Frozen tuna	-0.50	-15	1.41	42
Others	0.00	0	0.85	36
Total	**-0.25**	**-7**	**1.29**	**30**

*Source: Author's interview. Note: *The ratio of the price difference to the mean price level (Table 20).*

Differences in prices received between firms that initially adopted and those that never adopted HACCP systems are not statistically significant (Table 20 above), although there are major differences between certified and de-certified firms (Table 22 below). Input prices were not available from respondents, but could be found as secondary data by different regions of the Philippines. The minimum wage rate averages US$ 2.93 per day, but varies from 1-10 percent across the regions where respondents are located. Often, it cannot be assumed that the minimum wage is observed by most firms in the Philippines.[118] Thus, a more realistic figure would be to adjust the rate downwards to reflect this reality, as in most developing countries. However, the initial differences would still be captured by the adjusted data. The daily price of labor, measured as the regional difference in the minimum wage, is not different across HACCP firm categories. Unit price of raw materials is US $2.14, which comprises about 65 percent of total unit costs, measured in terms of total expenditure on raw materials (from SEC data) divided

[118] According to personal communication with J. Price Gittinger.

by the total output units (as reported by respondents). The average price of capital is US$ 0.19 per unit of capital and varies between those that initially adopted and those that never adopted. The price of capital is defined as the weighted average of the tax-adjusted interest and dividend (as a ratio of the long-term debt and equity), plus the weighted economic depreciation rate of fixed assets. Rates of economic depreciation per asset class were adopted from Hulten and Wykoff (1981). On average, respondents have three major export destinations, where the most frequent ones are the US, Japan, and EU (the EU was counted as one), and two distinct product forms, where the most frequent ones are deboned milkfish and frozen tuna. However, this varies between those that initially adopted and those that did not. For instance, certified firms have more diversified markets (i.e., four distinct product destinations) and a less diversified product line (i.e., two distinct product forms) compared to only one product destination and three distinct product forms among firms without HACCP systems, on the average.

In terms of capacity-related variables, across all respondents, there were 52 percent of firms that reported difficulty in getting credit: 30 percent of certified firms and 63 percent of firms with no HACCP (a statistically significant difference). The average number of years in business operation for respondents was ten and the year of plant establishment was nine, which means that some firms built new facilities after having started business operations. Those that initially adopted have been in the business relatively longer than those that did not adopt (although the average age of the plant is not significantly different). Respondents belong to one association on average, but only 58 percent are active. There are significant differences between those that initially adopted and those that did not. For instance, certified firms belong to an average of two

associations, while only 22 percent of those without HACCP belong to any association. Also, 70 percent of certified firms are active in the associations, while only 11 percent of those without HACCP are active. The average output per firm is 2,600 tons per year for all respondents, with significant differences between firms that initially adopted and those that did not.

4.1.2 Logit and Survival Analyses

Based on the LM results in Table 20, output price and quantity levels are significant factors correlated with the decisions of Philippine seafood processors to initially adopt HACCP. These findings are consistent with the hypotheses. Higher output price received from the products sold is correlated with higher incentives to adopt more expensive food safety systems. Larger firm size is positively linked to more firm capacity in terms of spreading the total costs of more expensive food safety systems. More specifically, a one-percent increase in output price level is associated with a 32-percent increase in the likelihood of being certified at least once. This figure implies a high sensitivity of adoption decision to changes in output prices, which warrants further analysis to see the robustness of the results. Since part of the difference in prices across firms is the difference in product forms, a dummy to capture the product-specific price level is used (*1=shrimp, 0=otherwise*). Results show that the dummy for shrimp is not significant, but has an effect on the odds ratio of output price level, changing from 0.32 to 0.10 (other coefficients slightly changed, but not their level of significance). With this new result, one could interpret that a one-percent increase in price level across similar product form is associated with a ten-percent increase in the likelihood of initial adoption. A one-percent increase in output level is correlated with a nine-percent increase in the

likelihood of being certified. Moreover, the results also indicate that there is a possible minimum size required to start and continue adoption. Thus, economies of size are potentially present in adopting HACCP systems exists.[119]

In terms of the rate of initial adoption, aside from the output price level and output size, the number of product forms and membership and active involvement in industry associations were also significant. A one-percent increase in the output price level is correlated with a 44-percent increase in the rate of initial adoption among firms.[120] Similar to the above LM results on output price level, this figure implies high sensitivity of the rate of initial adoption to changes in output price. When dummy for shrimp was added, the new HR is 1.06, which implies that a one-percent increase in price level within similar products is significantly correlated with a six-percent increase in the rate of initial adoption. A one-percent increase in the output level is associated with a one-percent increase in the rate of initial adoption. This result indicates that the larger the firm size, the larger the capacity of a firm to accommodate costs increases. One additional product form in the production line is correlated with a 26-percent decrease in the rate of initial adoption,[121] which indicates that producing more product forms acts as a disincentive to adopt because processes to control for cross-contamination within the plant are more difficult and costly. If a firm is active in trade/processor associations, the rate of initial adoption is twice than that of firms that are not active in trade/processor associations. This result indicates that these associations may provide the needed capacity, information,

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[119] This is explored further in Chapter 4.

[120] From earlier discussion, the marginal increase is 100*(HR-1) if HR>1.

[121] From earlier discussion, the marginal decrease is 100*/HR-1/ if HR<1.

technical support, and possibly resources to adopt the system.

Comparing the LM and SA results indicates that the significance and influence of output price level and firm size are consistent across the two models, signaling the some consistency of estimates regardless of the constant-hazard-rate assumption. However, active membership in associations and number of product forms did not appear to be significant in the LM, whereas they are significant in the SA. This difference may be due to the constant-hazard-rate assumption in LM; and the interest in hazard rate changes in SA. This implies the presence of non-constant-hazard-rates, as indicated by the significance of a number of variables in SA. Overall results indicate that both incentive- and capacity-related factors affect the firms' decision about initial adoption and the rate of this adoption, without giving a clear indication of the relative significance between the two.

4.2 Factors Explaining Continued Adoption

This section focuses on the firms that have been de-certified and those that remained certified. This section presents the mean comparison test between certified and de-certified firms; results of the LM estimation to determine the relative significance of incentive- and capacity-related variables to explain firms' decision to continue adoption or not; and survival analyses to explain changes in the rate of de-certification.

4.2.1 Mean Comparison Test

Certified and de-certified firms are similar, as seen in Table 22. Only the average EU-US price differentials are significantly different between the two groups. For instance, certified firms (in 2006) reported similar prices received from both US and EU markets, with accompanying similar shares of EU and US exports in the total exports. Despite no

price advantage, a relatively large share of EU exports provides a considerable incentive for certified processors to maintain certification. Non-certification would mean losing the large EU market share. On the other hand, de-certified firms (in 2006) reported much lower prices received from EU buyers than US buyers (by US$ 0.94/kg on average) before they were de-certified, with a resulting small proportion of EU exports in total exports. Much lower prices in the EU, coupled with large existing US exports and low existing EU exports, provide incentives for processors not to continue HACCP certification as long as they can still supply to the US markets. This may be the main reason why de-certified firms with existing large US exports may have opted to discontinue adoption, since there was apparently no price incentives to compensate for higher costs.

Table 22. Results of the mean comparison, logit, and survival analyses to explain continued adoption

Variables	Mean Comparison			Logit Model /a		Survival Analysis /b	
	Certified	De-certified					
Incentives							
Output price level (US$/kg)	3.95	4.22		1.28		0.30	*
EU-US price difference (US$/kg)	-0.01	-0.94	***	-0.94	**	0.01	***
EU-Others price difference (US$/kg)	1.35	1.09		-0.65	**	1.09	
Price of labor (US$/day)	3.01	2.85		0.33		0.37	***
Price of materials (US$/kg) /c	2.25	2.73					
Price of capital (US$/kg)	0.20	0.22		-0.01		0.00	
Number of markets (number)	3.00	3.00		0.02		0.47	***
Number of product forms (number)	2.00	2.00		0.23		2.50	***
Capacity							
Difficulty in credit access (dummy=0,1)	.35	.50		0.42	*	3.04	***
Years in business (number)	10.50	11.30		0.06		1.11	
Active in associations (dummy=0,1)	0.80	0.60		-0.01		0.30	***
Number of associations (number) /d	2.00	2.00					
Age of plant facility (number)	9.00	11.20		-0.07		.81	
Output (000 ton/year)	3.70	3.40		-0.25		0.97	

*** *Significant difference in averages at < 0.01 level of significance;* ** *at < .05 level of significance;* * *at < .10 level of significance*

Note: The test of difference in means was performed using a mean comparison test (ttest) of unequal variances (using both Satterthwaite's and Welch's formulas) in Stata program

/a Figures presented here are the odd ratios or marginal effects

/b Figures presented here are the hazard ratios

/c Due to multicollinearity problem from the high correlation between output price level and price of materials, we were only able to use one of these variables at a time in the models. However, the two models showed similar results. The one presented here is the one using output price level.

/d Due to multicollinearity problem from the high correlation between "number of association membership" and "being active in these associations," we were only able to use one of these variables at a time in the models. However, the two models showed similar results. The one presented here is the one using "being active in these associations."

4.2.2 Logit and Survival Analyses

Based on the LM results (Table 22), price differentials across markets (especially between the EU and US) and access to credit are significant factors in the sustainability of HACCP certification among Philippine seafood processors. For instance, a one-dollar increase in EU prices, compared to US prices, is significantly correlated with a 94-percent decrease in the likelihood of being de-certified (or a one-cent increase in price

differential is significantly correlated with a one-percent increase in the likelihood of certification).[122] This implies a high sensitivity of EU HACCP de-certification to price differentials between EU and US markets. A one-dollar increase in EU prices, compared to other markets' prices, is associated with a 65-percent decrease in the likelihood of being de-certified (or a one-cent increase in price differential is associated with a less than one percent increase in the likelihood of de-certification). Firms that reported difficulty in accessing credit have higher likelihood (42 percent) of being de-certified than firms that reported no difficulty.

Based on the SA, the rate of de-certification is significantly affected by several incentive-related factors such as price differentials, input prices, number of markets, and number of product forms; and capacity-related factors such as access to credit and membership and active involvement in association. The seemingly most important variable is the EU and US price differential, where a one-dollar increase in the difference between EU and US prices is correlated with a 99-percent decrease in the rate of de-certification (a one-cent increase in price differential is correlated with a five-percent decrease in the rate of de-certification).[123] This finding indicates a strong price incentive to continue or not with certification. A one-percent increase in the output price level is associated with a 70-percent reduction in the rate of de-certification. While this finding is consistent with the hypothesis, this large change in rate implies very high sensitivity of the rate of de-certification to increases in price level. Similar to the above LM results on

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[122] This is computed by dividing the coefficient with 100, and then recomputing the odds ratio (marginal effect) (see Hosmer and Stanley 1999).

[123] To reflect a change in the scale of explanatory variable, say from a dollar to cent, we used the approach adopted by Hosmer and Stanley (1999), i.e., $HR_{new}=\exp(\beta_{old}/100)$, where 100 refers to the change from dollar to cent scale.

output price, a dummy for shrimp was added. The new HR is 0.89, which implies that a one-percent increase in price level within similar products is correlated with an 11-percent increase in the rate of de-certification. An additional product form is associated with a 2.5-times increase in the rate of de-certification; which indicates the possible difficulty of controlling cross-contamination, which in turn provides a disincentive for firms to continue adoption. An additional market destination captured is correlated with a 53-percent decrease in the rate of de-certification. This result is not consistent with the hypothesis, but it may indicate that strong export-orientation leads to higher incentives to maintain a good image in the international market and thus to continue the EU certification. A one-percent increase in the price of labor is correlated with a 63-percent decrease in the rate of de-certification. Again, this result is not consistent with the hypothesis, but it may be due to other location-specific incentives apart from the cost of labor. A firm that is active in an association has a 70-percent lower rate of de-certification than a firm that is not active. This result is consistent with our hypothesis and indicates that active participation in a trade/processors association plays an important role in influencing continued certification or de-certification. Lastly, firms that reported difficulty in accessing credit have a rate of de-certification of three times the rate of those that reported no difficulty.

A comparison of the LM and SA results show the significance and influence of the EU-US price differential and the difficulty of accessing credit to be consistent across the two models. However, output and input price levels, number of product forms, number of markets, and active membership in associations did not appear to be significant in the LM, while they are significant in SA. The EU-other markets price

differentials appeared significant in the LM, but not in the SA. As indicated in the earlier discussion, this difference may be due to the constant-hazard-rate assumption in LM; and the relaxing of this assumption in SA. The difference in significance of a number of variables in SA and LM may imply the presence of non-constant-hazard-rates.

In summary, initial adoption is explained by both incentive- and capacity-related factors. Decisions about sustained adoption are explained more by incentive-related factors compared to capacity-related ones. Moreover, there are differences in the key factors affecting the decision to initially adopt and continue adoption – average price level and firm size are the major determinants in initial adoption; while EU-US price differentials and access to credit are the major determinants in continued adoption. Active participation in associations and number of product forms in the product line are factors that consistently affect both decisions to initially and continue adoption. Both models emphasize the role of price incentives as a key factor in facilitating and sustaining adoption.

4.3 Benefits and Costs of HACCP Adoption

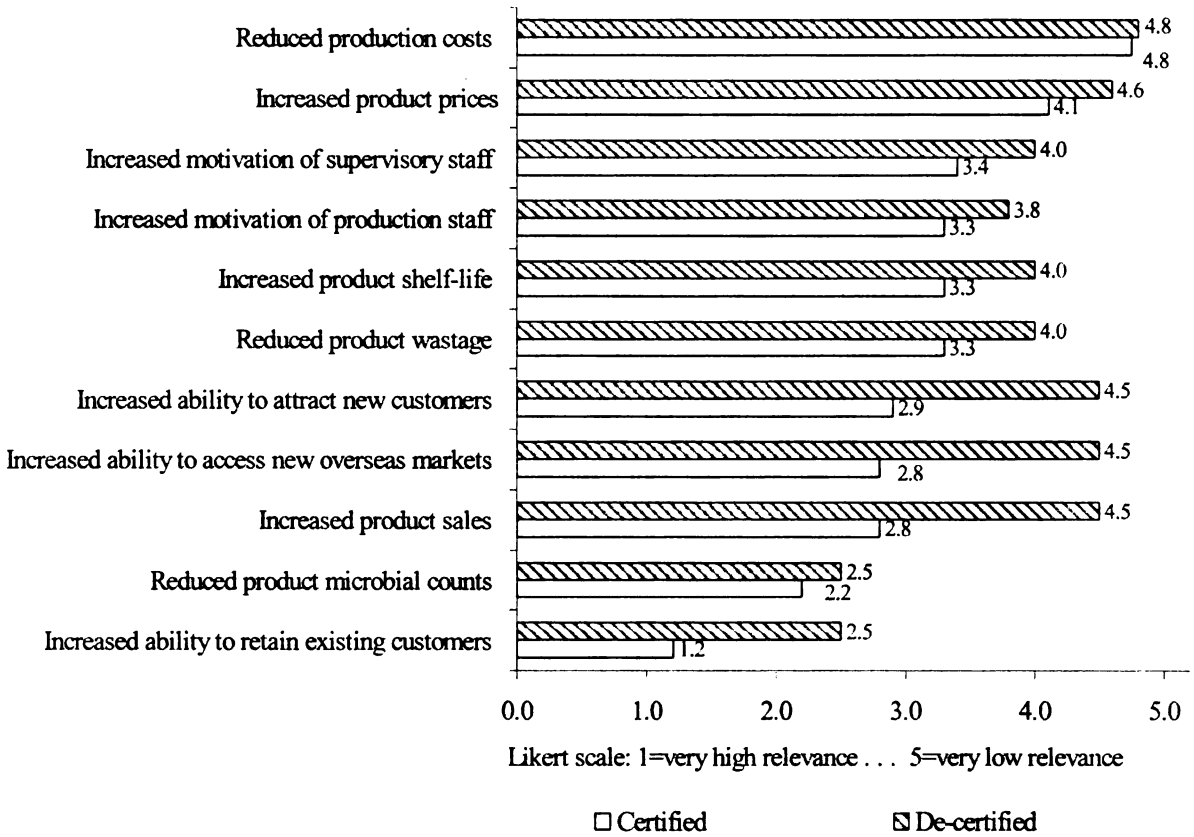
This section focuses on tracing the financial costs and benefits in terms of the flow of profits from EU HACCP certification (and spillover effects to the US and other markets). This section complements the above LM and SA results, and explores which changes in the profit flow provide additional reasons on why some firms stayed certified and others were de-certified. To examine benefits, both qualitative and quantitative analyses of HACCP adoption are employed. Actual cost of adoption as reported by the respondents, hypothetical profit loss due to non-adoption for certified firms, and actual profit losses due to non-adoption by de-certified firms are used to assess costs. Finally,

the benefits and costs are compared and net benefit-cost (NBC) estimates for both certified and de-certified firms are calculated.

4.3.1 Benefits from HACCP Adoption

In terms of realization of benefits, seafood processors were asked on how they would rate a list of 11 pre-determined benefit categories (adopted from Maldonado et al. 2005 and Henson et al. 1999) according to relevance or extent of realization of these benefits as these were actually experienced by the respondents (see questionnaire in Appendix 1). There are clear differences between certified and de-certified firms in their reported actual benefits. De-certified firms have much lower scores (given a rank closer to 5) than certified firms in all the benefit categories (Figure 18). The responses indicate that the realization of benefits associated with HACCP was less apparent to de-certified firms, compared to the certified firms; and this may be a reason why some firm discontinued certification. The most striking difference between certified and de-certified firms is the inability of the latter to attract new customers; enter new markets; and increase product sales. Expectations of new markets and new customers induced by HACCP adoption may have provided firms an incentive to initially adopt. However, the apparent lack of new markets and new customers actually gained from certification may have induced some firms to discontinue. Reduced product wastage within the plant, and reduced rejection rate at the importing country's ports, and improvement of staff motivation were not realized by either certified or de-certified firms. Higher output price and reduced product cost were ranked first as highly irrelevant/unrealized benefits from HACCP adoption for both certified and de-certified firms.

Figure 18. Average rank scores of certified and de-certified respondents on the benefits derived from HACCP adoption



Source: Author's interviews with 41 certified and de-certified respondents

A consistent pattern can be observed in the responses of firms in terms of the deviation of actual from expected benefits. Most of the certified firms reported that their expectations in terms of benefits are the same as the actual benefit experienced (Table 23). A few certified firms did report realizing higher actual benefits than expected in the access of new export markets and new customers, and in increasing motivation of both production and supervisory staff. On the other hand, majority of de-certified firms reported that their expectations in terms of benefits are the same as the actual benefit

experienced in some benefit categories. However, a large proportion of de-certified firms experienced lower actual benefits than what they were initially expecting in the other benefit categories (i.e., product microbial counts, product sales, access to new export markets and new customers, product wastage, motivation of staff, and product prices). Across all benefit categories, only seven percent of the certified firms reported lower actual than expected benefits, compared to 44 percent of the de-certified firms across all the benefit categories. Five percent of the certified firms reported higher actual than expected benefits; while no de-certified firm reported this case. About 88 percent of the certified firms reported that actual and expected benefits are the same, compared to only 56 percent of the de-certified firms.

Table 23. Distribution of respondents based on the comparison of actual and expected benefits of HACCP adoption

	Certified			De-certified		
	Lower	**Higher**	**Same**	**Lower**	**Higher**	**Same**
Increased ability to retain existing customers	-	-	19 *	-	-	15
Reduced product microbial counts	-	-	19	5	-	10
Increased product sales	-	-	19	15	-	-
Increased ability to access new export markets	-	2	17	15	-	-
Increased ability to attract new customers	-	4	15	15	-	-
Reduced product wastage	-	-	19	10	-	5
Increased product shelf-life	-	-	19	-	-	15
Increased motivation of production staff	-	4	15	4	-	11
Increased motivation of supervisory staff	-	-	19	3	-	12
Increased product prices	15	-	4	5	-	10
Reduced production costs	-	-	19	-	-	15
Percentage to total respondents (%)	**7**	**5**	**88**	**44**	**-**	**56**

*Source: Author's interviews. Note: *Figures are the number of respondents. Dash means zero.*

In addition to the above qualitative analysis, benefits from HACCP adoption were quantified. The categories that were quantified include: (i) output price increase; (ii) output quantity increases; (iii) lowered rejection rates at the importing countries' borders; and (iv) reduced product wastage.

4.3.1.1 Output Price Increases

The results above indicate no actual price increase, as a result of HACCP certification, for the majority of both certified and de-certified firms (Figure 18 and Table 23). This is consistent with findings of existing literature (Nganje 1999; Nganje et al. 1995; and Nganje and Mazzocco 2000). Moreover, when respondents were asked about their expectations of future price increases, all firms said that they do not anticipate price increases in the new future.

Three processors of frozen tuna processor said that:

". . . We are able to negotiate price only if the price of raw materials went up. For capital investments, like investments in HACCP, and other additional costs related to HACCP or improving safety and quality of the product, we could not negotiate an increase in price . . ." *(Frozen tuna processor, translated from Tagalog).*

". . . Buyers feel that sanitary requirements are a necessary part of the production process and that costs incurred in complying with their stricter regulation on sanitation and HACCP should be borne by us, producers and processors, and not them (buyers) . . ." *(Frozen tuna processor, translated from Tagalog).*

". . . Importers say that they cannot increase the prices they offer, as they have not been able to raise prices in the market. It may take some time to charge higher prices to consumers. If so, the increase in prices will go first to marketing and advertising . . ." *(Frozen tuna processor, translated from Tagalog).*

A canned tuna processor, mainly catering to the domestic market, is an exception. After adopting HACCP systems, this firm was able to find a Malaysian buyer and at the same time the price it received in the domestic market increased by two percent. However, this firm was not sure if the price increase was due to HACCP adoption or other factors that might have increased demand for their product in the domestic market. Table 24 summarizes the distribution of respondents regarding derived benefits from HACCP adoption.

Table 24. Distribution of respondents categorized by their responses on the benefits from HACCP adoption, by firm size category /a

	Certified						De-certified					
	All	C*	VS	S	M	L	All	C	VS	S	M	L
Respondents	**26**	**3**	**5**	**5**	**5**	**8**	**15**	**-**	**3**	**2**	**8**	**2**
No Price gain in existing markets /b	**19****	3	4	3	2	7	**14**	-	3	2	8	1
Price Differentials between alternative markets /c												
EU = US	**7**	1	1	3	1	1	**6**	-	1	2	1	-
EU > US	**13**	2	3	1	2	5	**-**	-	-	-	-	-
US > EU	**6**	-	1	1	2	2	**9**	-	2	2	4	1
EU > other markets	**24**	3	5	5	5	6	**12**	-	3	1	7	1
Actual change in export quantity to EU /d												
No change	**12****	2	2	1	1	6	**15**	-	3	2	8	2
Increase	**7**	1	2	2	1	1	**-**	-	-	-	-	-
No actual change in export quantity to US	**19****	3	4	3	2	7	**15**	-	3	2	8	2
Actual change in sales quantity to Other Markets /e												
No change	**14****	2	3	2	1	6	**15**	-	3	2	8	2
Increase	**5**	1	1	1	1	1	**-**	-	-	-	-	-
Expected change in export quantity to EU in the next 5 years /f												
No change	**16**	2	-	2	4	8						
Increase	**10**	1	5	3	1	-						
Expected change in export quantity to US in the next 5 years /g												
No change	**19**	2	2	1	4	8						
Increase	**7**	1	1	4	1	-						
Expected change in export quantity to Other Markets in the next 5 years /h												
No change	**18**	2	3	3	3	7						
Increase	**8**	1	2	2	2	1						
Difference in rejection rate /i												
No change	**11****	1	3	1	1	5	**7**	-	-	1	5	1
Higher in all levels	**2**	-	-	1	-	1	**1**	-	-	-	1	-
Lower in all levels	**1**	-	-	-	-	1	**3**	-	1	1	1	-
No answer	**5**	2	1	1	1	-	**4**	-	2	-	1	1
Lower production wastage /j												
No	**11****	3	4	3	-	1	**15**	-	3	2	8	2
Yes	**8**	-	-	-	2	6	**-**	-	-	-	-	-

*Note: Dash means zero; *C=Cottage; VS=Very-small; S=Small; M=Medium; and L=Large; ** Applies to only those firms certified earlier than 2006 and excluding those firms that were just certified in 2006, which did not have previous experience in HACCP adoption.*

/a Figures are the number of respondents in each category;

/b This may be due to other demand factors other than in association with HACCP systems adoption.

Table 24. cont'd

/c Discussed under section 4.1.1, page 147.
/d Based on 19 certified firms, the average increase is 2.7 percent (zero for de-certified firms)
/e Based on 19 certified firms, the average increase is 1.4 percent (zero for de-certified firms)
/f Based on 26 firms, the average increase is 2.1 percent (Not applicable for de-certified firms)
/g Based on 26 firms, the average increase is 1.5 percent.
/h Based on 26 firms, the average increase is 1.5 percent.
/i Based on 19 firms, the range for 7 firms that reported a change is 1-4 percent (either higher or lower than the pre-HACCP border rejection rates). Levels referred to here are at the national agency inspection/testing and importing country border inspection.
/j Based on 19 firms, the average increase is 0.2 percent (zero for de-certified firms)

4.3.1.2 Actual Increases in Output due to HACCP Adoption

Certified and de-certified firms reported different increases in the quantity of products sold due to EU HACCP adoption. Four certified firms reported a ten-percent increase; two firms reported five-percent, one firm reported a two-percent increase in the quantity of exports to EU, while the remaining certified firms reported no change in their exports to EU (Tables 24 and 25). This indicates that some certified firms were able to increase their production and sales to EU market because of HACCP certification. On the average, certified firms experienced an increase of 2.7 percent per year in exports to EU.[124] In contrast, no de-certified firm reported an increase in quantity exported to EU (during the periods that they were certified).

[124] Three percent mean for cottage firms; five percent mean for very small and small firms; 2.5 percent for medium firms; and 0.3 percent for large firms (Table 21).

Table 25. Summary of benefits derived by certified firms from HACCP adoption*

Category/Variable	C**	VS	S	M	L	All processing firms
Price differential (EU-other markets) for certified firms (US$/kg) [/a]	1.3	1.2	1.4	1.4	1.3	1.4
Price differential (EU-other markets) for de-certified firms (US$/kg)	1.1	1.0	1.1	1.0	1.1	1.1
Actual change in export quantity to EU (%)	3.3	5.0	5.0	2.5	0.3	2.7
Actual change in export quantity to US (%)	-	-	-	-	-	-
Actual change in sales quantity to other markets (%)	1.7	1.3	1.7	5.0	0.3	1.4
Expected change in export quantity to EU (%)	1.7	5.0	4.0	1.0	-	2.1
Expected change in export quantity to US (%)	1.7	1.0	5.0	1.0	-	1.5
Expected change in sales quantity to other markets (%)	1.7	2.0	2.0	2.0	0.6	1.5
Lower product wastage (%)	-	-	-	0.5	0.5	0.2
Loss in export quantity to EU due to non-adoption (%)	100.0	100.0	100.0	100.0	100.0	100.0
Loss in export quantity to US due to non-adoption (%) [/b]	12.0	12.0	12.0	12.0	12.0	12.0
Loss in sales to other markets due to non-adoption (%)	-	-	-	-	1.2	1.2

*Note: *Data applies to certified firms; while zero for de-certified firms; **C=Cottage; VS=Very-small; S=Small; M=Medium; and L=Large. Dash means zero. [/a] See average reported in Table 21; [/b] There are a few relevant observations (four firms across all size groups), so the aggregate mean was used.*

EU HACCP certification also enabled some firms to capture new buyers in the export and domestic markets. In terms of increases in quantity sold to the other markets (non-HACCP-requiring markets including domestic markets), one out of the 19 certified firms reported a 10-percent increase in sales in the domestic market, as a result of increased sales to restaurants and supermarkets chains due to HACCP certification; three certified firms reported a five-percent increase; one firm reported a two-percent increase; and the remaining 14 firms reported no increases. This indicates that some certified firms were able to increase their production and sales to other markets because of HACCP certification. On the average, certified firms increased exports to EU by 1.4 percent per

year.[125] In contrast, all de-certified firms said that they did not experience sales increases in sales to other markets, as a result of HACCP certification. In terms of increases in the quantity of exports to US, both certified and de-certified indicated that they did not experience increases in their existing US exports.

Similar to the price changes above, quantity changes reported by the respondents were complemented with analysis of secondary data. Average volume of seafood exports indicates that export volume decreased in HACCP-requiring countries, while it increased in non-HACCP-requiring countries (Table 26). This is most likely explained by a reduction in volume due to de-certification of some firms, diversion of some products by de-certified firms, and the general increase in demand for seafood products in non-HACCP-requiring countries (especially Southeast and South Asia and Middle East).

Table 26. Comparison of volume and value of seafood exports before and after EU and US HACCP regulation (in million kg per year; total seafood products)

Category	Period	HACCP requiring countries	Non-HACCP requiring countries	Japan
Volume of exports (million kg per year)	Before HACCP (1995-1998)	47.75	39.09	34.53
	After HACCP (1999-2004)	44.99	49.85	28.42
Value of exports (US$ million per year)	Before HACCP (1995-1998)	135.20	110.61	196.71
	After HACCP (1999-2004)	135.71	125.11	121.57

Source: DTI-Tradeline.

The average value of seafood exports was relatively constant in HACCP-requiring countries, despite the decrease in volume. The relative change may be due to the stronger influence from higher prices of frozen tuna and other seafood to the average general price

[125] The mean for cottage firms is 1.7 percent; 1.3 percent mean for very small; 1.7 percent for small firms; five percent for medium firms; and 0.3 percent for large firms (Table 21).

levels of seafood, or due to a relatively larger reduction in the less expensive product forms (e.g., canned tuna), and smaller increases in volume of the quantity of the more expensive product forms (e.g., shrimp). Part of the reduction in quantity or volume of exports may be due to the reduction of quantity, as a result of de-certification among some firms (based on processor interviews). On the other hand, the value of exports for non-HACCP-requiring countries increased, mainly due to increases in the quantity rather than price. In relation to firm response, although there are some increases in the quantity exported to other markets, this amount is rather small compared to the increase apparent from the secondary data. Moreover, there were no shifts from HACCP-requiring countries to non-HACCP-requiring countries apparent in interview data. Thus, the general increase may be mainly due to other demand factors in addition to the influence of HACCP certification and de-certification of firms.

4.3.1.3 Expected Increases in Output due to HACCP Adoption

Increases in the quantity of output, due to HACCP adoption are expected by some firms in the next five years (2006-2010) (see questionnaire in Appendix 1). One certified firm reported an expected ten-percent increase, and nine certified firms reported an expected five-percent increase in the quantity exported to EU (Tables 24 and 25). Again, these increases are anticipated mainly to come from sales to new buyers in EU markets that will be facilitated by HACCP certification. Interestingly, no large firm indicated any expected increase, while the other firm size categories (cottage, very-small, small, medium, and large firms) did anticipate increases sales (Tables 24 and 25). The remaining 14 certified firms did not anticipate any increases in quantity exported to EU in the next five years. The average expected increase in export quantity to EU is 2.1 percent

for the 26 certified firms.[126]

In terms of exports to US, one certified firm reported an expected ten-percent increase and six certified firms reported an expected five-percent increase in quantity of exports. Again, these expected increases were from cottage, very-small, small, and medium firms; and no anticipated changes were reported by large firms. The remaining 19 certified firms anticipated no increases in the quantity exported to US in the next five years. The average expected increase in export quantity to US is 1.5 percent for the 26 firms.[127]

Certified firms also reported an expected increase in the quantity of output to be sold to other markets. Eight certified firms reported an expected five-percent increase in the quantity of output to be sold to both existing and new buyers in other markets. These expected increases come from all firm groups irrespective of size. The average expected increase in sales quantity to other markets is 1.5 percent for the 26 firms.[128]

The average anticipated increases in sales described above are higher for the EU than for the US and other markets. Moreover, the anticipated increases in US and other markets may be linked to potential positive spillover effects of HACCP certification for one export destination, i.e., EU, on sales to other markets. The expected percentage increase in sales due to HACCP adoption seems to be relatively large (i.e., 1.4 to 2.7 percent of sales value). However, actual profit increases accruing to processing firms may

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[126] The mean for cottage firms is 1.7 percent; five percent mean for very small; four percent for small firms; one percent for medium firms; and zero for large firms (Table 21).

[127] The mean for cottage firms is 1.7 percent; one percent mean for very small; five percent for small firms; one percent for medium firms; and zero for large firms (Table 21).

[128] The mean for cottage firms is 1.7 percent; two percent mean for very small, small, and medium firms; and 0.6 percent for large firms (Table 21).

be small. At this point, gauging the significance of these benefits and deriving any implications would not provide information without taking into consideration the other benefits and comparing it with the costs.

4.3.1.4 Reduction in Rejection Rate

Firm responses showed mixed results in terms of the change in rejection rates due to HACCP adoption. The majority of the respondents (18 certified and de-certified firms) said that there were no differences in their rejection rates before and after HACCP adoption. On one extreme, three firms (two certified and one de-certified) said that they experienced higher rejection rates by one to four percent after HACCP adoption at the national certification agency (BFAR) and importing country ports, due to more stringent product testing that accompanied the mandatory regulation (Table 27). In contrast, four firms (one certified and three de-certified) mentioned that they had experienced lower rejection rates by one to four percent at BFAR and importing country ports after HACCP adoption.

Table 27. Summary of responses on the changes in rejection rates

Respondents	No Change	Increased rejection rates	Decreased rejection rates
Certified firms	Eleven (11) firms said that there was no change (5 firms have no answer).		
Firm A		Increase 2-4 percent at the importing country's port	
Firm B		Increase from zero to one percent at importing country port from due to stricter	
Firm C			Decrease from 2-4 percent to one percent at BFAR and importing country port
De-certified firms	Seven (7) firms said that there was no change (4 firms did not answer).		
Firm D		Increase at BFAR from zero percent to 1 percent; increase at importing country port from zero percent to 2-4 percent	
Firm E			Decrease at BFAR from 1 percent to zero percent; decrease at importing country port from 1 percent to zero percent
Firm F			Decrease at BFAR and importing country port from 2-4 percent to zero percent
Firm G			Decrease at BFAR from 1 percent to zero percent; decrease at importing country port from 1 percent to zero percent

Source: Author's interviews

4.3.1.5 Cost Savings from Lower Product Wastage

While there was no clear evidence of lower rejection rates, some certified firms indicated that they have experienced lower product wastage resulting from both lower product microbial counts and lower spoilage of raw materials and processed products. Two large firms and two medium firms said they had experienced about half a percent (0.5 percent) cost savings, due to reduction in product wastage and consolidation of processes made possible by the HACCP process standard (Table 24 above). Four large firms reported that they have experienced reduction in product wastage, but could not tell

the percentage of the reduction in costs. For computational purposes, we can assume that the percentage reduction in product wastage for the latter set of firms is also 0.5 percent. In contrast, cottage, very-small and small firms said they had experienced no improvement in product wastage and consolidation of processes as a result of adopting HACCP process standard.[129] De-certified firms also reported no cost savings from lower product wastage when they were still under HACCP systems.

4.3.2 Cost of HACCP Adoption

Across all respondents, on average, seafood processors estimated additional costs associated with HACCP systems equal to US$ 46,000 for fixed and non-recurring costs and US$ 19,000 for recurring costs. There were no significant differences in costs of HACCP adoption reported between certified and de-certified firms within the same size group. However, there is clear variability of costs according to firm size (Table 28). For instance, fixed costs for a representative cottage firm is US$ 1,700 compared to US$ 13,100 for very-small firm; US$ 32,400 for small firm; US$ 51,300 for medium firm; and US$ 89,300 for large firm. A similar pattern of differences exists for the recurring costs.

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[129] An interesting observation pertains to why the larger firms have higher tendency of reported improvements in operational efficiency vis-à-vis the smaller firms. Since HACCP systems, as any process standard, aim to coordinate, consolidate and reduce inefficiencies in the operation, these systems may impact larger firms more than smaller firms due to a more complex processes and more potential cross contamination in production inherent in larger firms.

Table 28. Total costs of HACCP systems for representative firms (in US$ 000)

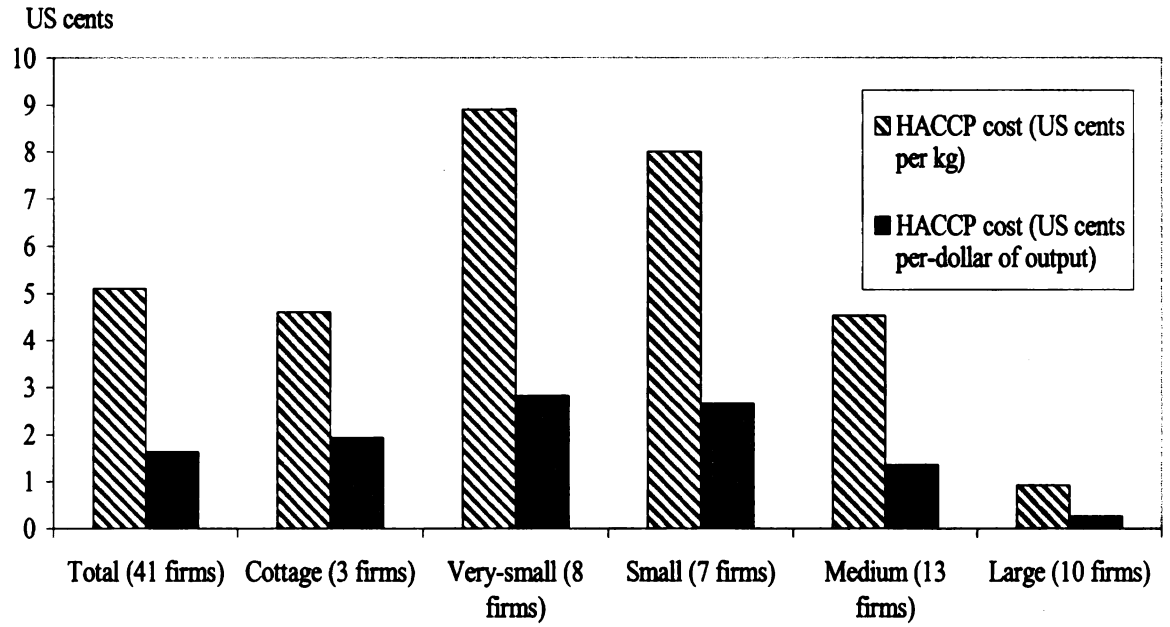
Cost Category	Cottage		Very-small		Small		Medium		Large	
	NR /1	R	NR	R	NR	R	NR	R	NR	R
Total /2	**1.7**	**1.9**	**13.1**	**4**	**32.4**	**7.3**	**51.3**	**13.4**	**89.3**	**53.1**
Plant & equipment cost (actual)	*1.3*	*0.1*	*10.1*	*0.3*	*28.3*	*0.8*	*46.6*	*0.3*	*81.6*	*8.2*
Other start-up HACCP costs										
Consultant's costs	-	-	1.6	-	1.8	-	1.1	2.7	0.4	6.2
HACCP training costs	0.1	-	0.6	-	0.7	-	1.9	-	3.5	-
Staff time in HACCP plan design	0.3	-	0.8	-	1.6	-	1.6	-	3.8	-
Total operating costs	-	***1.8***	-	***3.7***	-	***6.5***	-	***10.5***	-	***38.7***
Additional lab test costs	-	0.9	-	0.8	-	1.1	-	1.1	-	4.2
Additional manpower hired	-	-	-	0.7	-	0.7	-	0.2	-	17.1
Additional materials and utilities	-	-	-	-	-	1.7	-	1.0	-	2.5
Total additional GMP	-	*0.9*	-	*2.3*	-	*3.0*	-	*8.1*	-	*14.9*
GMP personnel training	-	0.2	-	0.6	-	0.7	-	2.0	-	3.6
GMP personnel expenses	-	0.2	-	0.6	-	0.8	-	2.0	-	3.6
GMP cleaning	-	0.4	-	0.6	-	0.7	-	2.0	-	3.8
GMP pest control	-	0.2	-	0.6	-	0.7	-	2.0	-	3.8
Interest + Depreciation /3	-	***0.4***	-	***3.0***	-	***8.0***	-	***12.0***	-	***21.0***

Source: Author's interviews. Note: Figure were converted using a PhP 55/US$ 1 exchange rate, which is the average in years 2002-2005. Dash means zero. /1 NR=Non-recurring, fixed costs; R=Recurring, yearly costs. /2 Does not include interest and deprecation costs. /3 Since capital investments are included in the non-recurring and recurring costs, interest and depreciation cost are not included in the total costs. However, in computing for variable costs and assuming that all the capital investments are loaned, these costs would be included.

Assuming a straight line depreciation of capital investments, annual HACCP costs were computed and compared with the firms' output quantity and value. Figure 19 presents the comparison of these HACCP costs across different firm sizes. Very-small firms had the highest cost per unit, followed by small firms. Cottage and medium firms have low costs per unit, but have substantially higher cost per unit than large firms. Figure 19 shows some indication of decreasing HACCP costs with the size of firm's output. However, the relatively lower cost by cottage firms than very-small and small firms warrants further investigation.[130]

[130] This will be further examined in Chapter 4.

Figure 19. HACCP cost per unit and value of output (in US cents)



Source: Author's interviews

4.3.3 Cost of HACCP Non-Adoption

For cost of non-adoption, the most direct source of information is the experience of de-certified firms when they were still certified. Of the 15 de-certified firms, five firms were exporting to EU markets prior to de-certification – three firms exported five percent; one firm exported 20 percent; and another firm exported ten percent (Table 29). Only one of these firms was able to shift some output to other markets, but at a much lower price. Moreover, this firm mentioned that this was an exception, as it is often extremely difficult to shift products to other markets.

Table 29. Export loss of sample firms due to HACCP de-certification, 2005

Company	Product	Output (tons/ year)	Shift to other markets	Percent of output value lost due to de-certification	Net loss (tons/year)
(A)	Frozen tuna	720	NO	5	36
(B)	Frozen tuna	540	50 percent of total US$ 108 export value to EU were able to shift	10	54
(C)	Shrimp	840	NO	10	84
(D)	Frozen tuna	480	NO	5	24
(E)	Shrimp	2,040	NO	5	102

Source: Author's interviews

When the certified firms were asked what would have happened without certification, 15 firms indicated they had an alternative market for some products. However, they would be forced to accept lower prices (about 20-40 percent lower based on the responses) in addition to reduced volume of sales (as already demonstrated by the volume of sales experience of the de-certified firms). Furthermore, these firms mentioned that they would incur additional investment in finding new buyers. Two firms mentioned that it would cost them about US$ 2,000 to US$ 5,000 to participate in food exhibitions and fairs to market their product and find potential buyers. Most of these firms believed it would be very difficult to find new buyers without HACCP. Thus, in the face of strong competition, non-adoption would mean that firms would not have alternative markets for their product and forgo their EU sales.

There are also apparent effects of non-adoption on the quantity of output to the US, although results are mixed depending on whether the respondent is certified or de-certified. Based on 15 de-certified firms, quantity of exports to US was not affected as a result of de-certification. On average, exports to US account for 80 percent of total sales for these firms. Since their US market was already large enough to provide them with

enough market even without EU, they had little incentive to adopt the EU HACCP certification. All de-certified respondents said there were no spillover effects on their US exports and that most of their US buyers required a different HACCP certification apart from the EU certification.[131] Some firms have been required to comply with US Department of Commerce certification, while some were just required to fax a copy of the HACCP plan even without approval from BFAR/EU. However, for most certified firms, adopting the EU HACCP certification also enabled them to comply with the US HACCP requirements. For instance, four firms with no or very low EU export still got the EU HACCP certification and were able to maintain their existing US markets with this certification.

There are some evident complementarities among the HACCP certification systems in certain countries. EU HACCP certification was used for US HACCP system compliance by most reporting firms, except a few firms that said they had to comply differently with US HACCP requirements. However, even without EU HACCP certification, firms can still supply to the US and other markets. On the other hand, firms with US HACCP certification were not able to use this certification to comply with EU's requirements. These indicate that EU HACCP requirements and their implementation, at least in the Philippine case, are much stricter than the US HACCP certification to date. According to many reporting firms, EU HACCP certification gave them a much secured position to maintain their current buyers not only in the EU, but also in other export markets and also the domestic market. Moreover, tuna canners reported that HACCP

131 This has been confirmed by Ching Baltazar, chief inspector of BFAR, in which she said that there is no agreement between the Philippines and the US to do the certification, but it depends on the importer to assure that their suppliers has HACCP system (based on the personal communications on September 1, 2005.

certification is a must for their industry, regardless of the market.

The above experiences by the processing firms indicate a much larger positive effect of EU HACCP certification coming from the complementary of different countries' certification and resulting increase in sales to US and other markets. Complying with food safety requirements in the EU also resulted in meeting requirements to export to the US and other markets (although the reverse is not true). As a result, efforts to implement enhanced food safety controls by the EU market may well have contributed to improve system-wide efficiency and reduced costs of adoption for distinct requirements in other export markets. These spillover effects to other markets will be included in the analyses made in the next sections.

4.3.4 NBC Analysis

The NBC estimation models for five representative processing firms across a span of nine years are presented in equation 26. Actual profit changes due to HACCP adoption and hypothetical missed profit changes due to non-adoption are added to estimate NBC. Based on equations 8, 9, and 10 (section 2.2 above), the NBC of HACCP adoption for representative firm *i* is the sum of the proportion of actual profit change associated with the actual change in quantity sold; proportion of actual profit change associated with the actual change in price; price gains from capturing higher-price markets than existing lower-price markets; and actual changes in costs due to HACCP adoption, less the hypothetically missed profit change in the event of non-adoption. Given *i* number of representative firms; *j* number of markets destinations; *k* number of product forms; and *t* time periods, equations 8, 9, and 10 can be rewritten as equation 26 below:

$$NBC_i = \Sigma_t \delta_t E[\Sigma_j \Sigma_k ((PM_{ijkt} \cdot (\Delta Y_{ijkt,H=1} - \Delta Y_{ijkt,H=0})) + (P_{ijkt,S1-S2} \cdot \lambda \Delta Y_{ijkt,H=1}) + (Y \cdot (\Delta P_{ijkt,H=1} - \Delta P_{ijkt,H=0})) + \Delta C_{ijkt,H=1})] \quad (26)$$

where i is the ith representative firm; j is the jth market; k is the kth product; t is time period; δ is the discount rate; λ is the proportion of the change in sales quantity as a result of capturing new higher-price markets in addition to already existing markets; and other variables are defined similarly as the earlier equations. The categories of representative firms, markets, products, and time used in the estimation are presented in Table 30. In terms of the NBC of HACCP adoption for a span of nine years, the net present values of total NBC from HACCP adoption were computed using an 11.5 percent discount factor and interest rate, which is adopted from the computed economic cost of capital in the Philippines by ADB (2005).

Table 30. Relevant categories of firms, markets, products, and time used in the NBC estimation

Category	Category Code	Definition
Representative firm	I	Representative firm as defined earlier (1=cottage, 2=very-small, 3=small, 4=medium, and 5=large)
Market	J	Region/country of product destination (1=EU, 2=US, 3=Other markets)
Product	K	Products (1=canned tuna, 2=frozen tuna; 3=shrimp; 4=milkfish; 5=octopus; 6=shrimp fry; 7=others)
Time	T	Time period (=1,2,3,4,5,6,7,8,9)

4.3.4.1 Assumptions of NBC Analysis

There are several assumptions made in the NBC estimations to simplify the estimation and make calculations possible. First, analysis is dependent on averages, which may hide variability in the data and introduces risk of overly generalization. This

chapter evaluates "representative" firms, which imply looking at central tendencies, but then considers different scenarios to determine sensitivity of the results to changes in the assumptions and averages. Second, expectations of increases in price and quantity were based on how firms anticipated the next five years, irrespective of actual or forecasted demand worldwide. Firms are assumed to be a knowledgeable source of information in terms of the future prospect for the specific firm or the industry. Third, analysis is based on hypothetical scenarios and respondents may have incentives to portray themselves in a more favorable light (social desirability bias) and assume that their experience will most likely also happen to other firms if they follow the same option (i.e., the opportunity costs of not adopting one specific option is proxied by the actual gains of those who have adopted that option). However, experiences of other firms are the only available source of expectations for what could have occurred and opportunity costs of their choices. Social desirability bias is minimized by introducing the objective of the research in general and of specific sensitive questions in a manner to minimize tendencies to favor either extreme side of the situation. Motivations are for the government and international community to know what the constraints really are, and at the same time, not tarnish the image of the industry by exaggerating complaints and negative responses.

4.3.4.2 Results of the NBC Estimation

Based on Table 31, 54 percent of the respondents have a negative NBC. Thus, processing firms in general would lose more than gain from EU HACCP adoption. All representative de-certified firms would lose with a range from 0.2 to 2.0 percent, if they would adopt EU HACCP systems. This seemingly lack of financial incentive may have been the reason why many firms discontinued certification. Very-small firms have the

highest loss, if these firms continued to adopt, which equals to two percent of total production value. Cottage and very-small certified firms would also lose about 0.6 to 0.8 percent from EU HACCP adoption. Despite this loss due to adoption, their actual decision to adopt implies that there might be other actual or expected benefits that they derive that are possibly not captured in the estimates. It might also be that these cottage and very-small firms have actually received subsidies from the government or support from importers, and thus may have overstated their reported costs.

Positive NBCs (by most certified firms) are mainly due to large cost savings from the reduction of product wastage[132] related to adoption of the HACCP systems and the EU and US exports that they would have foregone in case of non-adoption. Among the certified firms, large firms seem to have the highest net benefit from HACCP adoption, with approximately US$ 366,500 additional net profits or 1.2 percent of total production value.

[132] Although the percentage cost savings is only 0.5 percent average, the total amount saved once this percentage is multiplied to the total firm cost is much higher than the contribution to profit increases from quantity increases and other realized gains.

Table 31. NBC estimation of representative certified firm, processing industry, and fisheries supply chain from HACCP certification (in US$ 000), Year 2

$$NBC_i = \Sigma_t \delta_t E[\Sigma_j \Sigma_k ((PM_{ijkt} \cdot (\Delta Y_{ijkt,H=1} - \Delta Y_{ijkt,H=0})) + (P_{ijkt,S1-S2} \cdot \lambda \Delta Y_{ijkt,H=1}) + (Y \cdot (\Delta P_{ijkt,H=1} - \Delta P_{ijkt,H=0})) + (\Delta C_{ijkt,H=1} - \Delta C_{ijkt,H=0}))]$$

		Certified Firms					De-certified firms *			
		C (5)	VS (5)	S (5)	M (5)	L (8)	VS (3)	S (2)	M (8)	L (2)
Contribution from increased export quantity to EU	$(PM_i \cdot \Delta Y_{i,EU,H=1})$	0.0	0.0	0.0	0.0	0.0	-	-	-	-
Contribution from increased export quantity to US	$(PM_i \cdot \Delta Y_{i,US,H=1})$	-	-	-	-	-	-	-	-	-
Contribution from increased export quantity to other markets	$(PM_i \cdot \Delta Y_{i,OTH,H=1})$	0.0	0.0	0.0	0.2	1.4	-	-	-	-
Export loss from EU due to non-adoption	$(PM_i \cdot \Delta Y_{i,EU,H=0})$	-2.0	-4.5	-17.2	-17.4	-256.8	-0.1	-1.5	-2.2	-6.2
Export loss from US due to non-adoption	$(PM_i \cdot \Delta Y_{i,US,H=0})$	-	-2.0	-4.0	-9.7	-108.1	-0.9	-3.3	-8.0	-20.7
Sales loss from others markets due to non-adoption /a	$(PM_i \cdot \Delta Y_{i,OTH,H=0})$	-	-	-	-	-7.4	-	-	-	-
Contribution from price difference between newly captured markets and existing ones /b	$(P_{i,S1-S2} \cdot \lambda \Delta Y_{i,EU,US,H=1})$	0.0	0.0	0.0	0.0	0.0	-	-	-	-
Operating costs /c	$(\Delta C_{i,OC,H=1})$	1.9	4.0	7.3	13.4	53.1	4.0	7.3	13.4	53.1
Cost of capital amortization and interest rate /c	$(\Delta C_{i,K,H=1})$	0.4	3.1	7.8	12.3	21.4	3.1	7.8	12.3	21.4
Reduction on product wastage	$(\Delta C_{i,PW,H=1})$	-	-	-	18.1	67.2	-	-	-	-
$NBC_{t=2}$		**-0.3**	**-2.5**	**6.2**	**19.6**	**366.5**	**-6.1**	**-10.2**	**-15.5**	**-47.6**
		[-0.6]	*[-0.8]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-2.0]*	*[-0.3]*	*[-0.4]*	*[-0.2]*

**No cottage de-certified firm; Figures represent the periods with certification by de-certified firms; **Figures in italics and in square brackets are in percent pertaining to the ratio of the NBC to the total value of output. Dash means zero. Figure= 0.0 means the figures is greater than zero but less US$ 100. /a This corresponds to the loss of exports of canned tuna in other markets due to non-adoption. The loss of canned tuna exports in the EU and US*

Table 31. cont'd

markets are already captured in the overall export losses in these markets due to HACCP non-adoption. [/b] *Only a portion of the total increase in quantity comes from capturing new higher-price markets. The price differential is applied only to this portion of quantity increase and not the total increase.* [/c] *Figures are based on Table 28. Interest is computed assuming that all the start up costs will be loaned, using a 11.5-percent rate. In addition to the above computation, estimation was made, where costs of capital amortization and interest rate were assumed to accrue regardless of whether the firm continued or discontinued with HACCP certification. Thus, these costs also showed up as cost under de-certification, which implies a canceling-out effect of these cost items as certification-related costs and de-certification-related costs.*

Similar patterns are observed if the net present value for nine-year timeframe was computed for both certified and de-certified firms. Based on Table 32, small, medium and large certified firms would benefit from HACCP adoption by 0.2 to 1.2 percent; while the remaining majority of the firms would lose from HACCP adoption. For certified firms, EU HACCP certification provided them with a weighted-average[133] net gain equal to 0.8 percent of the firms' total production value. For de-certified firms, the NPV of HACCP system for all representative firms (irrespective of size) is negative, indicating a range of net losses between US$ 32,600 to US$ 254,000 (or less than 0.1 percent to 1.7 percent of total output value) for period of nine years. This translates to a weighted-average net loss equal to 0.4-percent of the firms' total production value.

Table 32. NBC analysis of HACCP adoption (in US$ 000)*

	Certified					De-certified			
	C	VS	S	M	L	VS	S	M	L
NBC1 [a]	INVESTMENT [b]					INVESTMENT			
NBC2	-0.3	-2.2	5.6	17.8	333.1	-5.6	-9.3	-14.0	-43.3
NBC3	-0.3	-2.0	5.1	16.2	302.9	-5.1	-8.5	-12.8	-39.4
NBC4	-0.2	-1.9	4.6	14.7	275.3	-4.6	-7.7	-11.6	-35.8
NBC5	-0.2	-1.7	4.6	13.6	303.4	-4.2	-7.0	-10.6	-32.5
NBC6	-0.2	-1.5	4.2	12.4	275.8	-3.8	-6.4	-9.6	-29.6
NBC7	-0.2	-1.4	3.8	11.3	250.7	-3.5	-5.8	-8.7	-26.9
NBC8	-0.2	-1.3	3.4	10.2	227.3	-3.1	-5.3	-7.9	-24.4
NBC9	-0.1	-1.1	3.1	9.3	206.6	-2.9	-4.8	-7.2	-22.2
Total NPV	**-1.7**	**-13.1**	**34.4**	**105.5**	**2175.1**	**-32.6**	**-54.7**	**-82.4**	**-254.1**
% to Output	***[-0.5]***	***[-0.7]***	***[0.2]***	***[0.4]***	***[1.2]***	***[-1.7]***	***[-0.2]***	***[-0.4]***	***[-0.1]***

** Figures are adjusted with 11.5-percent discount rate. [a] Represents the Net Benefit/Cost of HACCP adoption in Year 1; and the succeeding rows correspond to Year 2-9. [b] Fixed, non-recurring investments (in terms of physical plant facility, renovations, equipments, and HACCP plan development) are made in Year1.*

This financial loss is most likely the biggest disincentive for de-certified firms to

[133] The NBC percentages (to firm's total production value) were weighed using the number of firms in each size category to get the average NBC for both certified and de-certified firms.

continue with their EU HACCP certification. In addition to the above computation, a second estimate of NPV resulting from decertification was made, assuming that the capital costs of investments made to meet HACCP requirements (i.e., costs of capital amortization and interest rate in Table 31 above) would continue to accrue for the life of the assets even if the firm was decertified. In other words, we took these investments as fixed and not redeployable. Thus, these costs would show up not only as cost item under certification, and also as cost item under de-certification in Table 31 above. This assumption would lead to positive NBC for all certified firms; and slightly lower net loss for de-certified firms.

Estimations were also made using five and ten percent as proportion of exports to EU, representing two higher percentages of EU exports of reporting firms, instead of the three-percent average across all de-certified firms. Results showed that de-certified firms would still experience net loss if they continued certification. Some de-certified firms reported that requirements were becoming stricter each year, and that it was becoming more difficult to comply. Moreover, they said that it had already been harder to access funds to make the required additional investments.

In sum, a typical certified firm would summarize its decision and behavior towards initial and continued certification as follows:

> "We got certified because we anticipated a large EU market loss if we did not. Our cost of compliance was much greater than the financial benefits we derived as a result of our certification. But, what we gained is our ability to maintain our EU market, which we would have lost if we did not

get certification."

A typical de-certified firm, with zero EU exports to start with, would summarize its decision and behavior towards initial certification and de-certification as follows:

> "We got certified because we anticipated that we could capture some new EU and US buyers by complying with EU HACCP certification. However, we did not receive financial benefits from our certification, and the costs of compliance were substantial. Requirements were getting stricter and the cost of compliance became higher each year. We did not have an EU market to lose if we discontinued. Even though we still had to pay the capital amortization and interest rate from our initial fixed investments, it would still be financially beneficial for us to discontinue. Our US and other markets were not affected by our decision to initially certify and our subsequent decision to de-certify."

A typical de-certified firm, with more than five percent EU exports to start with, would summarize its decision and behavior towards initial certification and de-certification as follows:

> "We got certified because we anticipated that we could capture new EU and US buyers by complying with EU HACCP certification and we did not want to lose our small EU market. However, we did not receive

financial benefits from our certification, and the costs of compliance were substantial. Since we have a small proportion of EU exports, we would lose fully this market if we discontinued. Requirements were getting stricter and the cost to comply has gone higher each year. It has been getting more difficult to comply; and getting harder to access funds to make the necessary additional investments to comply. Our US and other markets were not affected by our decision to initially certify and our subsequent decision to de-certify, but our small EU exports would be fully lost."

Lastly, a firm without HACCP system would summarize its decision and behavior towards non-certification as follows:

"We did not adopt HACCP because it is not required by our current buyers. We did not want to go to the trouble and difficulties of adopting this seemingly complex system. However, in the future, if we plan to capture the export market, it would be more challenging to export due to this added HACCP regulation. Moreover, there is also threat that HACCP will be harmonized and required to all food supply, and thus, this poses a substantial challenge for us in the future."

4.3.4.3 Supply Chain Perspective

So far, costs and benefits of EU HACCP adoption and de-certification from the processing firm's perspective are estimated and analyzed. However, other players of the

industry may also be affected by the adoption decisions of these processing firms.

First, we start by looking at the value to the whole fisheries industry of the EU market access. Recall from above that the gross value of seafood output was US$ 2.3 billion (in 2002), of which 23 percent were from exports (30 percent of total exports to US, 24 percent to Japan, and 12 percent to EU). The net value added (NVA) of the industry is often computed as the gross output value less the total value of production inputs. The Philippine Input-Output (IO) matrix contains information on total inputs used by the industry. The latest available IO matrix is 1995; and due to the lack of more recent data,[134] we used the percentage or proportion of input values to total output values in 1995, and extrapolated this percentage with the latest figure on total output value (in 2002). Total inputs were 66 percent of the total output value in 1995 (equivalent to US$ 1.5 billion in 2002), and the NVA of seafood industry was 34 percent of the total output value (equivalent to US$ 801 million in 2002).

The NVA of seafood exports is US$ 184 million (measured as 23 percent of NVA).[135] Assuming equal NVA across export markets, NVA of seafood exports to US is US$ 55 million (30 percent of total exports); NVA of seafood exports to Japan is US$ 44 million (24 percent); and NVA of seafood exports to EU is US$ 22 million (12 percent).

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[134] The National Statistical Coordinating Board (NSCB) has been contacted by the author for more recent IO matrix, but it still could not release the latest versions to public. The 1995 figures and percentages used here may overstate the net value added of the Philippine seafood industry, considering that 1994 was prior to the development of seafood industries in several countries, e.g., in Vietnam and India. After this period, markets and prices were more competitive, and thus, provided less output value captured by players along the supply chain. Thus, these estimates above may be overstated. Since it is difficult to measure the overestimation, we discuss below different scenarios to see how sensitive the results and their implications are to the level of overestimation.

[135] One could assume that the NVA of seafood exports is greater than the NVA of the other sub-sectors in the seafood industry. However, due to lack of more detailed data, we applied the percentage of export to total value to arrive at an estimate of NVA of seafood export.

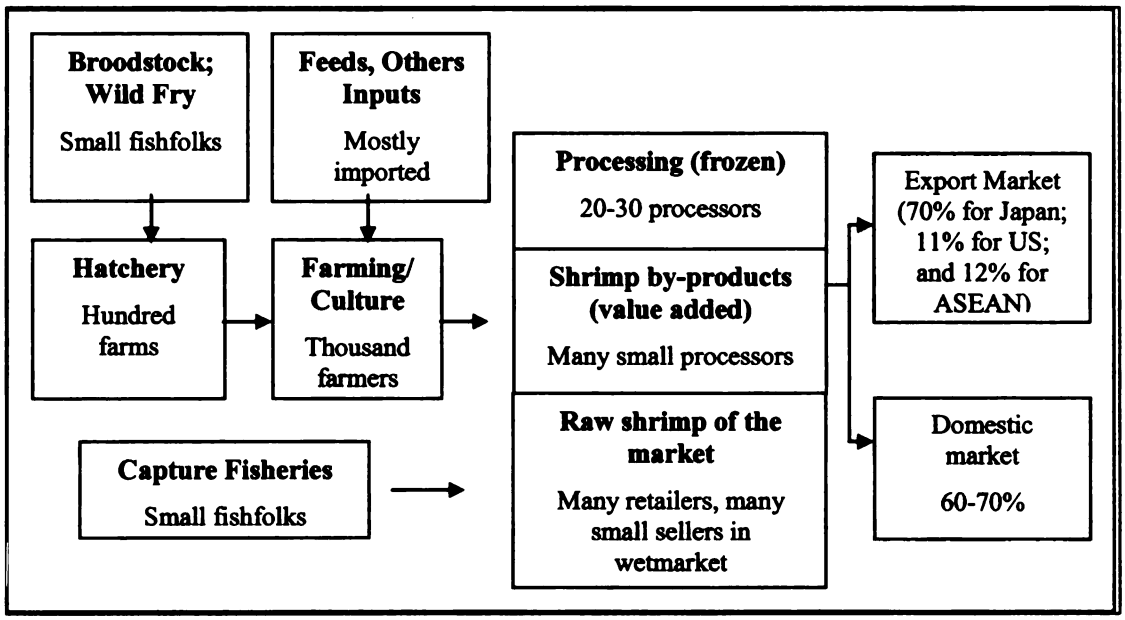
This NVA, originally enjoyed by the different players of the industry, would be lost due to the inability of firms to comply with the regulations of these markets. For instance, inability of processing firms to comply with EU HACCP certification would entail market access loss for the fisheries industry equivalent to US$ 22 million (the NVA of seafood exports to EU), and possibly some spillover effect to other markets.

However, as illustrated by the results above, not all processing firms will get certification and not all will remain without EU HACCP certification, depending on the actual cost and benefits experienced. As shown above, certified firms benefited from certification, thus they continued being certified; de-certified firms did not benefit by continuing certification, thus they de-certified; and firms without HACCP had no capacity and anticipated no benefits from adoption, thus they continued without certification. In other words, so long as some processors continue with certification and are able to supply to EU, the NVA of the industry from EU exports would not be fully lost. However, de-certification by some firms would mean a loss of a proportion of these NVA, estimated to be three percent of the total value of exports, average among the de-certified firms (details are discussed below).

To understand better the above complexities related to certification and de-certification, the fisheries industry is broken down into subsectors; and the different players and actors are now the focus of the analysis. Figures 20 and 21 show tuna and shrimp supply chains in the Philippines. The former represents capture fisheries, in general; and the latter represents the aquaculture products, in general. For aquaculture, the processes are: collection of wild broodstock, hatchery, farming, and the associated feed milling, processing, and marketing operations. For capture fisheries, the process

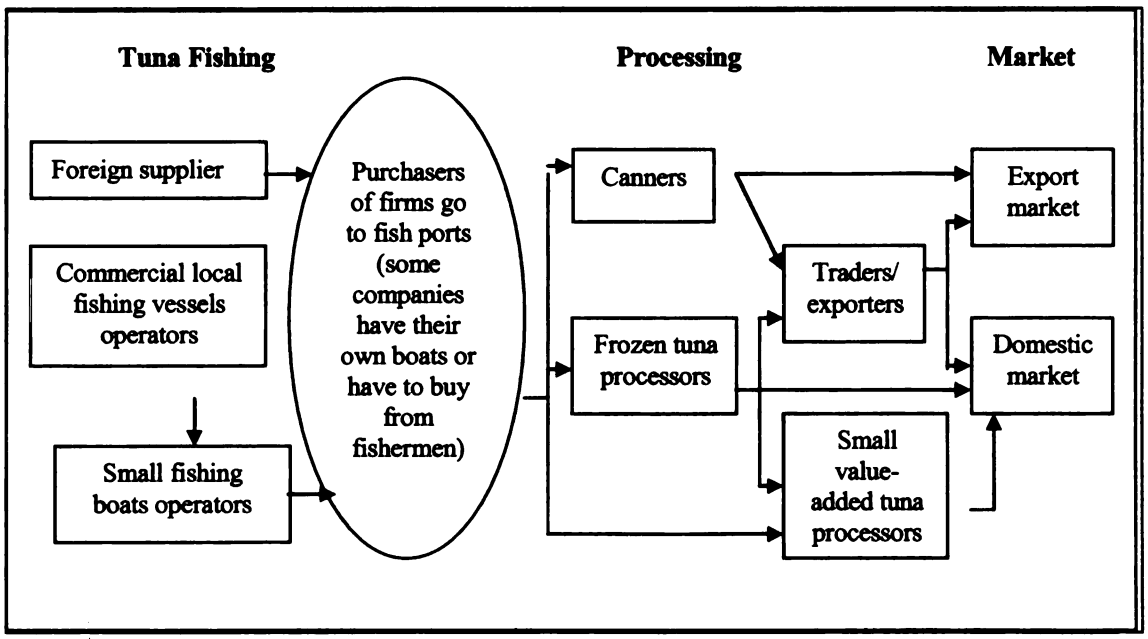
starts with fishing (often through fishing vessels), then transferring to smaller boats to take the fish to the ports, and then processing into frozen, chilled or canned products.

Figure 20. Philippine shrimp supply chain



Sources: Auburn University (1992); JMC (1997); Author's interviews

Figure 21. Philippine tuna supply chain



Source: Author's interviews

Key actors in the above activities can be grouped as: raw fish producers, other input suppliers, traders, and processors. The link between consumers and other chain actors is not discussed here since results above showed that output prices have not been responding to stricter controls of the food supply. Processors have been discussed in detail above, and thus, they are mentioned here, but are not fully discussed. This section focuses on the other players: raw fish producers, other input suppliers, and traders.

These other players are affected by both EU HACCP certification and de-certification by processing firms. First, processing firms' certification and its effect on other players are discussed. Since processing firms did not receive higher prices by adopting EU HACCP certification, it is also likely that other players would not receive higher prices as a result of processing firms' certification. Instead of price increases, their gains are in the form of net profits and NVA of newly-captured EU and US markets by processing firms. However, other players also bear some costs related to HACCP certification by processing firms. Recall from the above discussions that HACCP systems entail procedures and strategies to ensure safety of raw materials and other inputs. While processing firms have the responsibility to ensure this, they may pass the cost to raw material and input suppliers. Processing firms were asked what processes and activities were undertaken to ensure safe raw fish materials and inputs. Their responses are as follows:

(i) All firms reported rigorous testing for contaminants present in the raw fish materials

(ii) Sixty percent of the firms reported contracting with reliable raw fish suppliers

(iii) One firm reported slowly venturing into owned raw fish farms

Processing firms were asked how the above activities affected their raw material producers; and responses were varied depending on whether the raw fish are from aquaculture or fishing. Tuna processors said that raw tuna suppliers were not affected. Processing firms reported that fishing companies often have the control over raw fish supply. This implies that prices of raw fish adjust upwards quickly in response to less raw fish supply, but prices often do not respond easily to increases in available supply. In this case, the processing firms bear most of the cost of certification.

In terms of aquaculture (mainly shrimp and milkfish), processing firms said that raw fish producers were also affected by EU HACCP certification by processing firms. In most cases, fishfarmers had to change their production processes in order to comply with stricter requirements by the processors. The threat of not getting a contract from these processors poses a challenge to improve their processes, strengthen their control over contaminants in the production, and in some instances, comply with Best Aquaculture Practices, to signal their image to processors and other buyers. One processing firm said its firm had to vertically integrate to manage its raw fish materials better. As such, the cost of certification was borne entirely by the processor, but it also captured all the benefits. However, this poses greater pressure for other suppliers to adopt better production processes, otherwise, they lose their buyers, which have options to vertically integrate. Most of the de-certified firms said that other players were not affected since most costs were borne by the processors.

Nine raw fish producers (those supplying to certified, de-certified, and firms without HACCP) were also asked whether they are affected by HACCP certification by processing firms. Two producers, who supply to certified firms, said they incur higher

costs to comply with stricter requirements by processors; and the other fish producer, supplying to certified tuna processing firms, said it was not affected by HACCP system. Three fish suppliers of de-certified firms said they were not affected by EU HACCP certification. Three fish suppliers of firms without HACCP said they were not also affected by EU HACCP certification.

Second, processing firms' EU HACCP de-certification and its effect on other players are discussed. Recall from section 4.3.3 that the case of de-certification led to a loss of 5-10 percent per year of total sales (equivalent to approximately US$ 80,000 to US$ 350,000 loss per firm annually). However, when the costs of certification were accounted for, de-certified firms would actually be losing if they continued to be certified (average of 0.4 percent of firms' total production value). Thus, de-certification seems to be a "smart" financial strategy for de-certified firms. But, other players are negatively affected as described below.

Similar to effects of certification discussed above, when de-certified firms were asked how de-certification affected the other players in the industry, responses were varied depending on whether the raw fish are from aquaculture or fishing. In terms of tuna and other capture fish, processing firms reported that fishing companies were not affected. There may be some pressure for fishing companies to invest in HACCP certification for their vessels due to stricter regulation from the EU. However, fishing companies are still content with their existing non-EU markets, and thus, would not be affected much by the EU's regulation in the near future. However, the non-compliance of fishing vessels with HACCP regulation continues to put pressure on processing firms, facing greater challenges of finding raw fish materials from HACCP-compliant fishing

vessels. For caught seafood, this would also put pressure on the inability of the country to access the EU markets if the non-compliance of fishing vessels continues.

In terms of aquaculture, processing firms said that raw fish producers were affected by de-certification. Responding processors said de-certification meant a loss of an important market for the raw fish producers. This is confirmed by three raw fish suppliers of de-certified firms who were interviewed. In some cases, they were able to supply their raw fish to other domestic buyers and other importers, but had to face a much lower price. Based on Table 21 above, EU prices received by processors are higher by 22 for shrimp and 57 percent for milkfish. Prices received by raw fish suppliers also follow this pattern of price differences across markets. For the raw fish suppliers,[136] the loss of market (reduction in production by the de-certified firms) meant loss in profit (often measured as the net value added of producing raw fish). Thus, the sum of the NVA or net profits of these different players in the supply chain that are lost due to processing firms' de-certification can be interpreted as the industry-wide losses from EU HACCP de-certification.

A de-certified firm exports about US$ 9.4 million per year to all export markets on the average, and US$ 300,000 from this would be lost from EU HACCP de-certification, representing a loss of EU market access (recall that de-certified firms have a three-percent average proportion of exports to EU). There were 60 de-certified firms in 2005; and thus, the total EU export loss from de-certification of these firms is about US$ 18 million GVA, or US$ 6 million NVA (recall that 34 percent of seafood output value is the industry players' NVA). This figure represents 0.26 percent of the total gross value of

[136] There are two integrated firms as respondents.

seafood output; 0.75 percent of the total seafood export value; 3.3 percent of the NVA of seafood exports; or 27 percent of the NVA of seafood exports to EU. At the industry level, this figure would seem small in the overall scheme of things, especially if this cost is distributed amongst a wide spread of players. But, at the individual level, it would be a loss of revenue and source of livelihoods for some people.

There may be an overestimation in these figures from adopting the 1995 IO matrix. While it is difficult to ascertain the level of overestimation, different scenarios were adopted to inform about the extent and implication of this overestimation. On one hand, the value of total seafood exports declined by 1.8 percent from 1996-2006 (1.5 percent decline for EU exports). On the other hand, the per-unit value of seafood exports declined by 3.01 percent from 1996-2006) (but, increased slightly to 0.1 percent for EU exports). These figures indicate that quantity of seafood export increased, but the per-unit value decrease (except for the EU market, where quantity of seafood exports is declining and the per-unit value is slight increasing). The above figures also indicate that they may not be overestimation of NVA for seafood exports to EU, considering a slight per-unit value increase of 0.1 percent. Thus, two scenarios were adopted: 0.1-percent increase and 3.01-percent decrease (representing the upper bound) in the value of seafood exports over the years.

Assuming some levels of input prices changes, this figure could be used to project a more realistic, updated figure on the NVA of seafood exports. We assume a six-percent increase in input prices (representing average inflation rate in the Philippines in 1996-2006), and an additional 1.5-percent cost for the HACCP requirement. The first scenario would lead to a new NVA loss due to de-certification equal to US$ 5.1 million per year

(representing a 14-percent overestimation of the earlier estimation). The second scenario would lead to a new NVA loss due to de-certification equal to US$ 4.4 million per year (representing a 26-percent overestimation of the earlier estimation). However, this range accounts for similar percentages as the earlier estimation: 0.19 to 0.26 percent of the total gross value of seafood output; 0.55 to 0.64 percent of the total seafood export value; 2.4 to 2.8 percent of the NVA of seafood exports; or 20 to 23 percent of the NVA of seafood exports to EU. Similar interpretation and implications as above still hold. A summary of the above results are presented in Table 33.

Table 33. Summary of effects of HACCP certification and de-certification on processing firms and other chain players

Activity	Certified	De-certified	Without HACCP	Other Players*
Certification	Net gain=0.8% of total output value	Net loss=0.4% of total output value	No effect	*Capture fisheries*: no effect on other players; processing firms bear all HACCP costs *Aquaculture*: other players bear some of HACCP costs
De-certification	No effect (no shift of buyers from de-certified to certified firms)	Net gain=0.4% of total output value	No effect	*Capture fisheries*: no effect on raw fish producers; raw fish producers' loss of market (due to de-certified firms' loss of EU market) is likely passed on to other buyers in terms of higher raw fish prices *Aquaculture:* many other players would not find new buyers/new productive activities easily; some would be able to find, but at lower NVA; and thus would experience market access loss (=NVA) Total net loss=US$ 4.4-6 million (NVA)

*Note: *Does not include effects on the domestic consumption and local consumers*

There are three important implications of these findings. First, in terms of methodology, accounting for the "without adoption" scenario or opportunity costs substantially changes the results and implications than just accounting for "before and

after" approach.

Second, the results indicate that in many instances, the processing firms mainly bear the costs of implementing HACCP systems and limited costs are being passed along the chain (e.g., raw fish producers, traders, input suppliers, consumers). This is particularly true in the small-country case, where the industry can neither influence the price of its outputs nor influence the price of its inputs in the case of perfectly competitive seafood markets. There are also the potential demand inelasticity and price rigidities worldwide, not affected by intensified controls and stricter regulations for ensuring safe food products worldwide. Thus, output prices do not automatically increase as a result of stricter food safety standards.

Many processing firms would experience a loss from HACCP certification, and thus, they discontinue with the EU HACCP certification. This would lead to a small loss (about US$ 4-6 million) to the entire fisheries industry, especially if this cost is distributed among many players. The actual effect may differ among individuals, with varying degrees of loss of revenue and source of livelihoods. These differentiated and distributional impacts have not been explored by this study, but, an area for future research.

Several implications can be drawn from the results above. From the supply-side, strategies would be needed to improve the capital market and provide greater access to credit to reduce constraints faced by firms and individuals in venturing into productive activities. Collective action or greater engagement in existing associations could also benefit smaller firms, but, the currently limited collective action in the Philippine seafood industry shows that further research is warranted to understand the context where this

collective action may be strategic and efficient. From the demand side, both private and public sectors have a role to influence the inelasticity of demand and price rigidities, in cases where these are due to lagged market reactions or information asymmetries. Strategies can be in the forms of: (i) enhancing consumer awareness to build demand and influence willingness-to-pay for food safety; and (ii) ensuring credible food safety certification systems and to sustain consumer confidence worldwide.

4.3.4.4 Sensitivity Analysis

This section evaluates the robustness of above results to changes in key variables and assumptions. Sensitivity analyses were performed using 15 scenarios that assume different percentages of quantity, price, and cost changes due to HACCP adoption. Changes in Scenarios 1-10 below are based on median values reported by the respondents, instead of the means as used in the above estimation. For instance, two values were used for scenario 1-2 to reflect changes in the assumption on the increased export quantity to EU: one is a higher value and one is a lower value than the one used in the estimation above. The higher value used in the sensitivity analysis is based on the median of the non-zero values reported by the respondents; while the lower value used in the analysis is based on the median of the values reported by all the respondents, which is often zero (Table 34). In addition, Scenario 11 is included with the possibility that smaller firms experienced 0.5 percent cost reduction, due to lower product wastage. Scenario 12 is based on the possibility that the US standards will be harmonized with EU standards in terms of HACCP systems, leading to 100 percent loss of both EU and US exports, as a result of HACCP non-adoption. Scenarios 13 and 14 identify the percentage change in the above benefit/cost categories required for de-certified firms to have positive gains

from HACCP adoption. Scenario 15 adds another benefit item in the form of avoided costs due to retention or refusal of exports at the importing country border, which is roughly estimated by FAFST (2004) to be three percent of the total value of output.[137]

Table 34. Changes of key variables and assumptions used in the sensitivity analysis

	Scenarios used in the sensitivity analysis	Old (All)*	New percentages					
			All	C	VS	S	M	L
(1)	Higher increase in actual export quantity to EU	2.7	10.0	10.0	10.0	10.0	5.0	2.0
(2)	No increase in the actual export quantity to EU	2.7	0.0	0.0	0.0	0.0	0.0	0.0
(3)	Higher increase in expected export quantity to EU in the next 5 years	2.1	5.0	5.0	5.0	5.0	5.0	2.0
(4)	No increase in expected export quantity to EU in the next 5 years	2.1	0.0	0.0	0.0	0.0	0.0	0.0
(5)	Higher increase in expected export quantity to US in the next 5 years	1.5	5.0	5.0	5.0	5.0	5.0	0.0
(6)	No increase in expected export quantity to US in the next 5 years	1.5	0.0	0.0	0.0	0.0	0.0	0.0
(7)	Higher increase in actual sales quantity to other markets	1.4	5.0	5.0	5.0	5.0	5.0	2.0
(8)	No increase in the actual sales quantity to other markets	1.4	0.0	0.0	0.0	0.0	0.0	0.0
(9)	Higher increase in expected sales quantity to other markets in the next 5 years	1.5	5.0	5.0	5.0	5.0	5.0	2.0
(10)	No increase in expected sales quantity to other markets in the next 5 years	1.5	0.0	0.0	0.0	0.0	0.0	0.0
(11)	Higher reduction in product wastage for the cottage, very small, and small firms	0.0	0.5	0.5	0.5	0.5	0.5	0.5
(12)	Higher percentage loss in existing export quantity to US due to non-adoption	0.0	100.0	100.0	100.0	100.0	100.0	100.0
(13)	Increase in the output price received by firms	0.0	2.5	2.5	2.5	2.5	2.5	2.5
(14)	Even higher reduction in product wastage for all firms	0.0; 0.5	1.0	1.0	1.0	1.0	1.0	1.0
(15)	Add 3 percent of total value as benefit (avoided cost of refusal or detention based on FAFST (2004))	0.0	3.0	3.0	3.0	3.0	3.0	3.0

*Note: *The initial (old) percentages of changes in benefit and cost categories are presented in Table 25.*

[137] This category was not used in the initial estimation and was used as a scenario in the sensitivity analysis because of the very small number of firms in which the estimated was based on: only seven firms were interviewed and of these firms, only two were seafood processing firms.

Sensitivity results of scenarios 1-10 are consistent with the baseline above in terms of identifying net losers and net winners from HACCP certification (with only less about one percent change in the magnitude of benefits/costs by representative firms). Results are summarized in Appendix 10 and are described in the succeeding sections:

Scenario 1: Increasing the actual percentage gain in export quantity to EU from 2.7 to 5 percent does not change the net benefits received by processing firms (except a slight increase for cottage firms of 0.1 percent). However, the entire fisheries industry's net benefits increased by 0.8 percent of NVA.

Scenario 2: Reducing the actual percentage gain in export quantity to EU from 2.7 to zero percent does not change the net benefits received by processing firms, but the entire fisheries industry's net benefits decrease by 0.3 percent of NVA.

Scenario 3: Increasing the expected percentage gain in export quantity to EU in the next five years from 2.1 to five percent does not change the net benefits received by processing firms(except a slight increase for cottage firms of 0.1 percent); but the entire fisheries industry's net benefits increase by 0.1 percent of NVA.

Scenario 4: Reducing the expected percentage gain in export quantity to EU in the next five years from 2.1 to zero percent does not change the net benefits received by processing firms, but the entire fisheries industry's net benefits decrease by 0.1 percent of NVA.

Scenario 5: Increasing the expected percentage gain in export quantity to US in the next five years from 1.5 to five percent does not change the net benefits received by processing firms, but the entire fisheries industry's net benefits increase by 0.8 percent of NVA.

Scenario 6: Reducing the expected percentage increase in export quantity to US in the next five years from 1.5 to zero percent does not change the net benefits received by processing firms, but the entire fisheries industry's net benefits would decrease by 0.2 percent of NVA.

Scenario 7: Increasing the actual percentage increase in sales quantity to other markets from 1.4 to five percent does not change the gains received by processing firms, but the entire fisheries industry's net benefits increase by 0.1 percent of NVA.

Scenario 8: Reducing the actual percentage increase in sales quantity to other markets from 1.4 to zero percent does not change the gains received by processing firms, but the entire fisheries industry's net benefits decrease by 0.3 percent of NVA.

Scenario 9: Increasing the expected percentage gain in sales quantity to other markets from 1.5 to five percent does not change the net benefit received by processing firms, but the entire fisheries industry's net benefits increase by 1.1 percent of NVA.

Scenario 10: Reducing the expected percentage gain in sales quantity to other markets 1.5 to zero percent does not change the net benefits received by processing firms, but the entire fisheries industry's net benefits decrease by 0.1 percent of NVA.

Scenario 11: Increasing the percentage reduction on product wastage during processing from zero to 0.5 percent for the representative cottage, very-small, and small firms and the processing industry would provide some changes in net benefits for these firms. For instance, net benefits for representative cottage firms increase by 0.5 percent of the total output value; by 0.4 percent for very-small firms; by 0.5 percent for small firms. Compared to the increases in quantity of output sold above, the influence on cost through reduction of product wastage appeared to be the more important venue in increasing incentive for smaller firms to adopt HACCP systems. The net benefit of the entire fisheries industry would increase by 0.4 percent of NVA.

Scenario 12: Increasing the actual percentage loss of quantity sold to US from none to 100 percent (i.e., full spillover effect of the EU HACCP certification on US export) has induced some changes in net gains for almost all firms (both certified and de-certified). For instance, the net benefits barely increased for representative cottage firms. For very-small and small firms, the net benefits increase by 0.4 percent (an average of certified and de-certified firms). For medium firms, the net benefits increase by 0.5 percent; and for large firms by 0.2 percent. Recall from section 4.3.4.3 that the NVA of seafood exports is US$ 184 million per year, and 30 percent of this is coming from US exports. In the event of HACCP standard harmonization between the US and EU, this whole amount (US$ 55

million per year or US$ 497 million for nine years) will be lost, if all the firms will not apply for certification. But, as witnessed in the EU HACCP de-certification case, many of the firms will continue to be certified, considering the large proportion of their US exports. Thus, a major chunk, if not all, of the NVA of seafood exports to US will not be lost due to HACCP standard harmonization. This potential impact signifies that future harmonization of HACCP certification worldwide or full recognition and adoption of the EU HACCP certification by US will provide a substantial pressure to processors to adopt the system.

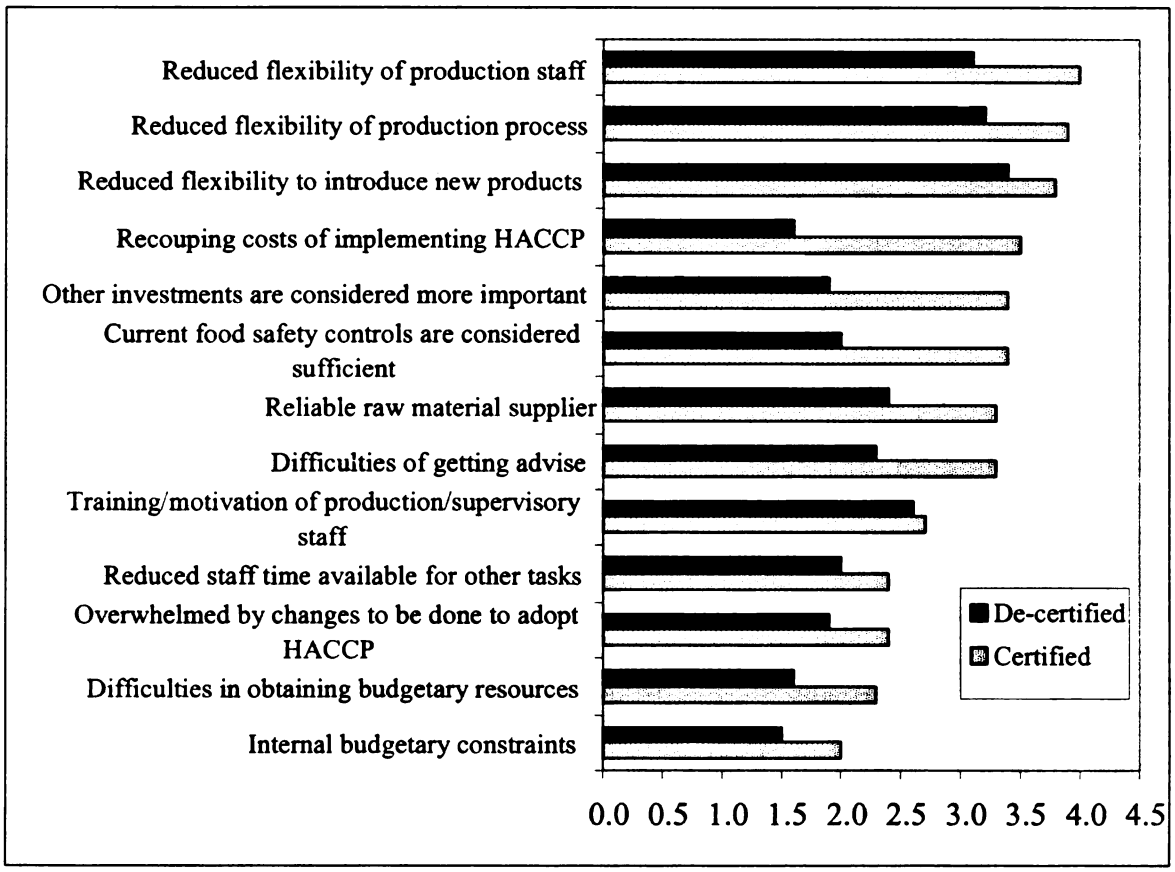
Scenarios 13 and 14: In an attempt to understand how HACCP adoption would provide net benefits to de-certified firms, changes were made to the reduction in product wastage and increases in output prices, both are the only two variables (used in this chapter) that could possibly provide positive net benefits to de-certified firms. Results indicate that a 2.5-percent increase in output price level or one percent increase in the reduction of product wastage will provide sufficient financial incentives for firms to sustain certification. This implies that initiatives to increase price levels of "safer" foods and enhance HACCP-induced efficiency within the plant will lead to greater sustainability of HACCP adoption. Information campaigns, consumer awareness, and strengthening the credibility of food safety certification systems are possible venues to influence the price levels. Moreover, more strengthening technical assistance to improve efficiency in quality and food safety control may also help out in further reducing in-plant product wastage.

Scenario 15: Reducing HACCP cost to capture the possible avoidance of costs related to refusal or detention of exports in importing country borders by three percent (as estimated by FAFST (2004)) would decrease the net loss of processing firms; and increase the net benefits of the entire fisheries industry by 0.1 percent. The above scenarios (except 12 to 14) indicate that estimation results are robust and implications are consistent despite changes in assumptions.

4.4 Difficulties and Constraints in EU HACCP Adoption

While the LM, SA, and NBC are very insightful, some difficulties and structural barriers that processing firms face may not all be captured above. This section summarizes the descriptive results of the interviews with processors on difficulties and barriers in HACCP adoption. In general, the most consistent response from firms was the lack of financing (from both internal and external sources) for necessary investment and additional operating expenses required for adopting HACCP systems (Figure 22). Many of the firms mentioned that one major concern is the overwhelming number of changes required to adopt HACCP systems and the time needed to understand and adjust to these changes. Staff time available to carry out other tasks was also a major concern both certified and de-certified firms.

Figure 22. Summary of mean scores of difficulties faced by firms



Note: The ranks are from "one" for major importance to "five" for minor importance for this chapter. Figures are the mean scores of 26 certified firms and 15 de-certified firms that responded.

While results for certified and de-certified firms show similarities in the general pattern across factors, it is apparent that almost all scores per factor were ranked more important by de-certified firms. The analysis of variance indicates significant differences between the two firm groups in terms of the importance they gave to chance to recoup costs of HACCP implementation – de-certified firms ranked this as a major concern, putting it with the same ranking as the concern on internal and external financing (Figure 22). "Firms' perception that other investments/priorities are more important" and that "current food safety controls are sufficient" are also major barriers to HACCP adoption for de-certified firms. Likewise, difficulty in accessing reliable raw material (that would

pass laboratory testing as required by the HACCP system) and difficulty in getting advice about HACCP systems appeared to be more important for de-certified firms than difficulties associated with staff motivation and training. These differences indicate the various opportunities and constraints faced by firms affecting their decision on continued certification or de-certification.

In comparison with other studies (Appendix 11), the major importance of the difficulty of financing faced by both certified and de-certified firms in this chapter is consistent with Herath and Henson (2005; 2006). Moreover, other major constraints consistent with Herath and Henson (2005; 2006) are: (i) overwhelming changes required to adopt HACCP systems (for both certified and de-certified); (ii) reduced staff time available to conduct other tasks (for both certified and de-certified); (iii) perception that other investments/priorities are more important (only for de-certified); and (iv) perception that current food safety controls are sufficient (only for de-certified firms). However, unlike Maldonado et al. (2005) and Henson et al. (1999), the results in this chapter show that while difficulties were associated with staffing (the need to retrain and to manage attitude/motivation of production and supervisory/managerial staff), [138] were not perceived to be among the most relevant concerns and difficulties faced by respondents (both certified and de-certified). While Mexico and UK may be more advanced in their food safety systems and in their processing facilities, the Philippines, in general, would still need to invest in renovations or restructuring plant facilities and several major adjustments in the production processes to accommodate HACCP systems. The relative importance of the difficulties, as ranked by firms, may reflect this.

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[138] Including the difficulties in hiring competent technical manpower especially for quality control/assurance.

While most of the above difficulties are inherent to HACCP systems, some (e.g., difficulty of credit access) mirror the structural deficiencies in the Philippines (Chapter 2). This reinforces the earlier findings that adoption to food safety systems depend on the enabling business environment, credit system and political commitment, which are currently weak in the Philippines. A healthy capital market and easier access to credit is a crucial step toward eliminating constraints in adopting HACCP. The other HACCP-related difficulties can also be reduced by stronger producers/processors/exporters' associations (see Chapter 2; results of LM and SA above). These associations can provide a venue to pool resources, expertise and networks together to facilitate access and sharing of relevant information about food safety systems.

Another interesting point pertains to the need to first strengthening the basic sanitation practices, before venturing into more complex physical and facility structure changes among firms. In a number of cases in the Philippine seafood industry, failure to sustain certification and frequent food contamination cases are caused by a weak foundation of hygiene and sanitation practices, despite substantive investments in new facilities and equipments made. Awareness campaigns and inculcating the sense of moral obligation to produce only "safe" food may be effective strategies for firm management to align employees' incentives with theirs. From a broader public health and industry competitiveness perspective, the public sector can also support such awareness campaigns towards greater appreciation and recognition of the value of food safety.

There is also a need to strengthen the national food safety inspection system. The

"artificial compliance,"[139] which was reported in a number of cases during the field visits, mirrors the weak economy-wide system to manage food safety. This has implications on the behavior of firms, possibly encouraging more artificial compliance among firms, and affecting the credibility and sustainability of the country's food safety management systems. Due to economies of size and high exclusion costs related to implementing surveillance and monitoring systems to manage food safety in the economy, the public sector can provide directly or indirectly the investment and services needed to design and implement these systems. In the long-run, it is crucial for the Philippines to focus on an enabling business environment to make it easier to encourage more businesses willing to invest in the country and offer joint ventures. Policies that protect certain sectors and hide some inefficiencies can be a necessary first step. For instance, many seafood processors are concerned that they would lose their EU markets because most of the fishing boats and vessels from which they source their raw fish could not comply with HACCP systems. In this case, complying with HACCP requires new vessels, since the existing ones are old and cannot pass the standards required by the EU HACCP system. Currently, fishing companies are reluctant to invest since they are satisfied with their existing markets. A strategy that could be explored is to reduce the current protection on fishing companies, which also lead to an implicit taxation on the seafood processing sector, by lowering the tariff imposed on imported fish raw materials (Chapter 2). This would allow entry of foreign suppliers in the industry, leading to more competitive prices of fish raw materials.

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139 According to four key industry informants, this means compliance on paper only, by using an EU HACCP certification number even though the product to be shipped and sold is not from the certified facility.

5 Summary and Policy Implications

This chapter focuses on understanding the sustainability of HACCP certification from a firm's incentive-capacity perspective. Data collected from 59 seafood processing firms in the Philippines were analyzed using logit, survival, and firm-level cost-benefit analyses in order to understand initial and continued adoption of EU HACCP systems. Results show that firms' decisions to adopt and the rate of initial adoption are explained by both incentive- and capacity-related factors. However, in explaining the decision to continue adoption and the rate of de-certification, incentive-related factors are more important than those of capacity-related ones.

Output price and quantity levels are significant factors in the decision of Philippine seafood processors to initially adopt and their rate of adoption. Membership and active involvement in industry associations and number of product forms are also correlated with their rate of initial adoption. In terms of continued adoption and the rate of de-certification, price differentials across markets (especially between EU and US) are significant factors in both firms' decision to continue adoption and their rate of de-certification. Associated with these price differentials is the observed level and proportion of exports to the US and EU markets that strongly differentiates certified versus de-certified firms. This implies that as along as firms are able to export to US and other markets, even without adopting EU HACCP systems, they will delay adoption in order to avoid the costs associated with it. Furthermore, difficulty in accessing credit is also a consistently significant factor in the decision to discontinue adoption and the rate of de-certification. All de-certified firms reported the difficulty in accessing credit as their major constraint in HACCP implementation. The rate of de-certification is also

correlated with input prices, number of markets, number of product forms, and association membership and active involvement.

Responses from firms (both certified and decertified firms) reveal that output prices in existing markets did not increase. No difference in the rejection rates at the border are observed by responding firms. Some certified firms reported increases in the quantity of output mainly, as a result of capturing new markets and in the reduction of product wastage. However, these benefits were not realized by de-certified firms.

A majority of the processing firms have incurred net losses from EU HACCP adoption. Procuring quality and safe raw materials and difficulties in controlling flow of materials from input production to processing and distribution are additional disincentives and costs faced by processing firms. Despite these losses by many processing firms, the entire fisheries industry stands to benefit from EU HACCP adoption (and would lose about US$ 4-6 million in the event of EU HACCP non-adoption by some firms). This gain or loss is associated with maintaining or losing EU market assess. Due to difficulties in shifting factors of production to other productive sectors, raw fish producers (particularly in aquaculture), traders, and other input suppliers would lose their net profits (or net value added) associated with the loss of EU market by processing firms. While de-certified firms had strong motivations to discontinue, there are losses of market access to EU by other industry players. The loss seems very small at the industry level, but could mean loss of revenue and source of livelihoods for other players; especially in the event of input market rigidities and in the case of smaller players, who have not much resources and flexibility to try out other markets and sectors.

Players who are largely affected by the de-certification can venture into forms of

collective action to provide a venue to join resources, expertise and relevant information about food safety systems and market opportunities. At a more macro-level, providing a healthy capital market and greater access to credit is of crucial importance. Both these supply-side strategies can be helpful to negatively-affected industry players in their strategic responses to de-certification. Affected players can either shift or complement current activities to other activities/markets (to compensate for the EU seafood market loss) or in venture into more vertically integrated system to capture the processing and exporting activities themselves. Which firm response is more strategic will depend on the context where firms operate. For instance, collective action, through producer cooperatives or associations, may be successful to some, but not to other. The Negros Prawn Producers' Cooperative, Inc. in the Philippines is a case of collective action among producers extending their production activities into marketing, processing, and exporting. While this is a successful case, there are been limited scaling up or replication of this scheme to other context and areas in the Philippines. Further investigation of the constraints and potential of producers (in selected areas or contexts) in venturing into collection action to gain greater competitive edge in high-value markets would be important.

Results also show that certified firms were not able to capture more demand from the EU importers initially buying from the de-certified firms. This implies that loss of EU market by the de-certified firms is not easily captured by firms in the Philippine seafood industry. This further implies that local competition may not be that strong, but tight competition worldwide is a greater challenge for processors. Results also show that efforts to comply with EU HACCP certification also meet HACCP requirements in the

US markets, and increases the competitive edge of firms in the maintaining their market share in global trade. This implies that net benefits of HACCP are underestimated if this is not taken account.

In general, smaller firms would lose more than larger firms in HACCP systems adoption, due to very high capital investments and limited production size to cover such costs. However, cottage firms stand to lose less than very-small firms; and small firms would lose less than medium firms, implying that the relationship between size and HACCP cost may be more complicated. This indicates a possible advantage of smaller firms in HACCP certification in some cases (e.g., where easier monitoring, supervision, and control over processes by smaller firms compensate or surpass the economies of size from bulky investments by larger firms) (Chapter 4 looks more in detail at the economies of size in seafood processing due to HACCP adoption). Sensitivity analyses performed indicate that there is high likelihood that smaller and de-certified firms would benefit from HACCP adoption through slightly higher output prices and reduction in product wastage.

Several strategies can be adopted. From the demand side, both private and public sectors have a role in reducing structural barriers and information asymmetries that lead to demand and price rigidities. These demand-side strategies can be in the form of: (i) enhancing consumer awareness to build demand and influence willingness-to-pay for food safety; and (ii) ensuring credible food safety certification systems to sustain consumer confidence worldwide. From the supply-side, strategies to strengthen the management of food safety should be put in place by launching awareness campaigns to educate and raise the sense of moral obligation to produce "safe" food both from a firm's

or government's perspective. There is also a need to enhance the current firm- and national-level inspection systems, as these have implications on the credibility and sustainability of these systems. Both private and public sectors can team up to intensify technical assistance to processing firms and raw fish producers on how to effectively implement HACCP systems. The seemingly unrealized production efficiencies associated with HACCP systems may just be a result of not properly implemented systems. A more careful guidance and thorough inspection systems would be warranted to better assist the processing subsector in implementing the system. Looking at ways to improve the capital market and provide greater access to credit is also an important step to reduce constraints faced by firms and individuals in venturing into productive activities. Some industry players may also benefit from collective action or greater engagement in existing associations. However, the currently limited collective action in the Philippine seafood industry shows that further research is warranted to understand the context where this collective action may be strategic and efficient. Lastly, a more proactive sharing of experiences and lessons learned from implementing food safety controls could be done across food subsectors of the economy to create synergies, realize efficiency, and reduce costs in producing safe and healthy food supply, which is crucial for both for public health and food industry competitiveness.

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ESSAYS ON FOOD SAFETY AND COMPETITIVENESS IN THE PHILIPPINE SEAFOOD INDUSTRY

Volume II

By

Catherine Ragasa

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Agricultural, Food, and Resource Economics

2008

CHAPTER FOUR

THE COSTS AND ECONOMIES OF SIZE ASSOCIATED WITH HACCP SYSTEMS – THE CASE OF PHILIPPINE SEAFOOD PROCESSORS

1 Introduction

Understanding the economic implications of food safety systems for the food industry is vital for policymaking. However, studies assessing these economic implications are limited and still leave a number of questions unanswered. Some authors emphasize the importance of food safety systems for market access and efficiency (Henson and Jaffee 2006; Nganje 1999). However, costs can be substantial and sometimes prohibitive (Henson and Jaffee 2006; World Bank 2005; FAO 1998; Cato and Lima dos Santos 2000), especially if insufficient additional economic benefits accrue to the industry, such as output price increases (Chapter 3; Nganje and Mazzocco 2000; Nganje 1999; Nganje et al. 1995).

One process standard that has received increasing research attention is the Hazard Analysis and Critical Control Points (HACCP) system, now being imposed as a mandatory regulation in meat, seafood, and other subsectors by a number of economies including the US and EU. Despite being required for access to certain markets and recommended by Codex as an effective method of ensuring food safety, adoption has been slow among firms in developing countries; and in recently years, many firms that initially implemented HACCP have discontinued. In order to facilitate adoption of this system, there is a need to understand the economic incentives that underlie these processes.

This chapter analyzes the cost of HACCP systems and complements the financial cost and benefit analysis performed in Chapter 3. In Chapter 3, HACCP expenditures reported by processing firms were mainly in terms of additional capital outlay and operating costs (including plant managers' and staff time in HACCP plan design and training). Chapter 3 also attempted to include only expenditures attributable exclusively to food safety (i.e., excluding expenditures that would have been invested by the firm even though they are not complying with food safety standards). Chapter 3 included estimates of benefits namely: changes in output quantity and price; price differentials between old and newly-captured markets; reduction in in-plant production wastage; and decrease in rejection rates at inspection sites. However, these reported estimates may not necessarily be the only costs and benefits associated with HACCP systems. Changes in the production processes due to these systems may result to other costs and benefits in the following forms:

(i) Opportunity costs resulting from months or years of disruption in production associated with renovations or building a new processing plant;

(ii) Opportunity costs resulting from crowding-out of non-food safety-related investments given limited firm resources;

(iii) Reduced flexibility in the production processes;

(iv) Slower production processes;

(v) Costs saved by producing both conventional and "safe" food together which can be lower than the cost of producing them separately (e.g., once production is stopped to make food-safety-related modifications, other investment projects can also be undertaken); and

(vi) Cost-saving innovations induced by changes in the production processes.

Not capturing these complementarities and crowding-out effects will lead to the under- or overestimation of HACCP expenditures. To the extent that food safety activities are completely distinct from conventional production processes, the marginal cost of an additional dollar of HACCP expenditures will be entirely reflected by HACCP expenditures alone and will exactly equal one dollar. However, if HACCP expenditures somehow complement or crowd-out conventional production, then the marginal cost could be less than (complementary case) or more than (crowding out case) a dollar.

A number of existing studies conclude that often HACCP expenditures reported by firms indeed do not reflect "true" cost due to the inherent difficulty in distinguishing costs related to HACCP versus conventional production processes. For instance, Antle (2000) concluded that there are efficiency-reducing effects of HACCP systems, indicating underestimation of HACCP costs. Nganje (1999) found that there are efficiency gains from HACCP systems, indicating overestimation of HACCP costs. However, in all these existing studies, the magnitude of under- or overestimation was not measured. This type of analysis is important to ascertain level of profitability or losses from adopting certain food safety systems. Especially in sectors and firms where profits or returns to capital are marginal (e.g., 2-5 percent of the sales value in the Philippine seafood processing industry case; see Chapter 3) and where reported HACCP expenditures (e.g., less than 1 to 7 percent of the value of production in surveyed studies; see Chapter 1) are close to providing negative profits to firms, accurate estimation of costs and benefits is crucial in making decisions to adopt from the firms' perspective and

policy decisions from the public sector's perspective.

There is also limited understanding on HACCP system adoption in developing countries, where trade-offs and challenges for food safety are greatest and difficulties in accessing detailed data needed for analysis are high. A number of existing studies used assumptions and data not applicable or non-existent in developing-country context (Ollinger and Mueller 2003; Antle 2000). Second, some existing studies used assumptions and models that do not represent the nature of HACCP systems. For instance, there are some problematic assumptions in Nganje (1999), particularly in modeling HACCP costs as independent of the factor prices and quantities of conventional production process. However, HACCP cost is dependent on factor prices and quantities. Thus, a different methodology to better capture the "true" nature of HACCP costs is warranted. This paper will provide new evidence on this important topic by filling in these key gaps in existing literature.

In addition, only a few studies exist that systematically and quantitatively analyzed the cost advantage or disadvantage of different firm categories, especially firm size, as a result of stricter food safety regulations (with the exception of studies of the US meat industry by Hooker et al. 2002; Ollinger and Mueller 2003; Nganje 1999). Among these studies, there is considerable variability in methods and the data used. Thus, the findings on the costs and size-distribution impacts of HACCP were different. For instance, in a study of the US meat processors, Hooker et al. (2002) finds that even after controlling for scale, very small plants incur higher HACCP compliance costs per unit of output. In contrast, Ollinger and Mueller (2003) find that costs per unit of output required for sanitation and process control are about the same for large plants as for small plants,

which suggests that larger plants are no more able than small plants to absorb these costs. Experts were quick to conclude that HACCP system impacts are context-specific (e.g., specific to product, location, and firm); and that most of the variability are due to non-uniform implementation across countries and different stages in the pre-requisite programs before HACCP systems were implemented. Nevertheless, research on this topic in the context of developing countries is limited to a few case studies which looked at examples of excluded small producers and processors from high-value market (Cato and Lima dos Santos 2000; Colatore and Caswell 2000; World Bank 2005). As such, the concentration of the literature on developed countries poses lack of understanding of what is happening in developing countries. The experience of developing countries may provide new insights to the growing attention to the equity dimensions of food safety systems.

In the Philippines, a number of smaller seafood processing firms have expressed concerns about difficulties and costs of adopting HACCP systems and other food safety standards. Mandatory HACCP regulation was imposed to seafood imports to the US and EU markets from other countries, including the Philippines. These markets account for 42 percent of the total seafood export value in the Philippines (in 2006); and these markets' exports exhibits an increasing trend over the years. Moreover, HACCP systems, even though not required by other importing countries, have become an important strategic marketing tool among firms due to more intense competition in the international seafood market. However, concerns arise from speculation that small firms [140] will have

[140] Firm size is based on the Philippine Department of Trade and Industry (DTI)'s classification (and is also used in most organizations in the Philippines): cottage firms are those under 10 full-time equivalent employees, small firms are those with less than 100 employees, medium firms are those with less than 300 employees, and large firms are those with 300 and more employees. Moreover, due to the observed high

disproportionate difficulties in complying with these standards. Inability of small firms to comply with these standards would mean their inability to enter and continue exporting to EU and US and also a reduction of their competitive edge in other markets. Currently, small firms continue to co-exist with medium and large firms. However, the increasing stringency of international food safety regulations poses concerns about a possible change in industry structure and deepening market segmentation (where the small firms are supplying to low-value saturated markets and large firms are supplying more lucrative markets). Chapter 3 shows that smaller firms receive lower net gains from HACCP certification and higher net loss for de-certification than their large-firm counterparts. This concern on cost disadvantage of smaller producers of HACCP systems warrants further investigation.

This chapter will help inform the debate on exclusion of small firms from high-value markets and their marginalization into increasingly saturated low-value markets, due to stricter food safety systems. This is done by examining firm-level economies of size in the Philippine seafood processing industry with respect to HACCP systems. Looking at economies of size informs policy issues related to industry restructuring to achieve greater efficiency. For instance, if there is sufficient evidence for economies of size, society as a whole will benefit from concentrating production to improve cost efficiency. This conclusion leads, however, to distributional issues – for example, what happens to the smaller producers and processors who cannot reduce their costs to stay competitive? For policymakers, it may be important to assist small producers develop any opportunities they may have to position themselves competitively or to support their

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heterogeneity among the small firms, this chapter has divided the small firms category: (1) very small firms are those with less than 33 employees (average of the small firms groups); and (2) small firms are those with 33 and more employees.

transition to other ventures.

This chapter looks at the seafood industry level and addresses three research questions:

(i) Does production size affect the level of costs incurred by Philippine seafood processing industry in adopting HACCP systems?

(ii) Do HACCP systems affect existing economies or diseconomies of size in the Philippine seafood processing industry?

(vi) Do HACCP costs affect conventional production costs as experienced by Philippine seafood processors?

(vii) Are reported HACCP expenditures over- or under-estimated?

(viii) Are HACCP systems efficiency-enhancing or –reducing?

The Philippine seafood industry is a good case to analyze because of several reasons. First, it can highlight the priorities required in a small developing country. Second, the co-existence of heterogeneous firms – ranging from very small to very large, very old to very new, and encompassing exporters and local suppliers as well as mixed-market-oriented firms – permits an understanding of their different responses to food safety regulation. Third, the difficulties faced by some firms in adopting HACCP systems and the success of others can help to elicit information on the factors influencing HACCP adoption or non-adoption within a single country. Understanding the impact of HACCP systems and food safety measures in general will help in balancing costs and benefits related to implementation and in designing effective strategies to support the transition for the producers and processors that are most adversely affected.

2 Conceptual Framework and Method

The framework used in this chapter centers on cost minimization and profit maximization. This chapter uses a private (firm-specific) perspective to analyze the financial impact of HACCP systems, which are mandatory for seafood exported to the EU and US markets and increasingly used as a food safety measure in a number of countries. The private approach is different from traditional welfare methods that evaluate costs and benefits of safety regulations to society as a whole, using methods like willingness to pay, willingness to accept, contingent valuation, hedonic pricing, and others. The private approach is appropriate when consumer demand for higher quality and safety is not compensated by an increase in price for end-products, as shown in Chapter 3. Moreover, this chapter looks at the industry-wide economies of size and cost structure, as compared to firm-level analysis done in Chapter 3. This section presents the theoretical model, empirical model, restrictions imposed, and sources and nature of the data used.

2.1 Theoretical Model

It is assumed that each plant p in each period T wishes to minimize the cost associated with producing a given quantity of conventional output Y. The function $F_{p,T}(.)$ defines a production technology involving Y coupled with inputs of capital, labor, energy, and materials. In particular, $F_{p,T}(.) = 0$ is the production frontier and $F_{p,T}(.) < 0$ describes feasible but inefficient input and output combinations. The production function is indexed over both plant p and time T to allow for exogenous time trends in productivity. The cost minimization performed by plant p is given by:

$$TC = \min_{M,L,K,E} P_M M + P_L L + P_K K + P_E E \qquad (27)$$

$$\text{such that } F_{p,T}(Y, M, L, K, E) \leq 0$$

where P_K, P_L, P_E, P_M represent prices of material, labor, capital, and energy, respectively, and TC is the total cost associated with output Y at each T and each plant p. The minimization in equation 27 above defines a cost function, equation 28, given below as:

$$TC = TC_{p,T}(Y, P_M, P_L, P_K, P_E) \qquad (28)$$

To be consistent with cost minimization, TC^* must satisfy the following conditions:

(i) TC^* is nonnegative, and nondecreasing in Y, i.e., the total marginal costs of production are nonnegative.

(ii) TC^* is nondecreasing in P_i where $i \in (M, L, K, E)$. Based on Shephard's lemma, the factor demand for input i is given by $X_i^* = \frac{\partial TC^*}{\partial P_i}$. Thus, TC* is nondecreasing in P_i if and only if factor demand for all inputs are nonnegative. Equivalently, the condition can be expressed in terms of cost shares of factor i, denoted $CS_i = \frac{P_i X_i}{TC^*}$, such that $CS_i = \frac{\partial \ln TC^*}{\partial \ln P_i}$ is nonnegative.

(iii) TC^* is linearly homogeneous in P_i, i.e., $TC^*(kP_i, Y) = kTC^*(P_i, Y)$ for all $k >$

0. This means that when prices of all the inputs increased by k percent, holding other else constant, total cost also increases by the same k percent.

(iv) TC^* is concave in P_i, i.e., the Hessian matrix, which is the matrix of second-order partial derivatives of TC^* with respect to P_i, with each element expressed as $\frac{\partial^2 TC^*}{\partial P_i P_j}$ $i, j \in (M, L, K, E)$, is negative semi-definite.

(v) The Hessian matrix is symmetric, i.e., $\frac{\partial^2 TC^*}{\partial P_i P_j} = \frac{\partial^2 TC^*}{\partial P_j P_i}$.

We now introduce food safety S as another output that plant p produces. Suppose TC in equation 28 can be broken down and expressed as a function of food safety costs (SC) and conventional production costs (PC) to produce two outputs (Y and S) as given in equation 29 below. Following equations 28 and 29 and introducing S as an output, PC and SC can be expressed as equations 30 and 31 as given below:

$$TC = f(PC, SC) \tag{29}$$

$$PC = P_{p,T}(Y, P_M, P_L, P_K, P_E) \tag{30}$$

$$SC = S_{p,T}(Y, P_M, P_L, P_K, P_E, S) \tag{31}$$

where SC is the total cost associated with producing food safety quantity S and PC is the total cost is associated with producing output Y and other variables are defined as above.

Antle (2000), following earlier work by Gertler and Waldman (1992) and Braeutigam and Pauly (1986), emphasizes that safety and quality are typically

endogenous (i.e., these factors are chosen by the firm and therefore correlated with exogenous variables in the firm's conventional cost function). The implication is that if product safety and quality are not accounted for in conventional cost function estimation, biases in model parameters will result. Antle (2000) defines "food safety exogeneity" (FSE) as a condition in which food safety does not affect productive efficiency and this FSE condition can be tested. In the present context, the condition for FSE is $\frac{\partial PC}{\partial S} = 0$. If the FSE hypothesis is rejected, it means that food safety contributes to higher or lower costs, because food safety influences conventional production costs beyond what is often reported as food safety costs.

Several studies have sought to model food safety (*S*). Ollinger and Mueller (2003) by analyzing process control and sanitation compliance and using microbial count and/or defects of intermediate and final products in the US meat industry, as measures of food safety (or the lack thereof). These types of data rarely exist in most countries. Antle (2000) uses observed "product quality," as a proxy for unobserved "food safety," in analyzing the cost of HACCP systems in the US meat industry. However, such detailed data on quality proxies are not available for the Philippine seafood industry. Nganje (1999) uses HACCP cost as an added explanatory variable to capture the presence or absence of FSE. In analyzing the effects of environmental standards, which are closely related to food safety standards, Morgenstern et al. (1998; 2001) and Joshi et al. (2001) use environmental regulatory costs *(RC)* as an added explanatory variable to capture the effect of environmental regulation on conventional production costs in addition to the dollar effect.

Since both *S* and *SC* are not observed, and given that the HACCP system is an

international standard for ensuring food safety, the approach followed here is to use HACCP Cost (*HC*), which is observed and can be measured, as a proxy for *SC* as presented in equation 32:

$$PC = PC_{i,T}(Y, P_M, P_L, P_K, P_E, HC) \tag{32}$$

As a proxy for *SC*, *HC* is not fixed but instead is dependent on P_i, *Y*, and *S*. *HC* is modeled as a function of these variables, a procedure that varies from most previous treatment of *HC* (or *RC* in the case of environmental regulation) as presented in equation 33. For instance, Joshi et al. (2001) treat *RC* as fixed and do not model *RC* as dependent on input prices P_i. Similarly, Nganje (1999) does not represent *HC* as dependent of input prices P_i, but rather models *HC* as another input of production different from P_i and uses *HC* per unit of *Y* as the price of HACCP system per unit of food safety (*S*).

There are several problematic assumptions in this approach. The first is that HACCP systems can be expressed in terms of a "factor quantity" that can be optimized given its price and other input prices. It is difficult to think what this "factor quantity" may be. If it is the quantity of food safety that is being optimized, that quantity would be difficult to measure empirically. A second problematic issue is that the price of HACCP (which would represent the price of food safety) used by Nganje (1999) is the cost of the HACCP system per unit of output, rather than the cost per unit of food safety quantity. Third, use of HACCP cost as another input assumes that it is different and can be substituted or complemented by other factors of production. Yet, the nature of HACCP appears to be different – that is, the cost of this food safety system is a mix of the costs of

the factors, which are additional to conventional production costs. Therefore, an adjustment in modeling the costs of HACCP systems could provide significant new insights. The analysis in this chapter adopts the approach of Morgenstern et al. (1998; 2001), which is the most relevant for capturing the true nature of *HC* (see equation 33).

$$PC = PC_{i,T}(Y, P_M, P_L, P_K, P_E, HC(Y, P_M, P_L, P_K, P_E, S)) \qquad (33)$$

To the extent that HACCP activities are completely separate from conventional production of *Y*, the coefficient on HC will be zero. In that case, the marginal cost of an additional dollar of *HC* will be entirely reflected by *HC* alone and will exactly equal one dollar. However, if *HC* somehow complement conventional production, the marginal cost could be less than a dollar. Alternatively, additional, uncounted costs (e.g., possible crowding out of productive investments, higher administrative costs, and loss of flexibility) could lead to a marginal cost exceeding one dollar.

2.2 Estimation Model

Equation 33 above is estimated using a translog cost function, which is similar to the methods used by the studies mentioned above. The research on scale economies for different sectors, mainly manufacturing, banking, roads, transportation, nursing and medical facilities, and libraries, may be classified into three categories: studies that examine scale economies using a Cobb-Douglas production function; studies that look at scale economies, as well as elasticity of input substitution, using translog cost functions; and studies that explore scale economies using simple cost functions. In this chapter, since we are interested in input substitutability and scale economies, a translog cost

function is used in the estimation.

Equation 34 provides the estimation model for *PC*. A commonly used way to accommodate multiple outputs in cost function analyses is to convert plant output into a vector of outputs of different products and then estimate a multiproduct cost function. However, some plants do not produce some products and the log of zero is undefined. Thus, we did not use the multiproduct cost function. Rather, we followed an approach used in the analyses of railroads (Caves et al. 1985), trucking (Allen and Liu 1995), airline industries (Baltagi et al., 1995), meat (Antle 2000, and MacDonald et al. 1996), poultry (Ollinger et al. 2005); and meat products (Ollinger and Mueller 2003) and modeled costs as driven by a single output and a vector of product characteristics. The time dimension, which captures the technical change, is represented by trend variable *T*. We assume that the technical change is input neutral (i.e., P_i do not affect the time trend). Thus, no interaction terms are included between T and P_i. We also assume that the technical change is scale neutral (i.e., Y does not affect the time trend). Thus, no interaction terms are included between T and Y. Firm- and plant-level characteristics are represented by dummies for the firm's main product form (D_f), number of distinct product forms *(Nform)*, and year that the plant was established *(Age)*.

$$\begin{aligned} \ln PC = {} & \beta_0 + \sum_i \beta_i \ln P_i + \beta_Y \ln Y + \frac{1}{2}\sum_i \sum_j \beta_{ij} \ln P_i \ln P_j + \\ & \frac{1}{2}\beta_{YY}(\ln Y)^2 + \sum_i \beta_{iY} \ln P_i \ln Y + \beta_H \ln HC + \frac{1}{2}\beta_{HH}(\ln HC)^2 + \\ & \beta_{HY} \ln HC \ln Y + \sum_i \beta_{Hi} \ln HC \ln P_i + \beta_{HN} \ln HC \ln Nform + \\ & \beta_N \ln Nform + \beta_T T + \sum_f \beta_f D_f + \beta_A Age \end{aligned} \tag{34}$$

where $i, j \in (M, L, K, E)$ and $f \in (CannedTuna, FrozenTuna, Shrimp, Milkfish)$.

The standard approach is to estimate the cost function given in equation 35, along with cost share equations. This approach increases estimation efficiency by fitting additional data on factor shares using the same underlying parameters (Morgenstern et al. 2001; Joshi et al. 2001; Lanen and Larcker 1992; Guilkey et al. 1983). By Shephard's lemma, the cost-share (CS_i) of factor i is derived from getting the partial derivative of *ln PC* (equation 36) with respect to $\ln P_i$ (i.e., $CS_i = \frac{\partial \ln PC}{\partial \ln P_i}$). This leads to the following factor share equations for PC (CS_i^P) as presented in equation 35 below:

$$CS_i^P = \beta_i + \sum_j \beta_{ij} \ln P_j + \beta_H \frac{\partial \ln HC}{\partial \ln P_i} + \beta_{HH} \ln HC \frac{\partial \ln HC}{\partial \ln P_i} + \beta_{iY} \ln Y \frac{\partial \ln HC}{\ln P_i} + \beta_{HN} \ln Nform \frac{\partial \ln HC}{\partial \ln P_i} \quad (35)$$

Due to the non-observability of S, we cannot easily estimate the HC component in equation 34. We have adopted the method used by Morgenstern et al. (1998; 2001), which uses the cost shares of factors for both PC and HC. In their model, the cost shares associated with Y production costs are not, in fact, observed. These "aggregate" cost shares are a weighted average of PC and HC shares. The aggregate cost shares will not equal the PC shares, except under the very restrictive assumption that the technology for producing output Y and S are almost identical. To work around this difficulty, the authors specify cost share relations for regulatory costs:

$$CS_i^t = \frac{HC}{PC+HC} CS_i^H + \left[1 - \frac{HC}{PC+HC}\right] CS_i^P \qquad (36)$$

We slightly modify the Morgenstern et al. (1998; 2001) method of using aggregate cost shares, where factor cost shares between *PC* and *HC* cannot be separated. Since our data allows segregation of factor costs between *PC* and *HC*, we specify shares for each factor *i* in *PC* and *HC*. We also specify a translog cost function for *HC* assuming constant returns to safety (*S*),[141] but non-constant returns to scale with respect to conventional production and HACCP. Equation 37 describes the production of food safety output (*S*):

$$\begin{aligned} \ln HC = {} & \gamma_0 + \sum_i \gamma_i \ln P_i + \gamma_Y \ln Y + \frac{1}{2} \sum_i \sum_j \gamma_{ij} \ln P_i \ln P_j + \\ & \sum_i \gamma_{iY} \ln P_i \ln Y + \frac{1}{2} \gamma_{YY} (\ln Y)^2 + \gamma_T T + \gamma_S S + \sum_f \gamma_f D_f + \\ & \gamma_A Age + \gamma_N \ln Nform \end{aligned} \qquad (37)$$

Again, by Shephard's lemma, the cost-share (CS_i) of factor *i* is derived from getting the partial derivative of *ln HC* (equation 37) with respect to *ln Pi* (i.e., $CS_i^H = \frac{\partial \ln HC}{\partial \ln P_i}$). The corresponding factor shares associated with conventional production are given in equation 38:

$$CS_i^H = \beta_i + \sum_i \gamma_{ij} \ln P_i + \gamma_{iY} Y \qquad (38)$$

[141] This assumption is useful in later estimation by providing the possibility of using factor cost shares associated with HACCP.

Since $CS_i^H = \frac{\partial \ln HC}{\partial \ln P_i}$, we can re-write equation 35 on CS_i^P presented above as equation 39 below. The estimation involves a system of equations given in equations 34, 38, and 39.

$$CS_i^P = \beta_i + \sum_j \beta_{ij} \ln P_j + \beta_H CS_i^H + \beta_{HH} \ln HC(CS_i^H) + \beta_{iY} \ln Y(CS_i^H) + \beta_{HN} \ln Nform(CS_i^H) \quad (39)$$

2.2.1 Approach: Pooled Cross Section across Time

The systems of equations described above are applied to a cross section of 59 seafood processing firms in the Philippines covering two time periods (2000 and 2003). These data came mainly from primary field data collection and income statements and statements of assets and liabilities of processing firms collected from the Securities and Exchange Commission in the Philippines (SEC).[142]

A pooled data approach (including 118 observations in the estimation) is used because it is more appropriate than alternative approaches, such as fixed effects, for several reasons. First, by pooling random samples drawn from the same population but at different points in time, we can obtain more precise estimators and test statistics with more power. Pooling is appropriate only insofar as the relationship between the dependent variable and at least some of the independent variables remains constant over time (Wooldridge 2003). Using 2000 and 2003 data, we ran two separate models and compared whether the two models are significantly different. The test indicate that the

[142] Details of the data collection methods are given in a later section.

models are not statistically different and that *PC* has the same relationship as the input prices *Pi*, *Y*, D_f, *Nform*, and *Age* in these two periods (see Appendix 12). Second, the pooled data approach can be used to increase sample size. To reflect the possibility that the population may have different distributions in different time periods, we allow the intercept to differ across years by using a trend variable. Third, firm heterogeneity is represented in several variables: (i) plant location, which is captured in P_L; (ii) firm size, which is captured in *Y*; and (iii) time-invariant plant/firm characteristics namely D_f, *Nform*, and *Age*. Not pooling the data (i.e., using fixed effect method) will lose the explanatory power of these time-invariant variables. In other words, the pooled data approach captures the heterogeneity of firms by including variables that do not change over time, utilizes ability of these variables to explain differences in costs, and increases the sample size.

2.2.2 Restrictions Imposed

Several restrictions and estimation techniques are employed to impose and test the necessary conditions for indirect cost functions (discussed earlier). First, ***linear homogeneity*** constraints (Condition 3) are imposed directly to the model before the estimation. When prices of all the inputs increase by a fixed percent, holding all else constant, total cost increases by the same percent. To implement this condition empirically, we set the following restrictions to the parameters of both *PC* and *HC* presented in equation 40:

$$\sum_i \beta_i = 1,\ \sum_i \beta_{ij} = 0,\ \sum_j \beta_{ij} = 0,\ \sum_i \beta_{iY} = 0,\ \sum_i \beta_{Hi} = 0$$
$$\sum_i \gamma_i = 1,\ \sum_i \gamma_{ij} = 0,\ \sum_j \gamma_{ij} = 0,\ \sum_i \gamma_{iY} = 0 \text{ and } \sum_i \gamma_{Hi} = 0 \qquad (40)$$

where $i,j \in \{M,L,K,E\}$. These restrictions are imposed by normalizing PC and factor prices (P_i) by the price of a factor, say price of K, and deleting factor K cost share (CS_K).

Second, ***symmetry*** conditions (Condition 5) are imposed as presented below:

$$\gamma_{ij} = \lambda_{ji}; \beta_{ij} = \beta_{ji} \tag{41}$$

where i is one factor, and j denotes another factor. Symmetry is imposed by dividing the cross- and own-elasticities by half. To estimate equations 34, 38, and 39, a system of seemingly unrelated regression equations (SURE) was used by adding a stochastic error term to each equation (Morgenstern et al. 2001; Joshi et al. 2001; Greene 2000). The error terms are correlated across the cost share (CS_i) equations (for both Y and S) because all factor cost shares for Y must sum to one. The same holds with factor cost shares for S. In addition, error terms are correlated between PC and CS_i equations because CS_i is the partial derivative of ln PC with respect to ln P_i. Thus, we explicitly impose ***equivalence of β_i's and β_{ij}'s in both PC and CS_i*** (in equations 34, 38, and 39) because of this PC-CS_i relationship. The system of equations (equations 34, 38, and 39) following all the restrictions above was estimated in Stata.

Conditions 1, 2, and 4 are tested after the estimation. Our post-estimation tests indicate that all these conditions are satisfied.[143] Thus, for all data points, $\frac{\partial \ln PC}{\partial Y} > 0$,

[143] If the model had not tested as adhering to these conditions, these conditions could have been imposed on the parameters (although there would be a trade-off due to some loss of flexibility). For instance, concavity constraint (Condition 4) can be directly imposed in the model before estimation by restricting the values of β_{ij}. While global concavity is rarely imposed due to problems of flexibility loss, several studies have imposed local concavity to increase the proportion of the data set satisfying concavity conditions at above 50 percent; see, for example, Chua et al. (2005) and Ryan and Wales (2000; 1998).

Condition 1 (***nonnegative marginal costs of production***) is satisfied. All ***fitted cost shares are positive*** and thus the model satisfies Condition 2. ***Concavity*** in input prices ensures that when the price of one input increases, holding everything else constant, the total cost does not decrease and costs increase at a decreasing rate as firms shift away from the relatively more expensive input. Thus, to satisfy concavity, the first-order partial derivatives with respect to P_i should be nonnegative, i.e., $\frac{\partial \ln PC}{\partial P_i} \geq 0$; and the Hessian matrix should be negative semi-definite. The Hessian matrix is negative semi-definite if *(i)* the sign of the first leading principal minor is non-positive, i.e., $\frac{\partial^2 \ln TC}{\partial P_M P_M} \leq 0$, and *(ii)* the signs of the further leading principal minors alternate. This is equivalent to having the eigenvalues of the Hessian matrix ≤ 0. Our post-estimation tests indicate that concavity conditions are satisfied at 75 percent of the data points, i.e., 75 percent of all the computed eigenvalues of the Hessian matrix are negative. This is within the acceptable level of concavity, which is at least 50 percent, in empirical models (Chua et al. 2005; Ryan and Wales 2000; 1998). Moreover, of the 25 percent where eigenvalues were positive and concavity conditions were violated, these eigenvalues were very close to zero (< 0.02) and most of them were < 0.0001, which indicates that concavity conditions could well be satisfied at 75 to 100 percent of the data points. Appendix 13 gives the results of the tests for Conditions 1, 2, and 4. Tests for the normality and homogeneity of variance of the error term (i.e., is independent of the mean), which are critical assumptions of a normal regression approach used in this chapter, are discussed in a later section.

2.2.3 Endogeneity

A potential econometric concern is the endogeneity of explanatory variables. For instance, the size of production *(Y)* can be a simultaneous decision factor along with the cost of production (*PC*). Size of production can affect *PC* and at the same time, *PC* may also affect the size of production (*Y*).

To handle the endogeneity problem in the models described above, the same processes and set of variables in Chapter 3 were used in this chapter. The Durbin–Wu–Hausman test (augmented regression test) for endogeneity was performed by including the residuals of the *Y* model (expressed and estimated as a function of all exogenous variables described above) in the *PC* model. The decision rule is that if the coefficient on the residual is significantly different from zero in the *PC* model, then *Y* is endogenous. Similar to explanatory variables used in Chapter 3, the *Y* model is based on a simple production function using profit margins (*pm*), to represent the difference between the output and input prices; dummy for corporation (*corp*), as a proxy for capital availability; year of business operation (*yrbus*), as a proxy for years of experience; and dummies for product form (*shrimp, milkfish, tunacan, tunafroz*) as the explanatory variables.[144]

Results shows that the null hypothesis - *Y* is exogenous – cannot be rejected at 95 percent level of confidence (see Appendix 15 for Stata results). Thus, *Y* can be assumed to be exogenous in the *PC* model.

2.2.4 Heteroscedascity

A potential econometric concern is heteroscedasticity (or varying variance) across

[144] This variable is also used in the *PC* model, however, it should still be included in the *Y* model that potentially explains changes in output level. As this variable is included in both models, this will not be used as an instrumental variable.

observations. The usual ordinary least squares (OLS) method does not follow this strategy and therefore does not make use of the information contained in the unequal variability of the dependent variable: It simply assigns equal weight or importance to each observation. To correct this, generalized or weighted least squares (GLS or WLS) is a method often used in which observations coming from populations with greater variability are given less weight than those coming from populations with smaller variability. The model used in this chapter, White's or Newey-West's Heteroscedastic-Consistent Variances and Standard Errors, often used when variance is unknown, which automatically corrects for heteroscedasticity, and thus, guarantees constant variance in the crosssectional data.

2.3 Data

Primary data were collected from face-to-face interviews with seafood processors; secondary data were obtained from income financial statements obtained from the Securities and Exchange Commission (SEC); and official national and regional averages for the minimum wage rate and kilowatt-hour cost of electricity were adopted from published data sources. Six years of income statements and statements of assets and liabilities (1999-2004) were obtained. To reduce the data outlier effects in these years, we used three-year averages, i.e., 1999-2001 and 2002-2004, and used two periods (T) – 2000 and 2003 - in the estimation. Table 35 presents the dependent variables (PC and CS_i) and explanatory variables (HC, P_i, Y, T, D_f, *Nform* and *Age*) used in the empirical models, including variable descriptions and sources.

Table 35. Defining and measuring the proxy variables used in estimating the system of equations

Variables	Description	Data source
Dependent Variables		
Production Cost (PC)	Total expenditure on major factors of production (including raw material; labor; energy; and interest & depreciation) less annual HACCP costs estimated from the values reported by respondents	SEC[/a], Interviews
Factor cost shares associated with Y (CS_i^P)		
CS_M^P	Total expenditure on raw materials expressed as a ratio of total production costs *(PC)* above. Raw materials are the raw fish or seafood that are processed.	SEC
CS_L^P	Total expenditure on labor expressed as a ratio of total production costs. Labor is defined as all labor hired by the firm	SEC
CS_K^P	Total expenditure on interest and depreciation expressed as a ratio of total production costs. Total cost of capital is defined as the sum of interest and dividend payments and depreciation expenses of existing assets.	SEC
CS_E^P	Total expenditure on energy expressed as a ratio of total production costs. Energy cost is equated with electricity cost[/b]	SEC
Factor cost shares associated with S CS_i^H	Estimated additional costs of factor *i* (materials, labor, capital, and energy) associated with HACCP adoption expressed as a ratio of total HACCP costs.	Interviews
Explanatory Variables		
HACCP cost (HC)	Estimated annual cost of HACCP systems[/c]	Interviews
Input Prices (P_i)		
P_M	Weighted average of fish/seafood raw material prices. This is computed as total expenditure on fish raw material divided by the total output quantity reported by respondents. (US$/kg)	Expenditure from SEC; Output from Interviews
P_L	Three-fourths of the minimum wage rate of the different regions in the Philippines (US$ per day). Adjusted minimum wage reflects variability of costs of labor (and goods) across regions.[/d]	Minimum wage rate
P_K	Price of capital defined as the weighted average of tax-adjusted interest and dividend (as a ratio of the long-term debt and equity) plus the weighted economic depreciation rate of fixed assets (US$/unit of capital)[/e]	SEC
P_E	Average price per kilowatt-hour of electricity (US$/kilowatt-hour)	ADB[/f]
Output (Y)	Volume of production (in tons)	Interview

Table 35. cont'd

Variables	Description	Data source
Product form (D_p)	Dummy for product form (frozen tuna, milkfish, shrimp, canned tuna or others)	Interview
Number of product form (Nform)	Number of distinct product forms in the production line. For instance, frozen shrimp is distinct from frozen octopus or frozen deboned milkfish.	Interviews
Age	Age of plant facility	Interviews

/a Securities and Exchange Commission; /b In some cases, it also includes light, water, and communications expenses as these are sometimes combined with electricity in the income statements of processing firms submitted to SEC; /c Many of the reporting firms do not have HACCP systems and many have zero or very limited initial investments towards adopting the system. Since we are employing a translog cost function and logarithm of zero is undefined, we put very low value for HC=0, i.e., HC=0.0001 in order to still use these observations and without creating any bias in the estimation results; annual HACCP cost is normalized by the total output to control for plant size; /d The adjustment to three-fourths of the minimum wage reflects the fact that minimum wage requirements are often not followed in developing countries, including the Philippines. The idea of adjusting the wage rate downwards was based on personal communication with J. Price Gittinger on November 15, 2006 during the "Workshop on Cost-Benefit Analysis of Agricultural Projects," World Bank, Washington, DC; /e Rates of economic depreciation per asset class were adopted from Hulten and Wykoff (1981); /f Asian Development Bank (ADB) (2005).

Interviews based on a semi-structured questionnaire were used to collect data because secondary data are not available. The final number of respondents includes 59 firms: 26 certified firms, 15 de-certified firms (those that are initially certified but discontinued certification in 2005), and 18 firms without HACCP systems. These firms represent 32 percent of the total population; eight percent of total seafood production; 67 percent of the volume and value of exports in 2004 (see details in Chapter 3). Costs categories adopted in this chapter are mainly based on Nganje (1999) and Maldonado et al. (2005), but adjusted depending on the specific context in the Philippine seafood processing industry. Actual costs[145] associated with HACCP adoption as reported by the processing firms are adopted in this chapter (see details in Chapter 3).

3 Results and Discussion

This section describes the data set used in model estimation, discusses the results of descriptive analysis of *Y* and *HC,* and analyzes estimation results from the system of equations. Empirical results and findings are presented in the order of the research questions listed earlier.

3.1 Summary Statistics of Explanatory Variables

This descriptive analysis provides detailed information about the key trends and patterns of the data. This also informs about the nature of variability and distribution of the data necessary to estimate the cost function and in making inference on the robustness

[145] Costs reported by certified firms reflect the full costs of HACCP implementation. De-certified firms reported their actual costs of adopting the HACCP systems and also their expected additional costs in order to be in compliance with the certification standards again. Firms without HACCP system reported zero to very small expenditures related to HACCP adoption. For some firms that have very small expenditures related to HACCP, this expenditure was mainly for attending training related to HACCP. The costs that firms actually spent in adopting HACCP are used in the analysis.

of the estimation.

In terms of *PC*, based on the average of 59 reporting firms, a canned tuna processor has the largest firm-level total costs, amounting to US$ 35 million, followed by shrimp processor with an average of US$ 7.0 million, octopus processor with US$ 5.0 million, chilled/frozen tuna processor with US$ 2.0 million, and milkfish processor with total costs of just over US$ 0.5 million (Table 36). Large variations in product form are evident in all firm size categories (except for canned tuna, which is produced only by large firms). However, this classification of costs by product form brings out differences in the shares of major cost components (i.e., raw materials, labor, capital, and energy). For canned tuna, raw materials are only 48 percent of total costs, labor is 27 percent, energy is 18 percent, and capital is 7 percent. Cost shares of frozen shrimp and tuna are similar, with raw materials constituting 70-71 percent of total costs, followed by capital with 14-15 percent, labor with 11 percent, and energy with 4 percent. Figures are similar for octopus[146] and other frozen seafood products, with raw materials accounting for 65-67 percent of costs, labor for 16-20 percent, capital for 10-14 percent, and energy for 4-6 percent. The cost breakdown for milkfish processors is raw materials (58 percent), labor (26 percent), capital (12 percent), and energy (5 percent).

In terms of *HC*, the cost incurred by a canned tuna processor to comply with EU HACCP certification in 2003 was US$ 98,000, on the average. However, this varied widely, as indicated by the large standard deviation (Table 36). On average, shrimp processors incurred US$ 19,000 in HACCP cost; frozen tuna processors, US$ 18,000; milkfish processors, US$ 14,000; octopus processors, US$ 15,000; and other seafood

[146] This prompted us to combine octopus and other frozen seafood in the dummy variables for product form.

processors, US$ 2,000. Capital costs made up the majority of *HC*, accounting for 42-56 percent of the total (depending on product form), followed by energy costs (24-40 percent), labor expenses (11-23 percent), and materials (1-7 percent). These factor cost shares were the similar to those in 2000 (for firms that adopted).

Table 36. Summary statistics of dependent variables for the system of equations

	Canned tuna (6) /a			Shrimp (8)			Frozen tuna (18)			Milkfish (11)			Octopus (5)			Others (11)		
	Ave.	SD /b	*2000-2003 (%) /c*	Ave.	SD	*2000-2003*	Ave.	SD	*2000-2003*	Ave.	SD	*2000-2003*	Ave.	SD	*2000-2003*	Ave.	SD	*2000-2003*
PC (US$ million)	35	21	*20*	7	3	*-9*	2	3	*8*	0.4	0.5	*123*	5	7	*-3*	0.2	0.5	*26*
CS_M (%)	48	1	*0*	70	2	*0*	71	1	*0*	58	3	*0*	67	1	*0*	65	5	*0*
CS_L (%)	27	1	*-9*	11	1	*-2*	11	1	*-3*	26	3	*-2*	16	2	*0*	20	6	*0*
CS_K (%)	18	0	*6*	15	2	*4*	14	2	*3*	12	3	*2*	14	2	*0*	10	2	*0*
CS_E (%)	7	1	*30*	4	1	*-13*	4	1	*-3*	5	1	*2*	4	1	*6*	5	1	*-4*
HC (US$ 000)	98	112	*40*	19	13	*50*	18	20	*1,300**	14	15	*(from 0 to 1423) /d*	15	13	*260*	2	0	*54,400**
HACCP CS_M(%)	2	1	*0*	6	1	*0*	1	1	*0*	7	1	*0*	1	1	*0*	4	4	*0*
HACCP CS_L(%)	23	20	*0*	22	18	*0*	17	12	*0*	15	6	*0*	11	5	*0*	16	8	*0*
HACCP CS_K(%)	48	12	*0*	40	20	*0*	43	22	*0*	42	33	*0*	48	26	*0*	56	8	*0*
HACCP CS_E(%)	27	10	*0*	32	17	*0*	39	22	*0*	36	17	*0*	40	21	*0*	24	3	*0*

*/a Numbers in parentheses are the number of respondents in each product type; /b Standard Deviation; /c Percentage change from 2000 to 2003. /d Since the old value is zero, the percentage change cannot be computed; * Very high percentage increase due to low starting figure.*

Notes: PC=annual production cost (less than HACCP costs); HC=estimated annual costs of HACCP systems; and CS_i (i=M,L,K,E) are the factor cost shares associated with conventional production (items below PC) and factor cost shares associated with food safety production (items under HC). These variables are also defined in Table 35 above.

The average firm's annual output reported by the respondents was 2,500 tons in 2002-2004, which increased from 2,200 tons in 1999-2001. These output levels vary widely across firms, as indicated by the large standard deviation (in both 2000 and 2003) (Table 37). In terms of input prices, based on the data, there is a clear increase in the price of materials, and this increase was also emphasized by respondents during the interviews. The average price of raw materials across all the product forms that a firm is producing was US$ 2.14 per kg in 2002-2004, which increased from US$ 1.81 per kg in 1999-2002. These figures were deflated to reflect adjustments for yearly inflation. The price of labor captures regional differences in minimum wage, which stayed the same during the periods of study. The figure was adjusted for inflation, resulting in a wage of US$2.93 per day in 2002-2004, up from US$ 2.54 in 1999-2001. The price of capital (measured as the weighted average of interest and dividend payment expressed as a ratio of long-term liability and equity, plus the weighted average of economic depreciation rate of fixed assets), averages 17-19 percent, although it varies across firms, ranging from 10-22 percent. The average price of energy is the same for the two periods, but was also adjusted for inflation (to US$ 0.09 per kilowatt-hour in 2002-2004 from US$ 0.08 in 1999-2001). About 29-30 percent of the respondents had frozen tuna as their main product (measured in terms of value); 18 percent had milkfish in 2002-2004, which increased from 14 percent in 1999-2001; ten percent had shrimp in 2002-2004, down from 14 percent in 1999-2001; and ten percent had canned tuna in both periods. To sum, the variables (except the price of energy) have enough variability to estimate the cost function.

Table 37. Summary statistics of explanatory variables in the system of equations

Variable	Variable Code	2000				2003			
		Ave.	SD	Min	Max	Ave.	SD	Min	Max
Output (000 tons)*	Y	2.22	5.40	0.00	24.00	2.50	6.75	0.00	38.40
Price of raw materials (US$/kg)	P_M	1.81	1.52	0.04	6.40	2.14	1.51	0.04	6.40
Price of labor (US$/day)	P_L	2.54	0.56	2.11	3.39	2.93	0.56	2.43	3.89
Price of capital (US$/unit of capital)	P_K	0.17	0.02	0.10	0.21	0.19	0.02	0.11	0.22
Price of energy (US$/kilowatt-hour)	P_E	0.08	0.00	0.08	0.08	0.09	0.00	0.09	0.09
Dummy for frozen tuna	D_{fFT}	0.29	0.46	0.00	1.00	0.30	0.46	0.00	1.00
Dummy for milkfish	D_{fM}	0.15	0.36	0.00	1.00	0.18	0.36	0.00	1.00
Dummy for shrimp	D_{fS}	0.14	0.35	0.00	1.00	0.10	0.35	0.00	1.00
Dummy for canned tuna	D_{fCT}	0.10	0.30	0.00	1.00	0.10	0.30	0.00	1.00
Age of facility	*Age*	9.10	5.34	3.00	29.00	9.10	5.34	3.00	29.00
Number of product forms	*Nform*	1.83	1.25	1.00	5.00	1.83	1.25	1.00	5.00

Source: Author's interviews. Note: Y=0.0 presented as minimum value this table does not mean zero output level, but actually equals three tons.

The mean, standard deviation, minimum, and maximum values of the explanatory variables in Table 37 above indicates possible skewness in the distribution of some variables, namely output, price of raw materials, price of capital, age of plant facility, and number of product forms. This skewness in the data implies that outlier/s would have given more weight in estimating the relationships in the model. To measure skewness, we graphed distribution of data using histograms.[147] The graphs indicate the presence of skewness among these variables (Appendix 16). Transforming the data into logarithmic forms reduced the skewness. However, the histogram still shows presence of outliers in the transformed data (e.g., price of labor and price of energy) (Appendix 17). More formally, Shapiro-Wilk and Shapiro-Francia tests for normality[148] were performed and results confirmed that the transformed data are still not normally distributed. While we

[147] Histogram is the graphical version of a table that shows what proportion of cases fall into each of several or many specified categories.

[148] Normality implies that the data follows a normal distribution.

are interested in the normality of the error term and not the normality of the variables *per se* to have a valid model and unbiased estimates, the presence of outliers and nonnormality in the variables may have an impact on the normality of the error terms. Sensitivity analyses will be performed by excluding data outliers (see later discussion of identifying the outliers in section 3.6). These new estimates will be compared with the initial ones to make inference on the robustness of the estimation (see later discussion on section 3.6).

3.2 HACCP Costs

Across 41 reporting firms with HACCP systems, on average, seafood processors estimated additional costs associated with HACCP systems equal to US$ 46,000 for fixed and non-recurring costs and US$ 19,000 for recurring costs. No significant differences in costs of HACCP adoption were reported between certified and de-certified firms of the same size group. The average costs of these two firm groups are presented in Table 38. Costs clearly vary by firm size. For instance, fixed costs for a representative cottage firm are US$ 1,700, compared to US$ 13,100 for a very small firm, US$ 32,400 for a small firm, US$ 51,300 for a medium firm, and US$ 89,300 for a large firm. A similar pattern of differences exists for recurring costs. After controlling for size of production, cost per unit of output and cost per value of output are highest for very-small firms, followed by, small, cottage, medium, and large firms (see Table 39 below). While this generally shows decreasing HACCP cost with size of production and potential economies of size in HACCP adoption, lower cost per unit of cottage firms than the very-small and small firms indicates a possible advantage due to smaller production size, in some cases.

Table 38. Total costs of HACCP systems of representative firms (in US$ 000)

Cost Category	Cottage		Very-small		Small		Medium		Large	
	NR[a]	R	NR	R	NR	R	NR	R	NR	R
Total[b]	**1.7**	**1.9**	**13.1**	**4**	**32.4**	**7.3**	**51.3**	**13.4**	**89.3**	**53.1**
Plant & equipment cost (actual)	*1.3*	*0.1*	*10.1*	*0.3*	*28.3*	*0.8*	*46.6*	*0.3*	*81.6*	*8.2*
Other start-up HACCP costs										
Consultant's costs	-	-	1.6	-	1.8	-	1.1	2.7	0.4	6.2
HACCP training costs	0.1	-	0.6	-	0.7	-	1.9	-	3.5	-
Staff time in HACCP plan design	0.3	-	0.8	-	1.6	-	1.6	-	3.8	-
Total operating costs	**-**	***1.8***	**-**	***3.7***	**-**	***6.5***	**-**	***10.5***	**-**	***38.7***
Additional lab test costs	-	0.9	-	0.8	-	1.1	-	1.1	-	4.2
Additional manpower hired	-	-	-	0.7	-	0.7	-	0.2	-	17.1
Additional materials and utilities	-	-	-	-	-	1.7	-	1.0	-	2.5
Total additional GMP	-	*0.9*	-	*2.3*	-	*3.0*	-	*8.1*	-	*14.9*
GMP personnel training	-	0.2	-	0.6	-	0.7	-	2.0	-	3.6
GMP personnel expenses	-	0.2	-	0.6	-	0.8	-	2.0	-	3.6
GMP cleaning	-	0.4	-	0.6	-	0.7	-	2.0	-	3.8
GMP pest control	-	0.2	-	0.6	-	0.7	-	2.0	-	3.8
Interest + Depreciation[c]	**-**	***0.4***	**-**	***3.0***	**-**	***8.0***	**-**	***12.0***	**-**	***21.0***

Source: Author's interviews. Note: Figures were converted using a PhP 55/US$ 1 exchange rate, which is the average in years 2002-2005. Dash means zero. [a] *NR=Non-recurring, fixed costs; R=Recurring, yearly costs.* [b] *Does not include interest and deprecation costs.* [c] *Since capital investments are included in the non-recurring and recurring costs, interest and depreciation cost are not included in the total costs. However, in computing for variable costs and assuming that all the capital investments are loaned, these costs would be included.*

3.3 Describing the Relationship of *Y* and *HC*

Annual HACCP costs were computed, using an 8-year straight line depreciation approach using the information in Table 38 above. Based on 41 reporting firms with HACCP systems, average HACCP expenditure by firm is US$ 0.05 per kilogram (kg) of output or about 1.6 percent of total value of output for the 41 reporting firms (Table 39).[149] By comparison, in a survey of 19 shrimp processors in Bangladesh, Cato and Lima dos Santos (2000) find that, on average, US$ 227,155 of start-up HACCP costs are incurred per plant (or US$ 0.14 per kg) and US$ 0.02 per kg of maintenance costs. These

[149] For detailed description of the HACCP costs, refer to Chapter 3.

figures sum to US$ 0.16 per kg, which is much higher than the estimated results for Philippine seafood processors. The difference may be explained by the presence of more advanced facilities and processes in the Philippines than in Bangladesh, prior to the mandatory EU and US regulations on HACCP systems. Colatore and Caswell (2000) surveyed US breaded fish processing firms and found out that on average, US$ 113,305 are incurred per plant as start-up HACCP costs (or US$ 0.001 per kg) and US$ 0.009 per kg maintenance costs. These figures sum to US$ 0.01 per kg, much lower than the estimated results for Philippine seafood processors. Similarly, this difference may arise from the relatively less advanced facilities and processes in place in the Philippines compared to the US before the mandatory HACCP regulations were imposed.

Table 39. Summary statistics of HACCP costs, by product form, 2005

	Start-up Costs /a		Recurring Costs /b		Annual Costs /c		Costs per Unit /d		Costs per Sales Price /e	
	Ave.	*SD*	Ave.	*SD*	Ave.	*SD*	Ave.	*SD*	Ave.	*SD*
Canned tuna (6)	111	*81*	54	*27*	68	*37*	0.4	*0.2*	0.2	*0.1*
Shrimp (7)	54	*29*	20	*9*	27	*12*	2.6	*1.3*	0.3	*0.2*
Frozen tuna (16)	50	*55*	16	*15*	22	*21*	6.6	*4.2*	2.0	*1.4*
Milkfish (5)	66	*31*	17	*6*	25	*9*	8.1	*4.6*	3.1	*1.8*
Octopus (4)	61	*48*	14	*9*	22	*14*	2.8	*1.8*	0.9	*0.6*
Others (3) /f	28	*36*	7	*8*	11	*12*	10.7	*10.8*	4.3	*4.1*
Total (41)	61	*54*	22	*20*	29	*26*	5.1	*4.9*	1.6	*2.0*

Note: This figure summarizes the HACCP costs of certified and de-certified firms and excludes 18 firms without HACCP systems. The figures are in nominal terms (figures in real terms were also derived but yields similar trends, see Annex 3)

/a US$ 000; /b US$ 000 per year; /c US$ 000 per year; /d US cents per kg of output; /e US cents per dollar of output; /f Includes a round scad and two shrimp fry/paste processors.

There are apparent differences across product forms. For instance, canned tuna and shrimp processors have lower HACCP costs (as a ratio of both unit and value production) than other processors. This apparent variation of cost by product type may in fact result from the production size of most firms within a given product group and not

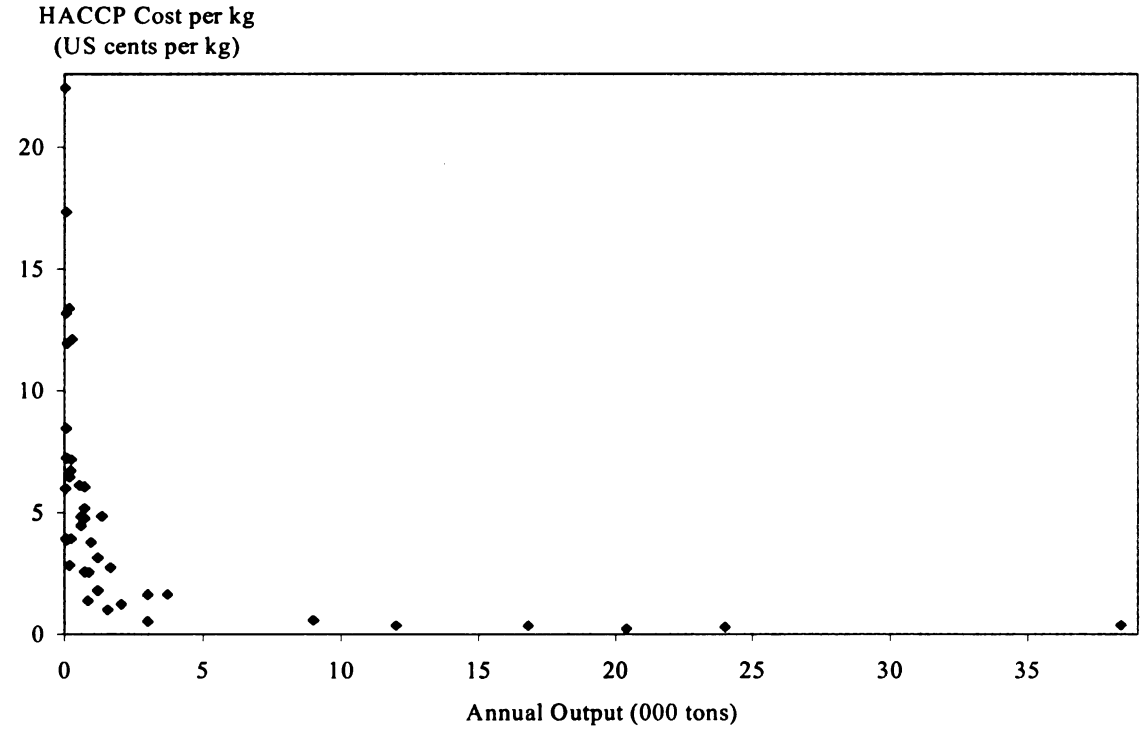
from the product form per se. It may also be that the age of the plant facility and not the product leads to higher *HC*. We employed an analysis of covariance to determine if there is a difference in *HC* (per unit output and per sales price) among product forms. Results indicate that the mean of *HC* differ significantly among product forms. Even after adjusting for production size and year of plant establishment, these variables still significantly differ by product form. Moreover, we tested whether the mean *HCs* of canned tuna and prawns are different from others, and results indicate that they are significantly different. What is driving the significant mean difference among product forms is the dummy for other products even when we control for production size and age of facility. It is difficult to make the case that other products (round scad and shrimp fry) lead to higher costs of HACCP adoption than tuna, milkfish, and prawn processors, especially since no specific regulations on only round scad and shrimp fry are imposed. Regardless, the reason might be that because these products are more prone to refusal and/or detention in the EU or US, firms make it a point to spend more on food safety measures, particularly on HACCP systems. These results could also just reflect low number of observations (i.e., three firms producing round scad or shrimp fry).

The relationship between annual production size (in terms of volume and value of output) and annual HACCP costs[150] is presented in Figures 23a and 23b below. There is a clear pattern of decreasing HACCP costs per unit with output level. This is mainly due to the relatively large fixed costs incurred in restructuring physical facilities and upgrading equipment (average of 24 percent of total annual HACCP costs) and the man-hours - external consultant and internal human resources used in HACCP plan development (20

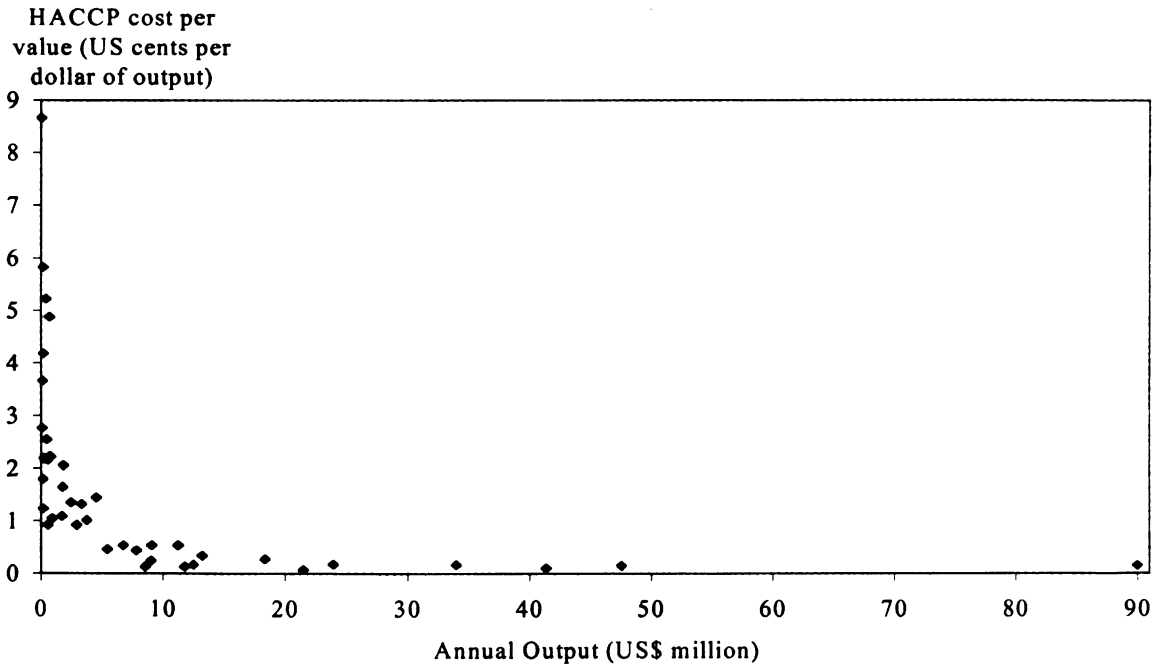
[150] Amortized using a straight-line depreciation method.

percent), and training and/or hiring for a HACCP/Quality Control/Quality Assurance person (six percent). In addition, the level or condition of food safety control systems that firms had before the mandatory regulation of HACCP systems may also explain variations in HACCP costs incurred. Often, as small firms have less rigorous food safety controls, they have to spend more to restructure both their physical plants and processes when confronted with sudden changes in requirements to continue or improve market access.

Figure 23. Scatter diagram of HACCP cost and output



(a) HACCP costs per kg of output



(b) HACCP Costs per dollar value of output

As indicated in Table 39 above, the percentage of HACCP costs is very small, compared to the total value of production by firms (i.e., 1.6 percent of the total value of production). However, when compared to the profit margin actually received by firms, the costs are more significant. For instance, on average, 1.6 percent of total value of output is spent on HACCP systems, while firms receive an average of 2.9 percent profit margin (Table 36). If the potential firm-level benefits of adopting HACCP systems do not actually accrue (as shown in Chapter 3), the extra costs will directly reduce profits to firms. HACCP cost per unit of output and as a ratio to sale price could also be substantial enough to wipe out any positive profits for very small and small firms (Table 40).

Table 40. Summary statistics of *HC* in comparison with profit margins, by firm size

	HC **(US cents per kg)**		***HC*** **(US cents per dollar of Y)**		**Profit Margin (Percent)***	
	Ave.	***SD***	**Ave.**	***SD***	**Ave.**	***SD***
Cottage (3)	4.59	*1.20*	1.93	*0.78*	2.33	*0.58*
Very-small (8)	8.91	*4.92*	2.82	*1.66*	2.00	*1.31*
Small (7)	8.00	*7.46*	2.65	*3.19*	2.43	*0.79*
Medium (13)	4.53	*3.04*	1.35	*1.24*	2.62	*1.04*
Large (10)	0.91	*0.83*	0.26	*0.16*	4.40	*1.58*
Total (41)	**5.10**	***4.95***	**1.63**	***1.86***	**2.88**	***1.45***

Note: Profit margins of firms without HACCP are much smaller than the HACCP adopter. Cottage, small, and medium firms without HACCP have 2.0 percent profit margin on average; while very-small firms have 1.75 percent.*

Interestingly, three cottage firms still appeared to be at positive profit levels (although profits were much lower) after adopting HACCP systems. In contrast, other cottage and small firms that did not have HACCP costs (with an average of only 1.4 profit margin on average) would mostly likely be unable to earn positive profits -- given the average of at least 1.9 percent of total output value to adopt a HACCP systems. This indicates that the cottage- to small-sized firms are likely to lose substantially with HACCP systems. Again, we tested whether the mean *HC* (per unit of output and per sales

price) and profit margin are significantly different among firm size group and the results show that they differ among these groups even when we control for product form and age of facility.

The three certified cottage firms are frozen tuna processors that previously worked at a larger organization but managed to find their own buyers and thus created smaller units on their own while still working closely with each other. At times, they also share customers and help each other in attempting to comply with the requirements of exporting. Their experience and how they started may be difficult to replicate for the other small firms that still do not have HACCP systems. However, the informal relationship and partnership that they share can be highlighted as an important element for successful business ventures for the small firms. These partnerships are crucial and should be promoted. The public sector can act as facilitator or enabler in cases of structural obstacles for such collective action.

3.4 Describing Process Changes due to HACCP

Based on the costs of HACCP systems listed in the beginning of this chapter, we asked firms to give us rough indications of the process changes associated with HACCP systems. Reporting firms indicated that there is no reduction in other capital and operating costs due to HACCP systems, no increased cost efficiency and cost-saving innovations, and that HACCP systems tend to reduce their operating flexibility (Table 41). This is opposite to the findings of Nganje (1999) and Paster (2008). Almost all firms reported that HACCP costs have the effect of crowding out investments that are not related to food safety. Firms had to stop production for about 3-12 months to accommodate plant changes motivated by HACCP systems.

Table 41. Summary of responses of firms about process changes related to HACCP

Category	Certified (26)*	De-certified (15)	Without HACCP (18)**
HACCP slows the production process	16	13	10
HACCP reduces operating flexibility	15	13	18
HACCP crowds out non-food safety investments	26	15	18
HACCP presents opportunity costs due to disruption in production associated with plant renovations	20	13	18
HACCP induces cost savings by undertaking both food safety and non-food safety projects together	5	4	8
HACCP initiates the process of looking more seriously at the firms' production efficiency	8	0	0
HACCP facilitates cost-cutting and other efficiency mesaures in the non-food safety related processes	2	0	0
HACCP lowers production wastages***	8	0	0

*Sources: Interviews with 59 processors. .Note: *Figures in parentheses are the number of respondents: **Responses in this column indicate reporting firms' perception rather than actual experience. Also discussed in Chapter 3.*

3.5 Results of the System of Equations Estimation

Tables 42 and 43 present the results of estimating a system of equations: the *PC* model (presented in equation 34) and the cost shares (presented in equations 38 and 39). The diagnostics of the model provide a strong indication of its overall fit and validity. Overall, the regressions are highly significant; the model can explain 99 percent of the variation in total production costs (as reflected in the R-squared). Because we are estimating a system of equations and imposing cross-equation parameter restrictions, the degrees of freedom available are $mn - k$ where m = number equations, n = number of observations, and k = number of parameters to be estimated (7 x 118 – 37 = 789).

Table 42. Results of the system of equations estimation

$$\ln PC = \beta_0 + \sum_i \beta_i \ln P_i + \beta_Y \ln Y + \frac{1}{2}\sum_i \sum_j \beta_{ij} \ln P_i \ln P_j + \frac{1}{2}\beta_{YY} (\ln Y)^2 + \sum_i \beta_{iY} \ln P_i \ln Y + \beta_H \ln HC + \beta_{HH} (\ln HC)^2 + \beta_{HY} \ln HC \ln Y + \beta_{Hi} \sum_i \beta_i \ln HC \ln P_i + \beta_{HN} \ln HC \ln Nform + \beta_N \ln Nform + \beta_T T + \sum_f \beta_f D_f + \beta_A Age + \beta_T Time$$

$$CS_i^P = \beta_i + \sum_j \beta_{ij} \ln P_j + \beta_H \frac{\partial \ln HC}{\partial \ln P_i} + \beta_{HH} \ln HC \frac{\partial \ln HC}{\partial \ln P_i} + \beta_{iY} \ln Y \frac{\partial \ln HC}{\ln P_i} + \beta_{HN} \ln Nform \frac{\partial \ln HC}{\partial \ln P_i}$$

$$CS_i^H = \beta_i + \sum_i \gamma_{ij} \ln P_i + \gamma_{iY} Y$$

Variable [a]		Coefficient		SE [b]	Variable		Coefficient		SE [b]
Price of Materials	β_M	0.74	•••	0.02	Output x Capital [c]	β_{KY}	0.04	•	0.02
Price of Labor	β_L	0.26	•••	0.05	Output x Energy	β_{EY}	-0.00		0.00
Price of Capital [c]	β_K	0.01	•	0.01	HACCP Cost	β_H	0.06	•••	0.01
Price of Energy	β_E	-0.11	••	0.05	HACCP Cost x HACCP Cost	β_{HH}	0.01	•••	0.00
Price of Materials x Price of Materials	β_{MM}	0.09	•••	0.01	HACCP Cost x Output	β_{HY}	0.02	•••	0.00
Price of Labor x Price of Labor	β_{LL}	0.03	•	0.02	HACCP Cost x Materials	β_{HM}	-0.00	••	0.00
Price of Capital x Price of Capital [c]	β_{KK}	0.00		0.02	HACCP Cost x Price of Labor	β_{HL}	-0.00	•••	0.00
Price of Energy x Price of Energy	β_{EE}	-0.02		0.02	HACCP Cost x Price of Capital [c]	β_{HK}	-0.00	•	0.00
Price of Materials x Price of Labor	β_{ML}	-0.07	•••	0.01	HACCP Cost x Price of Energy	β_{HE}	-0.00	•••	0.00
Price of Materials x Price of Capital [c]	β_{MK}	-0.01	•	0.00	HACCP Cost x Number of Product	β_{HN}	0.00		0.00
Price of Materials x Price of Energy	β_{ME}	-0.01	••	0.00	Number of Product	β_N	0.05		0.06
Price of Labor x Price of Capital [c]	β_{LK}	0.00		0.01	Dummy for Shrimp	β_{fS}	0.34	•••	0.10
Price of Labor x Price of Energy	β_{LE}	0.04	•••	0.01	Dummy for Frozen Tuna	β_{fFT}	0.09		0.08
Price of Capital x Price of Energy [c]	β_{KE}	0.01		0.02	Dummy for Canned Tuna	β_{fCT}	-0.26		0.19
Output	β_Y	1.04	•••	0.08	Dummy for Milkfish	β_{fM}	-0.22	•••	0.08
Output x Output	β_{YY}	0.01		0.02	Year of Plant Establishment	β_A	0.13	••	0.06
Output x Price of Material	β_{MY}	-0.02	•••	0.00	Time	β_T	0.07	•••	0.02
Output x Price of Labor	β_{LY}	0.00		0.00	Constant	β_0	-123.43	•••	37.71

Table 42. cont'd

Note: *,**,*** *Significant at* $\alpha = 0.10$, $\alpha = 0.05$, *and* $\alpha = 0.01$, *respectively;* [/a] *All variables (except dummies and year) are in log form;* [/b] *Standard error;* [/c] *The regression coefficients, designated* S_b, *were computed as* $S_b = S_e / \sqrt{(x - \bar{x})^2}$, *where* S_e *is the standard error of the estimate, given as* $S_e = \sqrt{\Sigma (y - y')^2 / (n - k - 1)}$, *y is the dependent variable, x is the explanatory variable,* $\bar{x}$ *is the average of x, n is the number of observations, and k is the number of parameters estimated; Total degrees of freedom=mn-k (where m=number of equations),=7x118–37=789; Model diagnostic: PC:* R^2*=0.99,* Chi^2*=128434, P-value=0.0;* CS_M^P *:* R^2*=0.41,* Chi^2*=417, P-value=0.0;* CS_L^P *:* R^2*=0.48,* Chi^2*=409, P-value=0.0;* CS_E^P *:* R^2*=-0.25,* Chi^2*=294, P-value=0.0;* CS_M^H *:* R^2*=0.14,* Chi^2*=20, P-value=0.0;* CS_L^H *:* R^2*=0.14,* Chi^2*=23, P-value=0.0;* CS_E^H *:* R^2*=0.22,* Chi^2*=36, P-value=0.0*

Table 43. Results of the estimation for HACCP cost shares

Variables		Coefficient	SE
CS_M^H			
Price of Materials	γ_{MM}	0.00	0.00
Price of Labor	γ_{ML}	0.01	0.01
Price of Capital	γ_{MK}	-0.02	0.06
Price of Energy	γ_{ME}	0.01	0.01
Output	γ_{MY}	**0.00**	**0.00**
Constant	γ_M	-0.02	0.02
CS_L^H			
Price of Materials	γ_{ML}	0.01	0.01
Price of Labor	γ_{LL}	0.07	0.05
Price of Capital	γ_{LK}	-0.06	0.08
Price of Energy	γ_{LE}	-0.01	0.06
Output	γ_{LY}	**0.02**	**0.01**
Constant	γ_L	-0.24	0.15
CS_E^H			
Price of Materials	γ_{ME}	0.01	0.01
Price of Labor	γ_{LE}	-0.01	0.06
Price of Capital	γ_{KE}	**-0.62**	**0.16**
Price of Energy	γ_{EE}	**0.61**	**0.15**
Output	γ_{EY}	**0.04**	**0.01**
Constant	γ_E	0.42	0.22
CS_K^H			
Price of Materials	γ_{MK}	-0.02	0.06
Price of Labor	γ_{LK}	-0.07	0.05
Price of Capital	γ_{KK}	**0.7**	**0.25**
Price of Energy	γ_{KE}	**-0.61**	**0.15**
Output	γ_{KY}	**-0.06**	**0.02**
Constant	γ_K	0.84	0.45

Note: The figures in bold are statistically significant at 0.01 level of significance.

While all of the parameters estimated in Tables 42 and 43 are important, the discussion here is limited to parameters that directly answer the research questions. We present here the results of the estimation focusing on the relationship between *HC* and *Y*; *HC* and *PC*; and *HC* and economies of size.

3.5.1 Estimating the Relationship of *Y* and *HC*

Section 3.3 provided scatter diagram and other descriptive statistics showing the relationship of *HC* and *Y*. While the descriptive analysis indicates a strong negative relationship between *HC* and *Y*, it does not allow measurement of the marginal contribution of *Y* to changes in *HC*, i.e., other variables that may also be correlated with *HC* and/or *Y* were not held constant. Here the descriptive analysis is complemented by an examination of the marginal contribution of Y on changes in *HC*. We are interested in looking at the significance of coefficients: β_{HY} and γ_{iY}. We look at the relationship of *Y* and *HC* in relation to *PC* through the significance of β_{HY}. We look at the relationship of *Y* with factor cost shares of HACCP systems, CS_i^H, by looking at the significance of parameters γ_{iY}'s.

The analysis from the cost function indicates a positive interaction between *Y* and *HC* in affecting *PC* (Table 42). For instance, the elasticity of *PC* to changes in *HC* is positively correlated with change in *Y*; and the elasticity of *PC* with respect to changes in *Y* is positively correlated with changes in *HC*. In other words, the underestimation of *PC* increases with *Y* and diseconomies of size in seafood processing increases with *HC*.

The coefficients γ_{iY} for $i \in \{M, L, E\}$ are significantly positive (Table 43), which indicates that higher *Y* corresponds to higher cost shares of M, L, E, but lower cost share of *K* to total *HC*. The larger the firm size, the more energy and labor (and a bit more of materials) costs are incurred for implementing HACCP systems and the less capital cost is incurred for these systems. This result may be due to the main observation that larger firms already have relatively more advanced facilities and systems, while smaller firms

must invest a lot more in equipment and facility improvements to comply, which requires more capital costs. There seems to be no significant factor substitution evident between labor, materials, and other factors; but, there is significant substitution between energy and capital (Table 43). While more capital investment is usually accompanied by more energy expenditure, the results indicate that plant restructuring and new equipments and machines may have contributed to more efficient energy use. This also implies that modeling HACCP cost as dependent on factor prices (which this chapter assumes) reflects a more appropriate approach to modeling HACCP costs as compared to Nganje's (1999) HACCP cost model with independent of factor prices.

3.5.2 Estimating the Relationship of *HC* and *PC*

The null hypothesis is that the coefficient β_H should be zero and that reported *HC* accurately reflect the cost of HACCP system. That is, HACCP-related activities (*HC)* should have no effect on non-HACCP production costs (*PC*). In particular, the parameter β_H measures the elasticity of *PC* with respect to reported *HC*. To get the dollar change in *PC* for a dollar change in reported *HC* (which will be called *PC offset* hereafter, adopting the term used by Morgernstern et al. 1998; 2001), $\frac{\partial PC}{\partial HC} = \beta_H \frac{PC}{HC}$, we multiply the estimated elasticity by the ratio of *PC* to *HC* for a particular firm. To get the dollar change in total costs (HACCP and non-HACCP) for a dollar change in reported *HC* (which we refer to as *marginal cost* of reported *HC* hereafter), we add one to this *PC offset.*

Our estimation results show that on average, β_H = 0.06 and is significantly different from zero ($\beta_H > 0$). This implies that there is significantly relationship between

HC and *PC,* and thus, we reject the FSE hypothesis (Table 42). A one-percent increase in *HC* leads to a 6-percent increase in *PC.* In dollars, using the equation: $\frac{\partial PC}{\partial HC} = \beta_H \frac{PC}{HC}$, a one-dollar change in *HC* leads to a 20-dollar change in *PC*, on the average. Due to the wide range of *PC/HC*, the dollar-for-dollar uncounted burden also varies widely.[151] The marginal cost of reported *HC* (i.e., the dollar change in total costs (HACCP and non-HACCP); 1 + 20) for a dollar change in reported *HC* is US$ 21. ***These results indicate a significant underestimation of HACCP costs as reported by firms.*** As reflected by interviews with Philippine seafood processors, this underestimation is due to the crowding-out effect, reduced flexibility in operations; slower production process; and production disruption related to renovations, which aggregately exceed that of costs savings and complementarities induced by HACCP systems.

While on average, β_H is the measure of the *HC-PC* relationship, we also allow this relationship to vary across different levels of *Pi, Y* and *Nform.* We test the joint significance of β_H , β_{HH} , β_{Hi} β_{HY} , and β_{HN} (where i=*M,L,K,E*). This elasticity, dependent in other factors, is shown in equation 42 below:

$$e_{PCH} = \frac{\partial \ln PC}{\partial \ln HC} = \beta_H + \beta_{HH} \ln HC + \sum_i \beta_{Hi} \ln P_i + \beta_{HY} \ln Y + \beta_{HN} \ln Nform \qquad (42)$$

Results indicate that β_H , β_{HH} , β_{Hi} β_{HY} , and β_{HN} are jointly significant. Higher *HC* correlates with higher elasticity of *PC* to changes in *HC*, which shows higher

[151] This has prompted Morgenstern et al. (2001) to use *HC/PC* as the dependent variable instead of ln *HC* See model estimation following this in section 4, this Chapter.

underestimation of *HC*. The higher the input prices, P_i, the lower the elasticity of *PC* to changes in *HC*, which shows lower underestimation of *HC*. Moreover, higher *Y* correlates with higher elasticity of *PC* to changes in *HC*, which indicates higher underestimation of *HC*. The elasticity of *PC* to changes in *HC* is constant regardless of the number of products processed by the reporting firms.

3.5.3 Estimating Economies of Size

We also measure economies of size, characterized as a production process in which an increase in the scale of the firm causes a decrease in the long-run average cost of each unit. The estimated translog cost function *PC* yields a direct measure of economies of size, which is the elasticity of *PC* with respect to *Y* as given in equation 43 below:

$$e_{PCY} = \frac{\partial \ln PC}{\partial \ln Y} = \beta_Y + \beta_{YY} \ln Y + \sum_i \beta_i \ln P_i + \beta_H \ln HC \qquad (43)$$

Cost elasticity less than one ($e_{PCY} < 1$) defines economies of size, which means that a one percent increase in quantity of production will lead to a less than one percent increase in total costs. Thus, lowering average costs as quantity of production increases. Estimated values exceeding one ($e_{PCY} > 1$) show diseconomies of size, which means that a one percent increase in the quantity of production will lead to a more than one percent increase in total costs. Thus, average costs rise, as the quantity of production increases.

On average, β_Y is the measure of economies of size. On the average, the measure of firms' economies of size in seafood processing is $\beta_Y = 1.04$, which signifies slight

diseconomies of size, but not statistically significant (from the null hypothesis=1). We allow this relationship to vary across different levels of *Pi, Y* and *HC*. Thus, each data point will have a different e_{PCY}. We then compare the e_{PCY} calculated at each data point to see if there are significant differences between plants with and without HACCP systems and before and after HACCP implementation.

We compare the economies of size measure among certified firms, de-certified firms, and firms without HACCP systems (Table 44). In 2003, on average, certified and de-certified firms have slight diseconomies of size, while firms without HACCP had slight economies of size. However, analysis of covariance indicates that the measures of economies of size do not significantly differ among these groups in both 2000 and 2003. Our estimation results indicate that, on average, ***there are no economies of size in seafood processing even with HACCP systems*** in contrast to most findings in literature. Since economies of size also measure the cost efficiency in scale, ***results indicate that all the firms, regardless of whether they have HACCP system or not, have similar degree of cost efficiency.***

Table 44. Results of the estimation on economies of size, by firm group

Firm groups	2003	2000
Certified	1.15	0.91
De-certified	1.14	0.94
Without HACCP	0.84	0.84
All	1.05	0.90

No economies of size associated with HACCP adoption, as shown in this chapter, may be due to the very small percentage of HACCP cost (in relation to total cost or production value) to substantially influence the diseconomies of size in the seafood processing in a pre-HACCP case. From another angle, despite capital investments and

subsequently reduced per-unit cost to be gained from expanding production, HACCP systems may be contributing more costs (e.g., through more supervision and monitoring needed, slower production process due to a more meticulous food contamination control). As the results show, this may be the case regardless of firm size.

Comparing before and after HACCP adoption, certified and de-certified firms had slight but statistically insignificant economies of size before HACCP adoption (year 2000) and slight diseconomies of size after HACCP adoption (year 2003). Firms without HACCP has slight economies of size for both periods (Table 44 above). It is likely that these certified and de-certified firms adjusted production in anticipation of greater demand or lower per-unit costs as a result of HACCP adoption, which is why we see a shift of economies of size from 2000 to 2003. It might be that the production adjustment was way beyond the optimal level, which indicates a possible gap between the actual and anticipated demand or per unit-costs. This may represent a state of disequilibrium, where production can be expected to go down. The measure of economies of size for firms without HACCP is similar for both years, 2000 and 2003.

Also, the marginal cost (MC), measured as $\frac{\partial PC}{\partial Y}$, of all firms with and without HACCP systems are estimated and the results are used to determine whether firms with HACCP systems enjoy lower MC than firms without HACCP systems. Table 45 shows the average MC of certified firms, de-certified firms, and those without HCCP systems. While there are some slight differences in averages, the analysis of covariance indicates that MC does not significantly differ among these groups. ***These results indicate no difference in the level of efficiency between firms with and without HACCP and in firms before and after adoption. From the cost (allocative) efficiency perspective, these***

show no evident sign of cost efficiency gains associated with HACCP adoption.

Table 45. Results of estimation on marginal cost, by firm group

Firm groups	2003	2000
Certified	0.011	0.020
De-certified	0.003	0.002
Without HACCP	0.076	0.087

3.6 Test for Normality and Sensitivity Analysis

The error terms were tested for normality, and a robustness test of results was performed. The Shapiro-Wilk and Shapiro-Francia tests for normality indicate that the error terms are not normal. Thus, the results may not be robust and should be interpreted with care. A common way to check for the robustness of the results is by looking at the presence of outliers, which were possibly given more weight in the estimation results. Sensitivity analyses were performed to see the impact of these outliers on the estimation results.

First, we looked at the outliers in the data. We used the method developed by Hadi (1992; 1994) (using the *hadimvo* procedure in Stata) to identify multiple outliers in multivariate data. Transforming most of the variables into log form removed any outliers in the data except for $ln\ P_K$. Two observations were identified as possible outliers. We excluded these outliers and re-estimated the model. Results of the first re-estimation model are presented in Table 46, and showed that the coefficients and their significance did not change much. The coefficients of $ln\ P_M$ and $ln\ P_L$ went up by 0.01-0.03, but the significance levels stayed the same. The only major change is that the squared term of $ln\ P_L$ became insignificant. However, the underestimation of *HC*, absence of economies of size, and absence of efficiency gains (between firms with and without HACCP and in firms before and after adoption) remained the same as in the original model. Despite

showing an initial sign of robustness of the results, the error terms of this first re-estimation model remained nonnormal. Thus, robustness cannot still be ascertained and inference from the results should be made with careful interpretation.

Table 46. Results of the system of equations re-estimation without outliers

Coeff. [a]	Original [b]		Model 1		Model 2		Model 3		Coeff. [a]	Original [b]		Model 1		Model 2		Model 3	
β_M	0.74	***	0.75	***	0.75	***	0.75	***	β_{KY}	0.04	*	0.04	*	0.04	*	0.04	*
β_L	0.26	***	0.29	***	0.26	***	0.29	***	β_{EY}	0.00		0.00		0.00		0.00	
β_K	0.01	**	0.01	**	0.01	**	0.01	**	β_H	0.06	***	0.06	***	0.04	***	0.04	***
β_E	-0.11	**	-0.11	**	-0.11	**	-0.11	***	β_{HH}	0.01	***	0.01	***	0.01	***	0.01	***
β_{MM}	0.09	***	0.09	***	0.09	***	0.09	***	β_{HY}	0.02	***	0.02	***	0.01	***	0.01	***
β_{LL}	0.03	*	0.01		0.03	**	0.01		β_{HM}	0.00	**	0.00		0.00	**	0.00	
β_{KK}	0.00	*	0.00	*	0.00	*	0.00	*	β_{HL}	0.00	***	0.00	***	0.00	***	0.00	**
β_{EE}	-0.02		-0.04		-0.02		-0.03		β_{HK}	- 0.00		- 0.00		- 0.00		- 0.00	
β_{ML}	-0.07	***	-0.07	***	-0.08	***	-0.08	***	β_{HE}	0.00	***	0.00	***	0.00	***	0.00	***
β_{MK}	-0.01	*	-0.01	*	-0.01	*	-0.01	*	β_{HN}	0.00		0.00		0.00		0.00	
β_{ME}	-0.01	**	-0.01	***	-0.01	***	-0.01	***	β_N	0.05		0.04		0.00		-0.03	
β_{LK}	0.00		0.00		0.00		0.00		β_{fS}	0.34	***	0.31	***	0.27	***	0.22	***
β_{LE}	0.04	***	0.04	***	0.05	***	0.04	***	β_{fFT}	0.09		0.07		0.06		0.04	
β_{KE}	0.01		0.01		0.01		0.01		β_{fCT}	-0.26		-0.26		-0.45	***	-0.48	***
β_Y	1.04	***	1.05	***	0.99	***	0.99	***	β_{fM}	-0.22	***	-0.26	***	-0.15	***	-0.26	***
β_{YY}	0.01		0.01		0.02	**	0.02	**	β_A	0.13	**	0.14	**	0.12	***	0.12	***
β_{MY}	-0.02	***	-0.02	***	-0.02	***	-0.02	***	β_T	0.06	***	0.06	***	0.06	***	0.07	***
β_{LY}	0.00		0.00		0.00		0.00	**	β_0	-123.43	***	-120.56	***	-122.79	***	-142.16	***

*Note: *, **, *** Significant at $\alpha = 0.10$, $\alpha = 0.05$, and $\alpha = 0.01$, respectively; [a] Coeff. means symbol of the coefficient or parameter estimated (consistent with equation 36 and Table 42); [b] Original model is one described in Table 42 above; Model 1 excluded two outliers in the data; Model 2 excluded four outliers in the residuals; and Model 3 excluded two outliers in the data and four outliers in the residuals.*

Second, in order to remedy the nonnormality of the error term, we looked at the possible outliers in the estimation residuals. We again used the method developed by Hadi (1992; 1994) (using the *hadimvo* procedure in Stata) to identify outliers. Four observations were identified as possible outliers in the residuals. We excluded these outliers and re-estimated the model. Results of the second re-estimation model are presented in Table 46, and showed that the coefficients and their significance did not change much (except the squared term of *ln Y* now becomes significant). However, the underestimation of *HC*, absence of economies of size, and absence of efficiency gains (between firms with and without HACCP and in firms before and after adoption) remained the same. Moreover, the error terms became normal, based on the Shapiro-Wilk and Shapiro-Francia tests. Thus, we conclude the results turned to be robust for the exclusion of the observations and inference can be made based on the normal regression assumptions.

Third, we re-estimated a third model excluding both outliers in the data and in the residuals described above. Thus, six observations were identified as outliers. Similar to the earlier models, results showed that the coefficients and their significance did not change much, except the squared term of *ln Y* now becomes significant and squared term of *ln* P_L becomes insignificant (which are the combined effect of the first and second re-estimation models). However, the underestimation of *HC*, absence of economies of size, and absence of efficiency gains (between firms with and without HACCP and in firms before and after adoption) remained the same. Moreover, the error terms were also normal, as in the second re-estimation model above. Thus, we conclude the results turned to be robust for the exclusion of the observations and inference can be made based on the

normal regression assumptions.

4 Other models

To measure the robustness and consistency of the results, we estimated other models:

Model 2: Using HC/PC, instead of ln HC/Y, as an explanatory variable to capture the relationship between HC and PC (or the under- (over-) estimation of HC)

This approach was used by Morgenstern et al. (2001). The coefficient of *ln HC/Y*, β_H, indicates a constant elasticity between *HC* and *PC*. However, a constant elasticity implies a varying dollar-for-dollar effect, with $\frac{\partial PC}{\partial HC} = \beta_H \frac{PC}{HC}$, and this effect varies by a large amount (up to $10,000) across firms. Because we find it implausible that the dollar-for-dollar effect fluctuates by such a large factor, we followed the same explanatory variable, *HC/PC*, as used by Morgenstern et al. (2001), rather than *ln HC/Y*.

As shown in Table 47, results in the original model are consistent with model 2, i.e., there is significant underestimation of the *HC*. In dollars, using the equation: $\frac{\partial PC}{\partial HC} = \beta_H \frac{1}{1 + \beta_H (HC/PC)}$, which is approximately the value of β_H, a one-dollar change in *HC* leads to a US$ 1.10-change in *PC*. Thus, the *PC offset* is equal to US$ 1.10. The marginal cost of reported *HC* (i.e., the dollar change in total costs (HACCP and non-HACCP) for a dollar change in reported *HC* is US$ 2.10.

Moreover, there are no significant economies of size in seafood processing with or without HACCP systems, similar to the findings from the original model.

Model 3: Using total variable cost, ln PVC, as the dependent variable instead of ln PC, and using capital stock, ln CAPITAL, as an additional explanatory variable, instead of the price of capital, ln P_K

As shown in Table 47, results in Model 3 indicate that *HC* is not statistically significant, which implies that *HC* does not affect total variable cost (more than the dollar effect). Moreover, the results imply no under- or overestimation of the *HC* in terms of the total variable costs. Combining this result with earlier results from the original model, indicating that *HC* affect *PC* (more than its dollar effect), Model 3 implies that *HC* significantly affect total fixed costs rather than total variable costs of firms. This further implies that there is underestimation of the reported HACCP-related fixed costs and that actual costs should be higher. Uncounted fixed costs could be because of the inherent difficulties to disaggregate HACCP-related versus non-HACCP-related fixed costs. The uncounted costs could also be in the form of crowding out effect of HACCP-related investments on non-HACCP-related investments and higher administrative and monitoring costs associated with HACCP adoption.

Results of Model 3 indicate that coefficient of production size (*Y*) is significantly less than one, which makes one directly assume that there were economies of size. However, following Caves et al. (1984); Filippini (1996); Filippini and Luchsinger (2005), we define economies of size (EOS) as the proportional increase in total costs (not variable costs) brought about by a proportional increase in output, holding all input prices and the number of plants fixed. This is equivalent to the inverse of the elasticities of variable cost with respect to output (Filippini and Luchsinger 2005) given in equation 44

below:

$$EOS = \frac{1 - \dfrac{\partial \ln PVC}{\partial \ln Capital}}{\dfrac{\partial \ln PVC}{\partial \ln Y}} \tag{44}$$

Using equation 44 above, on the average, EOS is 1.52, which implies diseconomies of size. The diseconomies of size are consistent across firms, with and without HACCP systems and firms with different sizes. These findings indicate that despite relatively large fixed costs incurred in upgrading physical facilities and equipment, which potentially lower average costs, higher production size would also mean higher investments in avoiding cross-contamination in the plant and more investments in monitoring and supervision. Moreover, HACCP systems may be friendly to smaller processors, given their potential to more easily control and monitor human and other resources. The findings also indicate that at present, both small and large firms operate with no cost advantage and no cost-related hindrances to entry and exit. Claims by the food industry regarding small players' exclusion in the high-value markets and deepening market segmentation in the industry due to food safety systems, e.g., HACCP, can be exaggerated.

Table 47. Results of the system of equations re-estimation with two variant models

Coeff. [/a]	Original [/b]	Model 2	Model 3	Coeff. [/a]	Original [/b]	Model 2 [/c]	Model 3 [/d]
β_M	0.740 ***	0.772 ***	0.829 ***	β_{KY}	0.040 *	0.015 *	
β_L	0.260 ***	0.299 **	0.310 ***	β_{EY}	0.000	0.005	0.010
β_K	0.010 **	0.623 **		β_H	0.060 ***	1.101 ***	-0.004 ***
β_E	-0.110 **	-0.694 ***	-0.139	β_{HH}	0.010 ***	-0.187	0.005 ***
β_{MM}	0.090 ***	0.083 ***	0.061 **	β_{HY}	0.020 ***	0.019 ***	0.012 ***
β_{LL}	0.030 *	-0.018	0.008	β_{HM}	0.000 **	0.030 *	0.001
β_{KK}	0.000 *	-0.034 *		β_{HL}	0.000 ***	-0.025	-0.003 ***
β_{EE}	-0.020	-0.134	1.028 ***	β_{HK}	0.000	-0.272 ***	
β_{ML}	-0.070 ***	-0.079 **	-0.055 **	β_{HE}	0.000 ***	0.267 ***	0.001
β_{MK}	-0.010 *	0.001		β_{HN}	0.000	0.002	-0.005
β_{ME}	-0.010 **	-0.005	-0.773 ***	β_N	0.050	0.066	0.050
β_{LK}	0.000	-0.004		β_{fS}	0.340 ***	0.417 ***	-0.406 ***
β_{LE}	0.040 ***	0.101 **	-0.255 **	β_{fFT}	0.090	0.161 **	-0.173 ***
β_{KE}	0.010	0.037 *		β_{fCT}	-0.260	-0.285	0.213
β_Y	1.040 ***	1.099 ***	0.336 ***	β_{fM}	-0.220 ***	-0.194 **	0.068
β_{YY}	0.010	-0.004	0.043 ***	β_A	0.130 **	0.108 *	0.004
β_{MY}	-0.020 ***	-0.018 ***	-0.011	β_T	0.060 ***	0.100 ***	0.070 ***
β_{LY}	0.000	0.001	0.001	β_0	-123.430 ***	-194.155 ***	-137.689 ***
				$\beta_{Capital}$			0.463 ***
				β_{Hcap}			0.000
				β_{mcap}			0.000
				β_{lcap}			0.000

*Note: *, **, *** Significant at $\alpha = 0.10$, $\alpha = 0.05$, and $\alpha = 0.01$, respectively; [/a] Coeff. means symbol of the coefficient or parameter estimated (consistent with equation 36 and Table 42); [/b] Original model is one described in Table 42 above; [/c] Model 2 uses HC/PC, instead of ln HC/Y, as an explanatory variable to capture the relationship between HC and PC, as described above; [/d] Model 3 uses total variable cost, ln PVC, as the dependent variable instead of ln PC, and uses capital stock, ln CAPITAL, as an additional explanatory variable, instead of the price of capital, ln P_K. In Model 3,*

Table 47. cont'd

$\beta_{Capital}$ is the coefficient of ln CAPITAL; β_{Hcap} is the interaction term between ln HC/Y and ln CAPITAL; β_{mcap} is the interaction term between ln P_M and ln CAPITAL; and β_{lcap} is the interaction term between ln P_L and ln CAPITAL.

5 Summary and Policy Implications

HACCP cost per unit decreases with output levels, as shown by descriptive analysis. This finding is mainly due to the relatively large fixed costs incurred in upgrading physical facilities and equipment, and hiring/training personnel for quality control and HACCP plan development. In addition, the condition of pre-existing food safety control systems before the mandatory US and EU HACCP regulation may also explain the variations in HACCP costs. Small firms, which often have less rigorous food safety control processes before the mandatory HACCP regulation, have to invest more to meet new food safety requirements that affect their market access.

HACCP costs were just 1.6 percent of the total value of output of firms, on average (ranging from 0.09 percent to as high as 8.5 percent of the total value of production). Thus, HACCP costs may be small enough to influence the overall production costs and economies of size in seafood processing. The cost estimation implies that when other factors are controlled for, the negative relationship of HACCP costs and firm size, shown by the descriptive analysis, disappears.

Results reject food safety exogeneity (FSE) in the production cost and further indicate the underestimation of reported HACCP costs. These results confirm earlier findings of Antle (2000). The underestimation of the reported HACCP costs is US$1.10 to US$20 more per dollar of the accounted value depending on the model used. Thus, the marginal cost (1 + uncounted costs) of HACCP systems could range from US$2.10 to US$21 depending on the model used. The exact figure may be difficult to ascertain, but it is clear in all the models used that there is underestimation of the accounted value. At the least, the results illustrate the challenge in accurately estimating and reporting HACCP

costs and emphasize the need for careful interpretation of costs as they are reported or estimated. Good assessment of costs and benefits are crucial for making sound support and policies toward greater food safety. There is a need to be careful in estimating costs and benefits before making policy implications.

In addition, there is no evidence of cost efficiency gains associated with HACCP systems, as shown in two estimation results: (a) firms with and without HACCP are both cost-inefficient, and there are no significant differences in terms of the level of inefficiency (marginal cost) between the two groups; and (b) no significant difference in terms of cost efficiency within firms before and after HACCP adoption. This contradicts the findings of Nganje (1999) on the US meat industry. It may be that efficiency gains were and are realized in the US meat industry; but not in other contexts such as the Philippine seafood industry. The results indicate that efficiency gains from HACCP systems (which is strongly supported by a number of studies on developed countries) may not hold in developing countries, where trade-offs and challenges for food safety are greater. As reflected by interviews with Philippine seafood processors, this underestimation is due to the crowding-out effect, reduced flexibility in operations; slower production process; and production disruption related to renovations, which aggregately exceed that of costs savings and complementarities induced by HACCP systems. Lack of efficiency gains from HACCP systems may reflect contextual realities and challenges in the Philippine seafood industry, different from the countries and sectors analyzed in past studies that showed efficiency gains. Results stress the importance of looking at the context- specificity associated with the relative effectiveness of food safety systems. For instance, higher "true" costs may imply a greater need for support for firms

to adopt and sustain HACCP systems. Lack of observed efficiency gains may have resulted from lack of proper adoption and handling of the HACCP system, which implies a need to strengthen technical assistance to firms for more effective implementation of the techniques and procedures of the system.

Results further indicate that there are no efficiency gains for large firms to expand production to lower their average costs, which translates to continued potential for small processors to compete in the basis of costs. Despite large capital investments, HACCP systems may be friendly to smaller processors, given their potential to more easily control and monitor human and other resources. This further indicates that at present, both small and large firms operate with no cost advantage and no cost-related hindrances to entry and exit. Claims by the food industry regarding small players' exclusion in the high-value markets and deepening market segmentation in the industry due to food safety systems, e.g., HACCP, can be exaggerated.

Some small firms can strategize and have HACCP systems and they can still compete with larger firms within the country. However, smaller firms may be constrained by the difficulty of accessing credit for them to expand production and start with the capital investments required of HACCP systems (Chapter 3). In such cases, strategies to strengthen the credit system or improve the availability of credit especially to smaller firms, which are mostly affected by credit crunch, are critical (not only from an equity perspective but also from an efficiency perspective).

In addition, constant innovation is crucial for firms to stay in business and not be excluded from the fast-changing markets for seafood products. Product differentiation and food safety and quality certification are areas that both the public and private sector

can work together to explore or strengthen. Implementing food safety measures can entail large costs (even higher than reported costs) and does not apparently lead to efficiency gains. Creative ways to expand the market, stronger linkages along the value chain, and partnerships with other firms, academe, research organizations and the public sector are of crucial importance. Organizing into associations, formally and informally, can leverage their advantage in expanding their product lines and markets (consistent with Chapters 2 and 3). The public sector can act as enabler of collective action by reducing any institutional or structural barriers to such collective efforts. It can start by creating a healthy business environment for private sector to grow and by promoting confidence-building measures, in cases where trust on the government is missing. It can act as a facilitator or catalyst for collective action and partnerships, especially in the absence of such efforts from the private sector.

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CHAPTER FIVE

CONCLUSIONS

Food safety is increasing being recognized as important element for public health, international trade, and food sector competitiveness. This dissertation addresses three important gaps in the growing literature related to food safety: (i) industry competitiveness and the role of food safety; (ii) firm behavior towards initial and continued certification of HACCP systems; and (iii) costs and economies of size in adopting HACCP systems.

1 Main Findings

Food safety regulations have both changed and enhanced the complexity and dynamics of the seafood industry. The varying levels of seafood export performance by Thailand, Vietnam and the Philippines, despite the many similarities among these three countries, showcase one of the most striking trends in the international seafood market. All three countries share similar proximity to major importing countries, a comparable crucial role of seafood exports in economic growth and employment, and similar overall richness in water resources. However, the Philippines has lagged far behind in seafood export market share; while that of Thailand's and Vietnam's has grown rapidly since the 1990s. A comparative institutional analysis of the three countries traces what led to these outcomes and how things happened and provides important policy and institutional insights for industry players and government officials interested in reversing the trends in the Philippines (Chapter 2).

A much earlier adoption and stronger commitment to export-oriented industrialization (EOI) policies and institutions are key to the differences in the export performance which benefited the seafood industries in Thailand and Vietnam. These EOI policies and institutions include: (i) private-public partnerships and industry linkages; (ii) proactive and aggressive export promotion strategies by both the private and public sectors; (iii) crucial public sector investments in infrastructure and healthy business climate; and (iv) reducing protection on import-substituting, manufacturing sectors and diverting scarce resource to the export sectors (including seafood industry). Amidst increasing competition worldwide, and despite the consistently recognized role of the seafood industry in contributing to economic growth, the Philippines has failed to support seafood exports, and instead has continuously taxed the industry implicitly by protecting other sectors.

The policies and institutions adopted in these three countries were shaped by political structures as well as economic and social factors in each country. It is often difficult to induce changes and radical reforms within a fixed political structure. It is beyond the scope of this dissertation to discuss change in political structures; however, the fundamental importance of pressure to the political structure to change the status quo and avoid stagnation of potentially viable sectors is clear.

Policies favorable to the seafood industry have been more easily passed in Thailand and Vietnam than in the Philippines due to the lack of sustained investments from sector actors to push forward these policies in the latter. The culture of free-riding, dole-out mentality, and lack of sustained collective action is more prevalent in the Philippines than in Thailand and Vietnam. The Philippines can learn from these

countries' experience, but structural changes need to occur including permitting healthy competition among interest groups and creating a favorable environment for collective action and business sector to flourish and for individual actors to participate and contribute to the betterment of the sector. Without such elements, high exclusion costs and high information costs will not be overcome and those policies favoring the sector will be passed. Political commitment and strong leadership to champion the cause of these sectors are crucial. Once political commitment is present, then several strategies can be adopted by the government, in partnership with the different stakeholders, based on lessons learned from the experience of Thailand and Vietnam.

Particularly important to the growth and development of food industries is an effective build-up of food safety management capacity. Related to EOI policies, Thailand and Vietnam focused on food safety and quality and strategically capitalized on these attributes to gain competitive advantage over other exporting countries. As experienced by Thailand and Vietnam, strengthening the management of food safety is an important contributor to the remarkable performance of their seafood industries. In contrast, the Philippines has lagged behind in terms of food safety condition, as indicated by higher intensity of import refusals compared to total exports to the US markets, slower adoption of food safety certification systems among firms, and recent case of EU HACCP de-certification of the majority of seafood processing firms.

To understand the factors explaining the recent de-certification from EU HACCP systems, logit, survival, and cost-benefit analyses were performed based on data obtained from 59 processing firms in the Philippines (Chapter 3). Results show that firms' decision to adopt and the rate of initial adoption are explained by both incentive- and capacity-

related factors. However, in explaining the decision to continue adoption and the rate of de-certification, incentive-related factors are more important than those of capacity-related ones.

Output price and quantity levels are significant factors in the decision of Philippine seafood processors to adopt initially and their rate of adoption. Membership and active involvement in industry associations and number of product forms also affect the firms' rate of initial adoption. In terms of continued adoption and the rate of de-certification, price differentials across markets (especially between EU and US) and access to credit are significant factors affecting both firms' decision to continue adoption and their rate of de-certification. The rate of de-certification is also affected by input prices, number of markets, number of product forms, and membership and active involvement in associations.

Responses from firms (both certified and decertified firms) reveal that output prices in existing markets did not increase. No difference in the rejection rates at the border are observed by responding firms. Some certified firms reported increases in the quantity of output, mainly as a result of capturing new markets and in the reduction of product wastage. However, these benefits were not realized by the de-certified firms.

A majority of the processing firms have incurred net losses from EU HACCP adoption. Procuring quality and safe raw materials and difficulties in controlling flow of materials from input production to processing and distribution are additional disincentives and costs faced by processing firms. Despite these losses by many processing firms, the entire fisheries industry stands to benefit from EU HACCP adoption (and would lose about US$ 4-6 million in the event of EU HACCP non-adoption by some

firms). This gain or loss is associated with maintaining or losing EU market assess. Due to difficulties in shifting factors of production to other productive sectors, raw fish producers (particularly in aquaculture), traders, and other input suppliers would lose their net profits (or net value added) associated with the loss of EU market by processing firms. While de-certified firms had strong motivations to discontinue, there are losses of market access to EU by other industry players. The loss seems very small at the industry level, but could mean loss of revenue and source of livelihoods for other players; especially in the event of input market rigidities and in the case of smaller players, who have not much resources and flexibility to try out other markets and sectors.

Other costs and benefits, also referred to as hidden costs or efficiency-related gains, not quantified through field interviews with processors were also addressed (Chapter 4). Included are opportunity costs resulting from months or years of disruption in production associated with renovations; crowding-out of non-food safety-related investments, given limited firm resources; slower production processes; and costs saved by producing both conventional and "safe" food together which can be lower than the cost of producing them separately.

A translog cost function, using pooled data collected from Philippine seafood processors, financial statements and other official sources, was used to estimate the under- or overestimation of the reported HACCP expenditures. The underestimation of the reported HACCP costs is about 6-10 percent of the accounted value (or US$1.10 to US$20 more per dollar of the accounted value) depending on the model used. The exact figure may be difficult to ascertain, but it is clear in all the models used that there is underestimation of the accounted value. At the least, the results illustrate the challenge in

accurately estimating and reporting HACCP costs and emphasize the need for careful interpretation of costs as they are reported or estimated. Good assessment of costs and benefits are crucial for making sound support and policies toward greater food safety.

The cost-benefit analysis discussed earlier (in Chapter 3) was further adjusted to reflect this finding in HACCP costs. However, results did not significantly change; and the same interpretations and implications still hold in terms of the significant factors affecting the decision to initially adopt and continue certification of HACCP systems.

The cost model estimation indicates an absence of economies of size in seafood processing even after HACCP systems, contrary to some findings in the literature, and this may be due to several reasons. First, the cost of HACCP adoption may be too small to affect the overall production costs and industry economies of size. Unlike the descriptive analysis, the cost estimation show that when other factors are controlled for, the negative relationship between HACCP costs and firm size disappears. Second, adjustments might have already been made in anticipation of greater demand or lower per-unit costs, as a result of HACCP adoption. Certified and de-certified firms had economies of size before HACCP adoption and diseconomies of size after HACCP adoption. It might be that the production adjustment was way beyond the optimal level, a state of disequilibrium, where production can be expected to go down. Third, despite large capital investments, HACCP systems may be more friendly to smaller processors than larger firms, given their potential to more easily control and monitor human and other resources.

Results show no cost efficiency gains associated with HACCP systems since: (i) firms with and without HACCP are both cost-inefficient, and there are no significant

differences in terms of the level of inefficiency (marginal cost) between the two groups; and (ii) firms show no significant difference in terms of cost efficiency before and after HACCP adoption. This contradicts the findings of a number of studies on the US meat industry. It may be that efficiency gains were and are realized in the US meat industry; but not in other contexts such as the Philippine seafood industry. The results indicate that efficiency gains from HACCP systems (which is strongly supported by a number of studies on developed countries) may not hold in developing countries, where trade-offs and challenges for food safety are greater. These results stress the importance of looking at the context-specificity associated with the relative effectiveness and efficiency of food safety systems, and this specificity matters in terms of tailoring specific support to relevant sectors. For instance, higher "true" costs may imply a greater need for support for firms to adopt and sustain HACCP systems. Lack of observed efficiency gains may have resulted from lack of proper adoption and handling of the HACCP system, which implies a need to strengthen technical assistance to firms for more effective implementation of the techniques and procedures of the system.

Results indicate that at present, both small and large firms operate with no cost advantage and no cost-related hindrances to entry and exit. Claims by the food industry, regarding small players' exclusion in the high-value markets and deepening market segmentation in the industry due to food safety systems, e.g., HACCP, could be overstated. Some small firms can strategize, have HACCP systems and still compete with larger firms within the country. Yet, constant innovation is crucial for firms to stay in business and not be excluded from the fast-changing markets for seafood products. Product differentiation and food safety and quality certification are areas that both the

public and private sector can work together to explore or strengthen. Implementing food safety measures can entail large economic costs (even higher than reported costs) and does not apparently lead to efficiency gains. In expanding production in order to compete, smaller firms are often constrained by the limited access to capital for much needed investments.

2 Policy Implications

While results from a sectoral study such as this should always be interpreted with caution considering data limitations, assumptions involved, and the dynamic nature of the seafood sector, some key messages and policy implications can be put forth. Addressing power structures and relations is crucial in order to bring about radical policy reforms and to improve the competitiveness of Philippine seafood exports. A top priority for the Philippines is to permit healthy competition among interest groups and create a favorable environment for collective action to thrive. Once political commitment is achieved, next step would be to enhance the business climate (which will benefit not only the seafood industry but all industries in the economy). Reducing protectionist policies directed towards certain industries, considered to be less efficient or promising than the seafood sector, is another important strategy that the Philippine could explore. This latter strategy will not only reduce implicit taxation on the seafood sector, but will also make available scarce resources to initiate the process of molding a viable and competitive seafood industry. Confidence-building measures can be adopted to gain trust and nurture a cohesive and cooperative behavior within the industry and other stakeholders.

Due to the complexity and advancement of Thailand's institutions, established buyers and suppliers, and consistent drive for quality and safety, it will take substantial

time and efforts for the Philippines to catch up with Thailand. Yet, as the experience of Vietnam indicates, the Philippines can do better than what it is currently doing and can aggressively pursue several strategies by learning from experiences of Vietnam in order to bring about change and to reverse existing trends in its seafood industry. The success of the Thai seafood processing industry (despite its higher processing costs, especially labor costs) also provides critical lessons on the importance of striving for an image of quality and safety.

Once a strong foundation and a favorable business climate are in place, the next necessary step is to focus on building capacity in food safety management. Both the industry and the public sector can implement several key strategies to improve adoption of food safety systems in the Philippines. Cost sharing measures, strengthening vertical coordination and industry linkages are needed to pool expertise and distribute costs and risks along the value chain. Collective action can be undertaken through associations that provide a venue to join resources, expertise and relevant information about food safety systems and market opportunities.

Strategies to strengthen the management of food safety can be put in place by launching awareness campaigns to educate and raise the sense of social, moral and health-related obligation to produce "safe" food, appreciation and recognition of the value of food safety. From the demand side, both private and public sectors have a role in reducing structural barriers and information asymmetries that may have led to demand and price rigidities. These demand-side strategies can be in the form of: (i) enhancing consumer awareness to build demand and influence willingness-to-pay for food safety; and (ii) ensuring credible food safety certification systems and to sustain consumer

confidence worldwide.

From the supply-side, strategies to strengthen the management of food safety should be put in place by launching awareness campaigns to educate and raise the sense of moral obligation to produce "safe" food both from a firm's or government's perspective. There is also a need to enhance the current firm- and national-level inspection systems, as these have implications on the credibility and sustainability of these systems. Both private and public sectors can team up to intensify technical assistance to processing firms and raw fish producers on how to effectively implement HACCP systems. The seemingly unrealized production efficiencies associated with HACCP systems may just be a result of not properly implemented systems. A more careful guidance and thorough inspection systems would be warranted to better assist the processing subsector in implementing the system. Looking at ways to improve the capital market and provide greater access to credit is also an important step to reduce constraints faced by firms and individuals in venturing into productive activities. Capital requirements of food safety systems increase the demand for scare funds and intensify the need for healthy capital market and credit systems. In cases of high information asymmetries and heavy credit rationing, public sector support may be needed to inject time-bound credit to jumpstart the development of a growth-potential industry, such as the Philippine seafood industry. This is particularly important for smaller processors, who may be more efficient than their larger counterparts, but are often constrained by lack of access to capital in order to make vitally needed investments.

Some industry players may also benefit from collective action or greater engagement in existing associations. However, the currently limited collective action in

the Philippine seafood industry shows that further research is warranted to understand the context where this collective action may be strategic and efficient. Lastly, a more proactive sharing of experiences and lessons learned from implementing food safety controls could be done across food subsectors of the economy to create synergies, realize efficiency, and reduce costs in producing safe and healthy food supply, which is crucial for both for public health and food industry competitiveness.

3 Further Research

Additional research could improve the analysis by capturing more observations and by adopting the methodologies relevant in other contexts or countries. Further analysis can be done to investigate recent changes in border rejection rates, possibly through secondary data analysis, if available. It may be useful to look at the technical efficiency in HACCP adoption, which is not covered in this dissertation, and could provide new insights on the efficiency gains from food safety systems as a number of studies have highlighted. The analysis on economies of size can also be complemented by analysis of economies of scope. Lastly, more detailed analysis can be done to analyze the output price formation and determination process related to adoption of food safety systems and optimal strategies for credit provision for the sustainability of viable sectors.

APPENDICES

APPENDIX 1 – QUESTIONNAIRE USED IN INTERVIEWS WITH SEAFOOD PROCESSING FIRMS

A. General information

1. What is the size of the plant in terms of capitalization (net worth/equity) in 2004?
   ☐ Micro & Cottage (upto 1.5M) ☐ Small (1.5-15 M) ☐ Medium (15-60 M)
   ☐ Large (60M & above)

2. What is the legal organization of the business?
   ☐ Single proprietorship ☐ Partnership
   ☐ Government Corporation ☐ Private Corporation ☐ Cooperative

3. What is the type of ownership?
   ☐ Foreign (____%) ☐ Local (_____%)

4. What is the year your business started operation? _____

5. When was your plant built? _____

6. When was major renovation last made with your plant? _____

7. Does the company own other plants or branches other than this plant?
   ☐ No ☐ Yes (specify _____)

8. What is the percentage of seafood in your plant's total production in 2004? ____%

9. How many different distinct seafood products does your company have in 2004? _____

10. What are the different distinct products other than seafood products did your plant produce in 2004?
    _____

11. How long have you been supplying to these markets?
    _____

12. PLEASE provide us with the general information about the production and sales of your plant in 2004.

		Main product	**Others**	**Others**
Total Capacity	(ton/mo.)			
Total Output	(ton/mo.)			
Domestic	% volume			
Export	% volume			
to EU (Specify: _____)	% exports			
to US	% exports			
to Japan	% exports			
to Others (specify: _____)	% exports			
Total Sales	(P/mo)			

13. Has your production and sales been expanding in the last 7 years? ☐ No ☐ Yes (what percent? _____)

14. If possible, kindly provide estimated value and volume of sales in 1999-2004.

15. Are you planning to expand your operations (production) in the next 5 years?
☐ No ☐ Yes (what percent? __ ; and what are the new target markets? _____)

B. Benefits of HACCP system

16. Do you have HACCP certification? ☐ EU ☐ US ☐ Others

[Note: Responses to questions starting from Question 17 should be separate in cases of multiple answers to Question 16.]

17. What was the year of first application for HACCP certification? ____

18. What was the year of your first HACCP system acceptance or certification? ____

19. How many HACCP plans do you have? *(Question to be ask if the plant has multiple product lines)* _____

20. What benefits are you experiencing since you have implemented EU HACCP certification? Please ENCIRCLE the appropriate rating in terms of the relevance of the list of benefit categories in terms of actually realizing these benefits.

1=VERY HIGH RELEVANCE 5=VERY LOW RELEVANCE

Increased ability to retain existing customers	1	2	3	4	5
Reduced product microbial counts	1	2	3	4	5
Increased product sales	1	2	3	4	5
Increased ability to access new export markets	1	2	3	4	5
Increased ability to attract new customers	1	2	3	4	5
Reduced product wastage	1	2	3	4	5
Increased product shelf-life	1	2	3	4	5
Increased motivation of production staff	1	2	3	4	5
Increased motivation of supervisory staff	1	2	3	4	5
Increased product prices	1	2	3	4	5
Reduced production costs	1	2	3	4	5

21. Related to Question 20 above, describe the different in expectation and actual benefits from implementing HACCP? Please CHECK the column below to help us determine whether the **actual benefits** are lower, higher, or the same as the **expected benefits** of HACCP adoption.

	Lower	**Higher**	**The Same**
Increased ability to retain existing customers			
Reduced product microbial counts			
Increased product sales			
Increased ability to access new export markets			
Increased ability to attract new customers			
Reduced product wastage			
Increased product shelf-life			
Increased motivation of production staff			
Increased motivation of supervisory staff			
Increased product prices			
Reduced production costs			

22. Please provide information as to help us understand if there were improvements in the percentage of samples and consignment being rejected before and after HACCP adoption. Please ENCIRCLE the appropriate change in rejection rate.

	Before HACCP						**After HACCP**					
Within the plant	10-15%	5-9%	2-4%	1%	0	Others	10-15%	5-9%	2-4%	1%	0	Others
At BFAR	10-15%	5-9%	2-4%	1%	0	Others	10-15%	5-9%	2-4%	1%	0	Others
At importing country's port	10-15%	5-9%	2-4%	1%	0	Others	10-15%	5-9%	2-4%	1%	0	Others

23. Did you experience or have you negotiated any INCREASE in PRICE since you implemented HACCP system? [*Separate answer for each export market destination*]

☐ Yes ☐ No

24. If yes to Question 23, what is the INCREASE in PRICE negotiated and received since you implemented HACCP system? [Separate answer for each export market destination]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

25. Do you anticipate any INCREASE in PRICE from implementing HACCP system in the next five years? [*Separate answer for each export market destination*] ☐ Yes ☐ No

26. If yes to Question 25, what is the expected INCREASE in PRICE from implementing HACCP system? [*Separate answer for each export market destination*]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

27. Did you experience any INCREASE in VOLUME OF PRODUCTION since your plant has implemented HACCP? [*Separate answer for each export market destination*]
☐ Yes ☐ No

28. If yes to Question 27, what is the INCREASE in PRODUCTION since your plant implemented HACCP system? [*Separate answer for each export market destination*]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

29. Do you anticipate any INCREASE in PRODUCTION from implementing HACCP system in the next five years? [*Separate answer for each export market destination*]
☐ Yes ☐ No

30. If yes to Question 29, what is the expected INCREASE in PRODUCTION from implementing HACCP system? [Separate answer for each export market destination]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

31. Did you experience any INCREASE in VOLUME OF SALES since your plant has implemented HACCP? [*Separate answer for each export market destination*]
☐ Yes ☐ No

32. If yes to Question 31, what is the INCREASE in VOLUME OF SALES since your plant implemented HACCP system? [*Separate answer for each export market destination*]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

33. Do you anticipate any INCREASE in VOLUME OF SALES from implementing HACCP system in the next five years? [*Separate answer for each export market destination*]
☐ Yes ☐ No

34. If yes to Question 33, what is the expected INCREASE in VOLUME OF SALES from implementing HACCP system? [*Separate answer for each export market destination*]
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

35. Did you experience any DECREASE in OTHER COSTS of processing since your plant has implemented HACCP? ☐ Yes ☐ No

36. If yes to Question 35, what inputs or costs of production did you reduce since you implemented HACCP?

_____

_____

37. If yes to Question 35, what is the DECREASE in OTHER COSTS of processing since your plant implemented HACCP system?
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

38. Do you anticipate similar trends as your responses to Questions 35-37 in the next five years?
□ Yes □ No

39. What is the anticipated increase or decrease in cost reduction from HACCP systems in the next five years, in percentage of total costs, if possible?

_____

40. Did you experience any COST-SAVING INNOVATIONS in processing since your plant has implemented HACCP? ☐ Yes ☐ No

41. If yes to Question 40, please specific this innovation.

_____

_____

42. Do you anticipate similar trends as your responses to Question 40-41 in the next five years? ☐ Yes ☐ No

43. What is the anticipated change in cost-saving innovations in the next five years?

_____

44. Did you experience any DECREASE in PRODUCT WASTAGE in processing since your plant has implemented HACCP? ☐ Yes ☐ No

45. If yes to Question44, what is the DECREASE in PRODUCT WASTAGE in processing since your plant implemented HACCP system?
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

46. Do you anticipate similar trends as your responses to Question 44-45 in the next five years? ☐ Yes ☐ No

47. What is the anticipated change in product wastage reduction in the next five years?

_____

48. Did you experience any CHANGE in FLEXIBILTIY in processing since your plant has implemented HACCP? ☐ Increase ☐ Decrease ☐ No Change

49. If Yes to Question 48, please list the changes:

_____

_____

50. Did you experience SLOWER production and processing since your plant has implemented HACCP? ☐ Increase ☐ Decrease ☐ No Change

51. If Yes to Question 50, can you give us an estimate of how slower is the production since HACCP adoption and how did it affect your profitability and productivity?

_____

_____

52. Did you experience any CROWDING OUT OF OTHER INVESTMENTS since your

plant has implemented HACCP? ☐ Yes ☐ No

53. If Yes to Question 52, can you give us an example of how HACCP adoption crowded out an important non-HACCP investment and how did this affect your profitability and productivity?

_____

_____

54. Did you have to stop production and processing to accommodate for the plant structural changes to implemented HACCP? ☐ Yes ☐ No

55. If yes to question 54, how many months did you close operations? _____

56. Hypothetically, IF YOU DID NOT ADOPT HACCP, what could have been your alternative market/s?

_____

57. How much would you expect your PROFIT to be LOWER if you did not adopt HACCP and thus had to change markets for your final product?
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

58. How much would you expect changes in the price of your product if you did not adopt HACCP and thus had to change markets for your final product?
☐ Higher price ☐ No difference ☐ Lower price

59. If you would receive lower price, how much would the price in your alternative market be lower than your market now?
☐ 1-3% ☐ 4-6% ☐ 7-9% ☐ 10-12% ☐ 12-15% ☐ Others _____

C. Costs incurred to comply with mandatory HACCP

60. PLEASE GUIDE US IN UNDERSTANDING THE COSTS INVOLVED WITH HACCP. What are your BEST ESTIMATES in terms of costs that the plant incurred to comply with HACCP? Please fill in the categories below.

Cost Categories	Cost Variables (in peso)	Year 1	Recurring Cost
Start-up costs	Physical Plant, Welding, Equipment, Laboratory facility		
	HACCP Plan design and development		
	Payment for Consultant		
	HACCP Training		
	Staff time involved in the HACCP design (Number of employees involved in the HACCP design: ____)		
Operating costs	Additional laboratory analysis		
	Additional labor and supplies for monitoring, recording and data mgt. (Number of additional labor hired: ___)		
	Materials and utilities due to more frequent corrective action & product re-work		
	Additional task training for improved GMP		
	Additional personnel expenses for improved GMP (incl. Medical expenses, gloves, etc.)		
	More frequent & thorough cleaning/disinfecting for improved GMP		
	Pest control for improved GMP		

61. Which of the investments and costs in Question 60 WILL YOU STILL INCUR EVEN WITHOUT HACCP?

_____

62. What year did you make the capital investments for HACCP and what is the expected useful life?

Physical plant changes: year invested _____ expected useful life _____

Equipments: year invested _____ expected useful life _____

63. Did you hire additional manpower to design the HACCP plan and implement the HACCP system? ☐ Yes ☐ No

64. Is yes, how many additional manpower did you hire? _____

65. Did you increase salary or other benefits per employee due to HACCP? ☐Yes ☐No

66. If yes, how much more did you increase your costs per employee? _____

67. Did you re-organize the business due to HACCP implementation? ☐Yes ☐No

68. If yes to Question 67, please describe the changes.

_____

_____

69. Did you change arrangements with your input and raw material suppliers due to HACCP implementation? ☐ Yes ☐ No

70. If yes to Question 69, please describe the changes.

_____

_____

71. Did you change your input and raw material suppliers due to HACCP implementation?
☐ Yes ☐ No

72. If yes to Question 71, please describe the changes.

_____

_____

73. Did you change arrangements with your buyers or agents due to HACCP implementation?
☐ Yes ☐ No

74. If yes to Question 73, please describe the changes.

_____

_____

75. What are the difficult aspects of HACCP that you experienced? Please ENCRICLE your perceived intensity of the difficulties that you have encountered (1 being of very high difficulty and 5 being of very low difficulty).

	1=VERY HIGH DIFFICULTY				**5=VERY LOW DIFFICULTY**
Internal budgetary constraint	1	2	3	4	5
Difficulties in obtaining external funding	1	2	3	4	5
Overwhelmed by things and changes to be done to adopt HACCP	1	2	3	4	5
Reduced staff time available for other tasks	1	2	3	4	5
Training/motivation of production/supervisory staff	1	2	3	4	5
Difficulties of getting advise	1	2	3	4	5
Reliable raw material supplier	1	2	3	4	5
Current food safety controls are considered sufficient	1	2	3	4	5
Other investments are considered more important	1	2	3	4	5
Recouping costs of implementing HACCP	1	2	3	4	5
Reduced flexibility to introduce new products	1	2	3	4	5
Reduced flexibility of production process	1	2	3	4	5
Reduced flexibility of production staff	1	2	3	4	5

Greater priority given to other issues and other investments	1	2	3	4	5
Uncertainty about potential benefits from HACCP	1	2	3	4	5
Perception that the current food safety control are sufficient	1	2	3	4	5

76. Are you aware of the recent de-listing or de-certification by EU of HACCP certified firms? ☐ Yes ☐ No

77. If YES to Question 76, in your opinion, what are the likely reasons for the recent de-listing by EU of HACCP certified firms? Please ENCIRCLE the relative importance of the following reasons (1 being of very high relevance and 5 being of very low relevance), based on your perception.

	1=VERY HIGH RELEVANCE				5=VERY LOW RELEVANCE
EU inspectors and inspections system are more strict than Filipino inspectors	1	2	3	4	5
Difficult to harmonize the inspection system of HACCP across countries	1	2	3	4	5
Organizational issue (e.g., conflict of interest - BFAR is both regulatory and trade promotion body of the government)	1	2	3	4	5
Cultural issues concerning inspectors (e.g., lax regulation, bribery)	1	2	3	4	5
Cultural issues affecting firms (e.g., "ningas cogon")	1	2	3	4	5
Lack of motivation and incentives among inspectors	1	2	3	4	5
HACCP is costly to implement and hard to comply with	1	2	3	4	5
HACCP is hard to sustain and thus firms loss motivation over time	1	2	3	4	5
Other processors just concentrate on profit and too little emphasis on food safety/quality	1	2	3	4	5
Others _____	1	2	3	4	5

D. Inputs of production

78. How many employees are there in this plant?
_____ Full time staff
_____ Seasonal production employees (average days/month _____)
_____ Number of supervisory staff
_____ Number of managerial staff

79. What is your total OPERATING COST/EXPENSE per kilo of seafood product?
_____

80. What are the percentages of your COSTS in Question 79 attributed to the different cost components? Please provide your answers in PERCENT of total cost in Question 79.
_____ percent spent on fish raw materials
_____ percent spent on labor costs
_____ percent spent on packaging materials
_____ percent spent on all other processing costs (utilities, overhead, etc.)
_____ percent spent on airfreight/transportation

81. What is the distance from your plant to the major source of raw material?

☐ Very Near ☐ Near ☐ Far ☐ Very Far

82. Is fish production (i.e., fishing operation which involves owning fish boats/vessels for capture fisheries or fishpond for aquaculture) part of your company?

☐ Yes, fishing/aquaculture and processing operations under one company and with a common/single accounting system

☐ Yes, fishing/aquaculture and processing operations are sister companies but with different accounting systems

☐ The company is not involved in fishing/aquaculture operations

83. How many distinct buying stations does your company have? _____

E. Others

84. In your opinion, what are the important factors that are constraining the Philippine seafood industry from attaining a higher level of export growth? Please ENCIRCLE the relative importance of the following factors (1 being of very high importance and 5 being of very low importance), based on your perception.

	1=VERY HIGH IMPORTANCE				5=VERY LOW IMPORTANCE
Supply conditions					
Cost and quality of seafood inputs	1	2	3	4	5
Cost of processing	1	2	3	4	5
Transport	1	2	3	4	5
Credit/Capital	1	2	3	4	5
Cost of doing business	1	2	3	4	5
Demand conditions					
Overall product quality	1	2	3	4	5
Consistency of product quality	1	2	3	4	5
Compliance with food safety requirements	1	2	3	4	5
Compliance with environmental requirements	1	2	3	4	5
Value added	1	2	3	4	5
Industry structure					
Difficulties to entry and exit	1	2	3	4	5
Government					
Tariffs/quotas	1	2	3	4	5
Bureaucracy	1	2	3	4	5
Government regulations	1	2	3	4	5
Lack of government support	1	2	3	4	5

85. In your opinion, what are the important food safety-related issues that are constraining the Philippine seafood industry from attaining a higher level of export growth? Please ENCIRCLE the relative importance of the following factors (1 being of very high importance and 5 being of very low importance)

	1=VERY HIGH RELEVANCE				5=VERY LOW RELEVANCE
Food industry's trust in the food safety regulatory body	1	2	3	4	5
Government's food safety regulatory systems	1	2	3	4	5
Cost of compliance	1	2	3	4	5
Traceability system	1	2	3	4	5
Monitoring and surveillance systems	1	2	3	4	5
Industry's current adoption of food safety systems	1	2	3	4	5
Culture of food safety among firms in the industry	1	2	3	4	5
Culture of product quality among firms in the industry	1	2	3	4	5

86. In your opinion, what are the important food safety-related issues that are constraining the Philippine seafood industry from attaining a higher level of export growth? Please ENCIRCLE the relative importance of the following factors (1 being of very high importance and 5 being of very low importance), based on your perception.

	1=VERY HIGH IMPORTANCE				5=VERY LOW IMPORTANCE
Administrative regulations; bureaucracy in the public sector	1	2	3	4	5
Capital market reforms	1	2	3	4	5
Trade policy	1	2	3	4	5
Export promotion policy	1	2	3	4	5
Macroeconomic policy	1	2	3	4	5
Food safety policy and regulation	1	2	3	4	5
Tax system's impact on investment and risk-taking	1	2	3	4	5
Investment in infrastructure	1	2	3	4	5
Competition policy	1	2	3	4	5
Labor policy	1	2	3	4	5

87. In your opinion, what are the export strategies that the government should pursue to promote seafood exports?

_____

_____

88. In your opinion, how would you rank the level of cooperation among Philippine seafood processors? Please CHECK the appropriate ranking **(1=greatest level of cooperation)**

☐1 ☐2 ☐3 ☐4 ☐5

89. In your opinion, do Philippine seafood processors care much about the image and reputation of Philippine seafood products in general and not just about the image of their company brand? Please CHECK the appropriate ranking **(1=greatest level of consideration)**

☐1 ☐2 ☐3 ☐4 ☐5

90. Aside from stricter food safety regulations, what are the concerns/problems that confront your company in particular and the industry in general?

_____

_____

91. In your opinion, what is the importance of the following firm strategies to achieve higher levels of competitiveness and how your firm is adopting these strategies? Please rate your perception on the importance of each strategy; your perception on your firm's performance; and explanation of the gap between the perceived importance and the actual adoption by your firm.

In Column (A): 1=VERY HIGH IMPORTANCE; 5=VERY LOW IMPORTANCE

In Column (B): 1= VERY STRONG ATTENTION; 5=VERY WEAK ATTENTION

Category	Importance (A)	Actual Adoption by firms (B)	Explanation of the gap between (A) and (B)
Cluster development			
Value chain coordination			
Industry-government partnership			
Participation in organizations & associations			
Cost sharing			
Investment in market infrastructure			
New product development & value-addition			
Partner with research organization			
R&D spending			
Strategies for food safety			
Traceability systems			
Corporate social responsibility			
Optimal marketing strategies			
Group marketing			

92. In your opinion, what programs and support from the government are needed by the processors and exporters in order to improve the profitability and viability of the Philippine seafood export industry?

_____

_____

93. Do you have any other comments you would like to make?

_____

Many thanks for your time and assistance.

APPENDIX 2 - GUIDE QUESTIONS FOR KEY INFORMANT INTERVIEWS

Guide Questions to Understand Thailand, Vietnam, and Philippines seafood industry; their seafood strategies and food safety measures

1. What to you think are the prospects of Thailand, Vietnam, and the Philippines in terms of seafood export growth? *[For key informants in the countries, ask specifically about the country of the person being interviewed; but follow-up with asking their perceptions on the other two countries. For key informants in international organizations, ask about their perception on all three countries]*

2. What were the key strategies adopted that were important in achieving the level of export competitiveness of the country (Thailand, Vietnam, and the Philippines? *[For key informants in the countries, ask specifically about the country of the person being interviewed; but follow-up with asking their perceptions on the other two countries. For key informants in international organizations, ask about their perception on all three countries]*

3. Kindly guide us through the different aspects of production and processing activities of the industry in the three countries. *[For key informants in the countries, ask specifically about the country of the person being interviewed; but follow-up with asking their perceptions on the other two countries. For key informants in international organizations, ask about their perception on all three countries]*

    a. Cost of aquaculture
    b. Supply of fish catch
    c. Cost of processing
    d. Political economy of seafood
    e. Importance of seafood in the economy (for growth, employment, poverty reduction)
    f. Challenges of the seafood industry
    g. Relationship with importing and other countries
    h. Trade policies

4. What the specific food safety issues in the country (Thailand, Vietnam, and the Philippines) and how did the country responded? *[For key informants in the countries, ask specifically about the country of the person being interviewed; but follow-up with asking their perceptions on the other two countries. For key informants in international organizations, ask about their perception on all three countries]*

5. **Food Safety**: Kindly rate the countries in terms of your perception of the level of focus on food safety strategies. What other categories that you would add to the list, and how do you compare the countries based on these categories?

Rating:
LOW=low level of attention
MEDIUM=average level of attention

Category	Thailand	Vietnam	Philippines
Attention towards product quality			
Investment in food safety			
Strong links with university in food safety training & implementation			
Proportion of establishments certified			
Number of refusals and detentions			

6. **Research and innovation capacity**: Kindly rate the countries in terms of your perception of the condition of innovation capacity of the three countries based on a pre-existing list. What other categories that you would add to the list, and how do you compare the countries based on these categories?

Rating:
LOW=low level of capacity
MEDIUM=average level of capacity

Category	Thailand	Vietnam	Philippines
Innovation/technical research capacity			
Research organization-academe-industry-government partnerships			
Funding for seafood research and extension			
Knowledge and technological transfer from importing countries or foreign investors in the country			
Effectiveness of extension services			
Active participation in international setting and research bodies (e.g., visibility and asking TA from FAO)			

7. Export promotion strategies. Kindly rate the countries in terms of your perception of the level of export strategies of the three countries based on a pre-existing list. What other categories that you would add to the list, and how do you compare the countries based on these categories?

Rating:
LOW=low level of attention
MEDIUM=average level of attention

Category	Thailand	Vietnam	Philippines
Active participation and even sponsorships of trade fairs			
Export credits			
Subsidized loans			
Active Export promotion Council			
Active producer and processor associations			
Active private sector investment in the sector			
Investment of the government in the sector			

APPENDIX 3 – BFAR'S PLANT INSPECTION CHECKLIST FOR EU HACCP SYSTEM (DRAFT)

1. Structural Conditions for Establishments

1.1 General conditions relating to premises and equipment
a. Has adequate space for processing been provided?
b. Has the production flow been designed systematically to avoid cross contamination?
c. Is the flooring waterproof and with adequate drainage?
d. Are the walls smooth, impermeable and easy to clean?
e. Are the ceiling or roof linings easy to clean?
f. Are all doors made of waterproof material, easy to clean and tightly fitted?
g. Is there adequate ventilation especially for processes producing steam or water vapor?
h. Is there adequate natural or artificial lighting present? Are lights adequately protected?
i. Are all working equipment, tables, containers, conveyor belts and knives in contact with fish & fishery products made of non corrosive materials and easy to clean and sanitize?
j. Has adequate designated area with cleaning material for cleaning the plant, equipment and utensils been provided?
k. Have an adequate number of non – hand operated hand – wash basins and sanitizing facilities in all processing area been provided?
l. Have an adequate space for changing rooms with smooth, washable, walls and floors?
m. Is there adequate number of toilets? Do toilet doors not open directly onto production areas?
n. Are there adequate number of non – hand operated hand – wash basins present in the toilets?
o. Is there adequate protection against pests, rodents, insects and birds (Fly proof, insectocutors, drain screen for rats, rat traps)?
p. Are there adequate supplies of potable water or clean seawater for use in processing? Are all non – potable water pipe lines clearly marked/coded?
q. Are waste disposal containers air tight, non corrosive and disposed hygienically to avoid cross contamination?
r. Are there designated area and adequate facilities for the cleaning and disinfecting of transport vehicles provided?
s. In the case where live crustaceans are stored, have appropriate facilities to ensure the viable maintenance of the live animals been provided?
1.2 For chiller/cold storage rooms
a. Does the chilled cold room comply with all of the general provisions required above except hand-washing and ventilation conditions?
b. Is the refrigeration system sufficiently powerful to keep products at prescribed chilling/freezing temperatures?
c. Is the temperature – recording device easily accessible for reading? Is the sensor located in the hot spot (farthest from cold air blower)?
d. Have temperature record charts/data logger been maintained at all times and made available for inspection?
e. Are temperatures from temperature recording device monitored &recorded manually at fixed intervals?

2. General Hygiene Conditions

a. Are floors kept in a satisfactory state of cleanliness and repair so that they do not cross contaminate?
b. Are all walls kept in a satisfactory state of cleanliness and repair so that they do not cross contaminate?
c. Are all ceilings kept in a satisfactory state of cleanliness and repair so that they are not a source of contamination?
d. Are all equipment and instruments kept in a satisfactory state of cleanliness and repair so that they are not a source of contamination?
e. Are pest control measures effective?
f. Is the working area, equipment, instruments used for processing one product type at a time to avoid cross contamination?
g. Is potable drinking water used for all purposes?
h. Are all detergents, sanitizers and in-contact lubricants approved/suitable for use in food industries?

3. Hygiene Conditions Applicable to Staff

a. Is suitable clean protective clothing and head gear being worn?
b. Are hands rewashed each time work is resumed?
c. Are all wounds covered by a suitable water proof dressing?
d. Is all smoking, spitting, eating and drinking strictly prohibited within the production and storage areas?
e. Are measures in place to ensure that the employer is taking every measure to ensure that staff will not contaminate fishery products such as training of workers on GMP/GHP/HACCP, sign boards, warnings/reminders?
f. On recruitment, is all staff required to prove there is no medical impediment to their being engaged in food production?

4. Specific Requirements for Fresh Fish Processing

a. Are all chilled, unpackaged products stored or displayed under ice at the establishment's cold room while awaiting handling?
b. Is re – icing carried out as often as necessary to maintain freshness?
c. Has the ice been made from potable water?
d. Is the ice stored in receptacles of hygienic condition?
e. Have all pre – packed fresh products been chilled using ice or mechanical refrigeration?
f. Is all heading or gutting carried out in such a way as to avoid contamination?
g. Have all products been washed using potable water or clean seawater following heading or gutting?
h. Is all filleting or slicing carried out in a work area dedicated for this purpose?
i. Is all filleting or slicing carried out in such a way as to avoid contamination?
j. Are fillets and sliced fish removed from workbenches as quickly as possible to avoid spoilage?
k. Are all containers used for dispatch or storage of fresh fishery products designed to drain melt water from ice?
l. Do these containers protect fresh fishery products from contamination?
m. Are the containers used to store fresh fish clean?
n. Have all guts and other parts that have been separated from fillets and slices been removed from the vicinity and been placed in suitable containers?
o. Are leak-proof containers provided for the storage of waste while awaiting disposal?
p. Are these waste storage containers easy to clean and disinfect?
q. Is all fish waste removed at least at the end of each working day?

r. Is the waste stored a source of contamination?
s. Is the waste stored a source of pollution for the surroundings?

5. Conditions for Frozen Fish Products

a. Is the refrigeration system sufficiently powerful to rapidly bring down temperature to prescribed freezing temperatures (-18^{0}C or lower)?
b. If fish is frozen in brine intended for use in canning do they maintain it at -9^{0}C or below in the Freezer?
c. Do fresh products to be frozen or quick frozen comply with all requirements of section 4 of this checklist?
d. Do storage rooms for frozen products satisfy the requirements/conditions stated under section 1.2 of this checklist?
e. Are fishery products being thawed under hygienic conditions?
f. Is there adequate drainage for any melt water produced?
g. Is excessive increase in temperature during thawing prevented?
h. Are thawed fishery products handled in the same manner that fresh fish should be handled?
i. After thawing does preparation and / or processing take place without delay?
j. Are thawed fish put directly onto the market marked/labeled as "thawed fish"?

6. Requirements for Processing of Fishery Products

6.1 General conditions
a. Do all fresh, frozen or thawed fish used for processing comply with the specific requirements laid down in Chapter IV, Sections I and II?
b. Where the processing treatment is used to eliminate or control the levels of pathogenic microorganisms has it been approved under law?
c. Has the person responsible for the establishment kept a register of the processing carried out?
d. Do these records include monitoring of temperature, heating times, salt content, pH, water content, etc.?
e. Have these records been kept for inspection for at least the expected storage life of the fishery products?
f. In the case of perishable fishery products does the product label include specific instructions on storage temperatures?
g. Have all fishery products been subjected to sterilization in hermetically sealed containers?
h. Is the water used for the preparation of the cans potable?
i. Is the heat treatment used appropriate with regard to heating time, temperature, filling and size of containers?
j. Is the heat treatment capable of destroying pathogenic microorganisms and spores?
k. Has the heating equipment been fitted with devices to verify the parameters of the process?
l. Has potable water been used to cool the containers after heat treatment?
m. Are additional, random checks carried out to ensure the processed products have undergone appropriate heat treatment in accordance with the Directive?
n. Are samples taken of production each day to ensure the efficacy of sealing?
o. Are checks carried out to ensure containers are not damaged?
p. Have all containers been given a batch identification mark?
6.2 Smoking
a. Is the smoking process carried out in a separate dedicated area?
b. Are materials used to produce smoke stored away from place of smoking?
c. Are all wood material used for smoking free from paint, glue, varnish or any chemical treatment?
d. Are products cooled rapidly after smoking to the required temperature?

6.3 Salting
a. Is the salting process carried out in a separate dedicated area?
b. Is salt used in the process clean and stored hygienically to avoid cross contamination?
c. Does the establishment ensure that salt is not re use?
d. Are the containers used for salting or brining appropriately designed and constructed with non corrosive material to avoid contamination?
e. Are the salting / brining containers hygienic and easy to clean?
f. Are containers used for salting or brining cleaned before and after use?
6.4 Cooked crustacean and molluscan shellfish products
a. Does rapid cooling follow all cooking?
b. Does cooling continue until reaching a temperature of melting ice i.e. 3^0C?
c. Is the water used for cooking and / or cooling potable?
d. Is shelling or shucking undertaken in hygienic conditions to avoid contamination?
e. Do shelling or shucking staff pay attention to hand washing and in-contact surface cleaning procedures to ensure hygienic conditions are maintained during processing?
f. Are machines cleaned at frequent intervals and disinfected at the end of each working day?
g. After shelling or shucking are products immediately kept chilled or frozen?
h. Are microbiological checks undertaken at regular intervals on the cooked product?
6.5 Mechanically recovered fish flesh
a. Is the mechanical process carried out without delay after gutting or filleting?
b. Is the machinery cleaned at intervals of at least every two hours?
c. After recovery of fish flesh, is recovered material immediately frozen or used in a product?

7. Specific Requirements for Conditions Concerning Parasites in Fishery Products

a. During the production process are fish visually checked for the presence of parasites?
b. If fish are obviously infected with parasites are they separated and removed from that fish being placed on the market?
c. If herring/mackerel is to be consumed raw, is the herring/mackerel frozen to a temperature of -20^{0}C for at least 24 hours in all parts of the fish?
d. If herring/mackerel undergoes a cold smoke of 60^{0}C or less; is salting and/or marinating process applied to herring/mackerel frozen to a temperature of -20^{0}C for at least 24 hours in all parts of the fish, sufficient to kill nematodes (parasites)?
e. Is there documented evidence to show that the above freezing activities for the above species are undertaken?
f. Is there documentation accompanying the above species when placed on the market, describing the process that the fish species have undergone?

8. Specific Requirements for Health Control & Monitoring of Production Conditions

a. Have any regular inspections been undertaken to ensure conditions for approval are still fulfilled?
b. Have regular inspections been undertaken to ensure fishery products are handled correctly?
c. Have regular inspections been undertaken to ensure cleanliness of the premises, facilities, instruments and staff?
d. Have regular inspections been undertaken to ensure identification marks are put correctly?
e. Have regular inspections been undertaken at whole sale and auction markets?

f. Have regular inspections been undertaken on storage and transport conditions?
g. Have organoleptic checks been carried on fresh or chilled products prior to processing?
h. Do the fresh or chilled products comply with the freshness criteria prior to the processing?
i. If there is doubt to the freshness of the fishery products are chemical/micro tests carried out?
j. Has the fresh or chilled fish been previously removed from the market where it failed organoleptic examination?
k. Is TVB–N test required? Do the results comply with the required limits for TVB–N?
l. Where required, has a Histamine sample nine fish been taken? Was mean value 100ppm or less?
m. Were all samples less than 200ppm?
n. Were all samples less than 100ppm, with no more than two samples having a result of more than 100ppm but less than 200ppm?
o. Is there a monitoring system in place for environmental contaminants (i.e., heavy metals & organochlorinated substances) present in the edible parts of fishery products?
p. Are there established chemical parameters, sampling plans and method of analysis used?
q. Have any microbiological analysis been undertaken? Are the results acceptable?

9. Specific Requirements for Packaging

a. Is packaging carried out under hygienic conditions, and avoiding cross – contamination?
b. Does the packaging maintain the organoleptic characteristics of the fishery products?
c. Does the packaging prevent the transmission of harmful substances to the fishery products?
d. Is the packaging strong enough to protect the fishery product?
e. Is the packaging material/container, if re – usable, for holding fresh fishery products, made of smooth and corrosion-resistant material? Are they easy to clean & disinfect?
f. Are packaging materials/containers for fresh fishery products held under ice provided with drainage for melt water?
g. With exception of re – usable containers for fresh fishery products, is all other packaging material for single use only?
h. Is unused packaging material stored in a dedicated area for its purpose?
i. Are all packaging materials protected from dust contamination?

10. Specific Requirements for Labeling

a. Is the establishment approval number marked on individual units?
b. Is the country of dispatch marked on all individual units?
c. Is it possible to trace back the product to the establishment dispatch?
d. Is the common commercial name of the fish declared on the label?
e. Is the scientific name of the fish declared on the label?
f. Is the production method (caught at sea, caught in freshwater, cultivated, farmed) declared on the label?
g. Is the catch area (FAO Map) for fish caught at sea identified on the label?
h. Is the country of origin for fish caught in freshwater identified on the label?
i. Is the country of origin for fish farmed identified on the label?
j. Are the labeling requirements mentioned above identified throughout the production process to allow full traceability of origin of all products?
k. Are all ingredients identified on the label?
l. Are details of the physical processes undertaken (i.e. frozen, chilled, smoked) identified on the label?
m. Are details of the packaging method (i.e. vacuum, modified atmosphere packaging) identified on the label?
n. Is the "best – before" or "use – by date" identified on the label?
o. Are any special storage instructions or conditions of use identified on the label?

11. Specific Requirements for Storage & Transport

11.1 Storage
a. Are fresh products kept at a temperature of 3^0C or less during storage?
b. Are thawed frozen products kept at a temperature of 3^0C or less during storage?
c. Are cooked and chilled crustaceans kept at a temperature of 3^0C or less during storage?
d. Are molluscan shellfish products kept at a temperature of 3^0C or less during storage?
e. Are frozen fishery products (except fish in brine) kept at an even temperature of -18^0C during storage?
f. Are processed products kept at a temperature specified by the processor during storage?
g. Is contamination of the fishery product prevented during storage?
11.2 Transport
a. TransportAre fresh product kept at a temperature of 3^0C or less during transport?
b. Are thawed frozen products kept at a temperature of a melting ice (3^0C or less) during transport?
c. Are cooked and chilled crustaceans kept at a temperature of a melting ice (3^0C or less) during transport?
d. Are molluscan shellfish products kept at a temperature of a melting ice (3^0C or less) during transport?
a. Are frozen fishery products (except fish in brine) kept at an even temperature of -18^0C (plus -3^0C allowed for brief periods only) during transport?
b. Are processed products kept at the temperature specified by processor during transport?
c. Is contamination of the fishery product prevented during transport?
d. Does the transport vehicle allow for the specific temperature to be maintained?
e. If ice is used, does the transport vehicle allow for melt water drainage?
f. Is the inside condition of the transport vehicle smooth, easy to clean and disinfect?
g. Is the inside condition of the vehicle such that, it does not affect the fishery product?
h. Is the transport vehicle being used solely for transporting fishery products?
i. Where other products stored & transported together with fishery products in the vehicle, are they packaged properly and individually so as to prevent cross-contamination?
j. If the transport vehicle is used for carrying other products, are guarantees for non-contamination (i.e., documentation provided) in place due to transport conditions being thoroughly cleaned and disinfected?
k. Does the transport conditions allow for sustaining of life for placing of live animals on the market?

Source: BFAR (2005)

APPENDIX 4 – HACCP PLAN DEVELOPMENT

1. Preliminary steps
a. General information
b. Describe the food
c. Describe the method of distribution and storage
d. Identify the intended use and consumer
e. Development a flow diagram
2. Hazard Analysis Worksheet
a. Set up the Hazard Analysis Worksheet
b. Identify the potential species-related hazards
c. Identify the potential process-related hazards
d. Complete the Hazard Analysis Worksheet
e. Understand the potential hazard
f. Determine if the potential hazard is significant
g. Identify the critical control points (CCP)
3. HACCP Plan Form
a. Complete the HACCP Plan Form
b. Set the critical limits (CL)
4. HACCP Plan Form
a. What
b. How
c. Frequency
d. Who
e. Establish corrective action procedures
f. Establish a recordkeeping system
g. Establish verification procedures

Source: JMC (1997)

APPENDIX 5 – INSTRUMENTAL VARIALES FOR OUTPUT MODEL

We test potential instruments in the output *(Y)* model. These potential instruments were included in the LM and SA to explain HACCP adoption and the rate of this adoption; the results indicate that they are insignificant, and thus they pass the first test of being valid instruments. Next, the Y model was estimate in order to test the significance or any of these potential instruments (or whether there is joint significance among them); and the Stata results are shown below:

(1) *shrimp = 0*
(2) *milkfish = 0*
(3) *tunacan = 0*
(4) *tunafroz = 0*
(5) *pm = 0*
(6) *corp = 0*

F(5, 48) = 13.33
Prob > F = 0.00

The results strongly indicate that we reject the null hypothesis that these potential instrument are not jointly significant; therefore, they can be considered jointly significant. We conclude that these variables can be used as instrumental variables (IV) for use in the *Y* model.

APPENDIX 6 – TEST FOR ENDOGENEITY

Steps in Testing Endogeneity

Given a structural model presented as:

$$y = a_1x_1 + a_2x_2 + \ldots + a_kx_k + u,$$

where $y, x_1, x_2, \ldots, x_k$ are **observable** random scalars and u is the **unobservable** random disturbance. An explanatory variable x_j is said to be endogenous **in equation 32** if it is correlated with the disturbance term u; x_j is exogenous if it is uncorrelated with the disturbance term. It is important to stress that in this 'empirical' or econometric definition, variables are inherently neither exogenous nor endogenous; instead their nature is conditional on the way the structural model is written (Greene, 2000). An empirical researcher will be interested in estimating the parameters in the structural model. It is important to the researcher to know whether an explanatory variable is endogenous in a specific structural equation because it affects the way in which its parameter should be estimated. Possible causes of endogeneity are omitted variable, simultaneity and measurement error. In the model presented above, the likely econometric problem is simultaneity, between being de-certified/certified representing the ability to export (especially to EU and partly to US) and the production level. There might be a presence of instantaneous feedback among these variables. If so, the structural disturbance and the explanatory variable will be correlated.

To test for endogeneity, assuming these functions below:

$$z = a0 + a1*x1 + a2*x2 + e1$$

$$y = b0 + b1*z + b2*x3 + e2$$

To check for endogeneity, regress z with explanatory variables for both z and y as presented below:

$$z = c0 + c1*x1 + c2*x2 + c3*x3 + e3$$

Next is to get the residual *zhat*, then perform an augmented regression as present below:

$$y = d0 + d1*z + d2*x3 + d3*zhat + e4$$

Rule: If the coefficient on the residual is statistically different from zero, reject the null of exogeneity. If there are multiple endogenous variables, jointly test the residuals from each first stage. If *d3* is significantly different from zero, then *zhat* and *e4* are correlated, thus z is endogenous and then OLS for y (as a single equation) is not consistent.

Following the steps above and given that $z=Y$, the results of the test of endogeneity of Y performed in Stata are given below:

For LM (initial adoption decision)

. test yhat
H_0: yhat = 0
chi2(1) = 4.40
Prob > chi2 = 0.03

For LM (rate of initial adoption)

. test yhat
H_0: yhat = 0
chi2(1) = 4.41

Prob > chi2 = 0.04

For SA (de-certification decision)

. test yhat
H_0: yhat = 0
chi2(1) = 4.39
Prob > chi2 = 0.03

For LM (rate of de-certification)

. test yhat
H_0: yhat = 0
chi2(1) = 4.32
Prob > chi2 = 0.02

Therefore, we reject that *yhat* is equal to zero, and thus, *Y* is endogenous.

APPENDIX 7 – HACCP COSTS

Collecting data on the costs of adopting HACCP is challenging since the systems are designed to be flexible based on the firm's context and inclusion of prerequisite sanitation programs. There is further variability among firms based on year of adoption and accounting systems used (i.e., where are costs associated with HACCP systems incorporated in the cost accounting of firms?). Colatore and Caswell (2000), who studied the US breaded seafood industry, for instance, have mentioned that studying and forecasting costs are difficult because HACCP is a very flexible system as it allows each processor to choose a different way to comply with the regulation. These authors also reported that many companies failed to have a reliable costs and benefits estimation of HACCP implementation beforehand. Maldonado et al. (2005), on the Mexican meat industry, mentioned that the circumstances of the individual enterprises and the standards in place before adopting HACCP have significantly affected the costs associated with plant improvement, consulting, and the time spent on documentation.

Recognizing the difficulties in getting good estimates of costs, Maldonado et al. (2005), on the Mexico meat industry, and Henson et al. (1999), on the UK dairy processing sector, had used qualitative approaches, with the use of "ranks" and "yes-no" choices, to elicit information about HACCP costs among processing firms. For instance, Maldonado et al. (2005) and Henson et al. (1999) asked the respondents to rank six different costs in order of importance (with "one" for major importance and "six" for minor importance). Henson et al. (1999) pointed out that in the UK dairy processing industry, staff-related costs (staff training and staff time in documentation) are the most important costs reported by respondents; while Maldonado et al. (2005) showed that in

Mexican meat industry, the most important type of cost was investment in new equipment.[152] These authors also compared the expected and actual implementation costs of HACCP systems across firms; and the results show that in Mexican meat industry, the respondents' expectations of the implementation costs were surpassed in most cost categories, while in the UK dairy industry, majority of respondents indicated that the costs of implementing HACCP systems were approximately in line with their prior expectations (Maldonado et al. 2005; Henson et al. 1999).

Despite these reported difficulties of estimating costs, several authors have emphasized that getting estimates of HACCP costs is of crucial importance. For instance, Colatore and Caswell (2000) concluded that the uncertainty on costs and benefits estimations could be a major restraint to planning HACCP adoption by individual seafood companies. It is paramount to look at financial difficulties in adopting HACCP systems before a strategy would be effective in encouraging greater adoption of these systems. Moreover, there are existing studies, e.g., Nganje (1999), that have innovatively collected relevant cost data from firms and have analyzed these cost data by disentangling their components and explaining their variability across firms. This implies that with appropriate methods of collecting data and interpreting them with caution, it is possible to get valid estimates that would be beneficial to the future implementation and promotion of HACCP systems. In this paper, we attempted to move a step forward compared to the qualitative approaches of Maldonado et al. (2005), which is the only available relevant study on a developing country context, and adopted the quantitative

[152] The Mexican market has high availability of hand-labor, while modern and sophisticated equipment comes from abroad, which most likely explains why equipment and not staff costs was the major cost in the Mexican meat industry (Maldonado et al. 2005).

approaches that were employed by Nganje (1999). Specific modifications on and combinations of these two studies made in this paper are discussed further in the next sections.

1 HACCP Cost Categories

The costs categories adopted in this paper are mainly based on Nganje (1999) and Maldonado et al. (2005) (Appendix Table 1). The cost categories used by these two studies were adjusted to fit the specific context in the Philippine seafood processing industry. In this paper, the two major cost categories adopted are (1) start-up and implementation costs, and (2) operating costs (Appendix Table 1). Under the start-up and implementation costs, there are three components: HACCP plan development consisting of consultants hired and staff time in developing the HACCP plan; HACCP training; and equipment and structural changes in the plant facility (Appendix Table 1). Under the operating costs, there are five components: additional labor needed for data management and supervision; additional product testing; staff task training related to HACCP and prerequisite sanitation programs; additional materials and utilities; and additional personnel, cleaning, and pest control expenses for improved prerequisite sanitation programs (i.e., Good Manufacturing Practices (GMP)).

Appendix Table 1. Comparison of HACCP cost categories included in the two previous studies and this paper

Cost Category	Nganje (1999)	Maldonado et al. (2005)	This Dissertation (2007)
Start-up & Implementation cost			
HACCP plan development	√	√/*a*	√/*b*
Training	√	√	√
Equipment and building		√	√
Managerial changes		√	
Operating costs			
Labor for data management & supervision	√	√	√
Product testing	√	√	√
Staff training		√	√
Hours of staff working with inspectors	√		
Materials and Utilities /*c*	√		√
Additional GMP expenses			√/*d*

/a Includes external consultant and staff in documenting system.
/b Includes consultants and time of staff allotted for HACCP plan design.
/c Includes additional costs of materials and utilities due to more frequent corrective action & product re-work; and due to more expensive raw materials from suppliers as they often have to align their production with HACCP systems.
/d Includes additional personnel expenses, more frequent cleaning, and improved pest control for improved GMP.

While there is an overall coherence in the selection of cost categories between this paper and the two studies mentioned above, there are some deviations which reflect the adjustments made to fit these into the Philippine seafood processing industry context. For instance, there were no managerial changes experienced by the Philippine processing firms (although a few firms hired additional quality control/assurance staff). These costs were already captured in the HACCP plan development and labor associated with data management and supervision. Hours spent with inspectors (included in Nganje (1999)) were included in this paper as additional labor or staff time for data management and supervision. Materials and utilities (due to more frequent corrective action & product re-work; and due to more expensive raw materials from suppliers as they often have to align

their production with HACCP systems) were included as a cost component by Nganje (1999), were not included by Maldonado et al. (2005), but were included in this paper. Nganje (1999) has shown that most respondents in his study reported increases in materials and utilities associated with HACCP systems and the preliminary interviews done among Philippine seafood processing firms through this paper have indicated that these costs may be substantial in the Philippine context. Lastly, additional costs to comply with the requirements of the prerequisite sanitation programs, e.g., GMP, were included in this paper unlike the other two studies. One would expected that the US food industry, in general, may already have a more sophisticated food safety and quality systems and better enforcement of sanitation requirements than the Philippines. The food processing firms in general in the Philippines have to invest in these prerequisite sanitation programs before they can comply with the HACCP system requirements.

2 Considerations on HACCP Costs

One important issue repetitively raised during the development of the questionnaire materials for HACCP costs is "*when to start accounting for HACCP costs*" as some firms may have been already moving toward HACCP systems as part of their marketing strategy before the US and EU made HACCP systems mandatory for their seafood supply. However, most firms have been aware and/or their interest has been heightened mainly because of the mandatory HACCP systems imposed by EU and US. As a rule adopted by this paper, the HACCP costs pertains to the additional costs to comply with such mandatory regulation by EU and US.

Another important issue is the possibility that the additional costs incurred are not entirely associated with HACCP systems. For instance, renovations of the plant facility

may be done even without the conscious effort and explicit plan to adopt HACCP systems. In order then to derive at the relevant investments costs that are mainly associated with HACCP, a follow-up question shown below, was made to determine which of the HACCP costs were actually attributed to HACCP and which ones were not:

> "Which of the investments and costs in Question __ [cost category table] will you still incur even without HACCP?"

Lastly, to adjust the figures for inflation and to devise a method of comparing the amount of investment undergone by firms in different years, a follow-up question was asked as to what year the capital investments were made for HACCP regulation and the expected useful life of these investments:

> "Physical plant changes: year invested ___ expected useful life _____
> Equipment: year invested ___ expected useful life _____ "

3 Notes on the HACCP Cost Computation

Variations were observed on the costs given by the respondents. There was an apparent pattern of GMP improvements, physical start-up costs, and HACCP training based on firm size (number of employees) and of additional laboratory expenses based on product form. There seemed to be, however, no pattern in other costs regarding the number of additional manpower hired, hiring of consultants, and amount of time spend on the HACCP plan design. The computation of specific components is presented below:

3.1 Physical Plant Structure

Depending on the condition and the existing layout and design of the plant, the required renovations vary. Common forms of renovations done by respondents to comply

with HACCP are: (1) changing the plant design (for smoother production flow to avoid cross-contamination); (2) improving hygienic condition by adding more restrooms (to maintain a ratio of one cubicle per nine employees), locker room, foot and hand dips; (3) improving the fixtures like flooring, ceiling, lighting, doors, and screens, (4) enclosing the receiving area to minimize the entry of flies, insects, and dusts, and (5) having industrial washing and drying machines. Some plants have had to change their waste disposal system/drainage to comply with GMP and HACCP systems. The costs of renovations depended on the size of the plant, number of employees, and existing condition and fixtures of the plant. The renovation costs seemingly vary by size of the firm, e.g., medium and large firms have bigger area to renovate and have more employees for the required facilities for their hygiene and sanitation.

Some firms found their existing facility too old or too complicated to make the necessary renovations to comply with GMP requirements and thought that it would be more costly to renovate than build a new plant. Others found their existing facility too small to anticipate expansion in production due to HACCP systems. The cost of a new plant depended on the size of the plant. Based on the interviews, there were seven firms that built new facility to comply with HACCP (Appendix Table 2).

Appendix Table 2. Cost of building a new facility (including equipment)

Size	Firm	Product	Year 1 costs (in US$ 000)	Useful life (years)	Recurring Costs (in US$000)	Annual Costs (in US$000)
Small	1	Frozen Tuna	13	5	0.0	3.5
	2	Shrimp fry	13	10	0.0	1.3
Medium	1	Milkfish	91	10	0.0	9.1
	2	Milkfish	91	10	0.0	9.1
	3	Frozen Tuna	182	10	0.0	18.2
Large	1	Frozen Tuna	91	10	0.9	9.1
	2	Canned Tuna	91	10	1.8	9.1

Source: Author's interviews.

There were no figures given by three firms that resort to toll packing (using the certified facility and sometimes even production employees) of a certified company or government corporation to supply to the Europe or US markets. For instance, upon knowing that there is a government corporation facility that they could rent and would enable them to supply the EU market, they tried this and continued in the business. One firm, however, said that the rental price increased by ten percent and another said that it increased by 20 percent.

3.2 Equipment

Based on the EU report during their inspection in the Philippine seafood industry, many firms visited were using wooden and not stainless, old, and hard to clean equipment and paraphernalia during processing. This is consistent with the result of the interviews where firms had to invest additional equipments to satisfy the requirements of a HACCP system including stainless knifes, production tables, and other equipment. Moreover, due to greater responsibility towards a coordinated system, processors had to employ stricter control at the production level in terms of verification costs of raw materials. For many, this involved even purchasing raw material tester or histamine test kits. Many preferred to get a quick result on their raw materials, so that they could decide quickly whether to use them or not. They also chose to be able to monitor their outgoings quicker, so that they can decide to ship out their products quicker. This meant freeing up time and inventory. Most medium firms had invested in small laboratories with test machines ranging from raw material tester or histamine test kit to chemical (histamine) test machines (costing around US$ 9,000 to US$ 36,000). Aside from these, some smaller firms and almost all medium and large firms invest in cold storage and blast freezer (around US$55,000), and

some invested in incubator, sterilizer and conveyor (around US$27,000 to US$36,000) and automated temperature graph (around US$27,000). The costs of equipment depended on existing equipment and the product form, which was more demanding for tuna because of stringent test for histamine.

3.3 Hiring Consultant

The small firms usually just asked for help from government agencies or other companies; the medium firm hired a local or foreign consultant; and the large firm hired a foreign consultant for HACCP plan and certification. Hiring consultants for some was a one-time cost; while for other firms, it was a yearly cost since they have to get certification from US Department of Commerce as a yearly requirement by their US buyers.

3.4 HACCP Training

Many small firms sent one or two staff to attend HACCP and then subsequently invited BFAR personnel to train them on HACCP system. Most firms attended HACCP training once or twice for the first year for HACCP.

3.5 Staff Time in HACCP Plan Design

It took one to two persons to study and prepare the HACCP plan for 1-6 months (50 percent of the time) for the small and medium firms, respectively; and 7-10 people (6 months-1 year) for large firms. The annual salary was based on a 22 days/month and 12 months/year working period at PhP250/day. The firms said that the HACCP plan design was a one-time cost during the start-up year, but they also felt the need to revise and improve it from time to time.

3.6 Additional Manpower

As expected, additional tasks were required of the HACCP system such as additional monitoring, record keeping and review of records. To accommodate this new task requirement, most firms simply extended the job of their existing employees. There were a number of medium firms, however, that hired one additional person usually for quality control (QC) and/or quality assurance (QA), while a few large firms hired up to 26 persons or added PhP16 (or US$0.35) in their employees' daily wage. Salary was computed based on a 22 days/month and 12 months/year working period at PhP200/day.

3.7 Additional Laboratory Costs

As part of the HACCP system, firms have had to perform or outsource laboratory analysis for their products and religiously maintain records for record-keeping and inspection purposes. Three cottage tuna processors incurred an estimated additional annual laboratory test costs amounting to PhP50,000 (US$910) mainly due to stricter and more frequent histamine tests, which firms have to comply with as a part of the HACCP system. The responses of other firms (very-small, small, medium, and large) were more varied ranging from 0 to PhP200,000 (0 to US$3,000). These additional costs depended on the level of laboratory testing they were doing before adopting HACCP system. Those firms that reported minimal additional costs had been doing almost the same level of laboratory testing before and after HACCP.

3.8 Additional Materials and Utilities

The main component of a HACCP system is setting measurable critical limits (CL) at critical control points (CCP) and doing corrective actions when deviations occur. Corrective actions could be in terms of rework or disposing/destroying the product.

Based on the interviews, however, all firms have not reported any disposing of products while majority said that they had experienced re-working their products if deviation from the critical limit occurred at least once. Others also said that prices of raw materials partly due to some adjustments that raw material producers/suppliers have to do to comply with the requirements of HACCP certification. These two factors had led to additional costs to firms in terms of additional materials and utilities. A total of 13 firms said these costs were minimal (almost zero); 16 firms (or 39 percent) incurred US$ 901 additional cost; 10 firms incurred US$1,800; and two firms incurred US$ 9,100 (Appendix Table 3).

Appendix Table 3. Interview responses on the costs of additional corrective action

Cost of corrective action (US$ 000)	Number of respondents	Percent
0.0	13	32
0.9	16	39
1.8	10	24
9.1	2	5

Source: Author's interviews.

3.9 Improved GMP Operating Expenses

As evidenced by the recent EU inspection report, most firms were not critical provisions of GMP. As a requirement of a HACCP system, additional efforts were made to improve the firms' GMP. These included additional expenses in: (1) personnel training for GMP (required twice a year); (2) personnel expenditures including personnel paraphernalia (e.g., gloves, apron, booths, etc.) and staff medical examination; (3) more frequent cleaning and using cleaning brands with allowable concentration; and (4) more meticulous and intensive pest control or contracting people for pest control following a quarterly requirement.

APPENDIX 8 - HACCP BENEFITS

There are two methods used to identify and quantify the benefits associated with HACCP adoption. These methods involve qualitative approach using Likert-scale scoring and quantitative approach.

1 "Likert scale" Questions

A Likert-scale[153] was used to draw meaningful responses from firms concerning HACCP benefits. Respondents were asked to rank pre-determined "HACCP benefits" according to the importance or relevance based on their experience. The pre-determined benefits from implementing HACCP systems were adapted from Maldonado et al. (2005) and Henson et al. (1999). The list of benefits is presented in Appendix Table 4 along with the summary of results from Maldonado et al. (2005) in the Mexican meat industry context and in Henson et al. (1999) in the UK dairy processing industry context.

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153 A Likert scale is a type of response scale often used in questionnaires where respondents specify their level of agreement to a statement. While Likert scaling is a common method, measuring either positive or negative response to a statement, it may be subject to distortion from several causes. Respondents may avoid using extreme response categories (central tendency bias); agree with statements as presented (acquiescence bias); or try to portray themselves or their organization in a more favorable light (social desirability bias). Despite these potential biases, this analysis can provide very useful insights on the important benefits and pressing problems faced by firms toward HACCP systems.

Appendix Table 4. List of benefits and their rank scores associated to the implementation of HACCP systems based on previous studies*

Benefits	Maldonado et al. (2005)	Henson et al. (1999)	
	Mean rank scores	Proportion of respondents giving zero rank (%)	Proportion of respondents giving rank of one (%)
Reduced product microbial counts	2.6	31.2	17.0
Increased ability to attract new customers	2.8	27.0	17.0
Increased ability to access new overseas markets	2.9	68.4	0.0
Increased product shelf-life	2.9	45.4	9.9
Increased product sales	3.3	50.4	2.8
Increased ability to retain existing customers	3.3	23.4	34.0
Increased product prices	3.5	61.4	0.7
Reduced production costs	3.5	52.9	4.3
Increased motivation of production staff	4	39.7	4.2
Increased motivation of supervisory/managerial staff	4.4	37.6	4.3
Reduced product wastage	5.3	43.3	9.2

** Ranks were given based on 1=very important and 11=unimportant; for Henson et al. (1999), zero rank corresponds to a benefit that had not been realized.*

In Maldonado at al. (2005), respondents were asked to rank a list of benefits from 1 to 11, with 1 being very important and 11 being unimportant. Reduction in microbial counts was indicated as the major benefit in the Mexican meat industry (Appendix Table 4). Most of the benefits that the respondents received with the implementation of the HACCP systems were reported to be greater than their initial expectations.

In Henson et al. (1999), respondents were presented with a list of benefits and asked to rank them according to importance in terms of the overall benefits of HACCP adoption; and if a benefit had not resulted, respondents were instructed to allocate a rank of zero (Appendix Table 4). The results indicated that increased ability to retain existing

customers, increased ability to attract new customers and reduced product microbial counts were reported to be important benefits. The authors noted that a relatively high proportion of respondents (around 30 percent) indicated that these benefits were greater than expected; while the majority of the respondents indicated that the benefits they had experienced from implementing HACCP systems were approximately in accordance with their prior expectations.

Both studies emphasized that the results presented above should be interpreted with some caution as difficulties may arise in isolating the impact of HACCP systems if other organizational changes had taken place at the same time. As an implication of this difficulty, these studies have pointed out that firms would have tended to emphasize the costs of implementing HACCP systems over the benefits. This then warrants a careful examination of costs and more importantly, the benefits associated with HACCP adoption.

2 Quantitative Questions

To complement the "Rank" questions, this paper asked respondents, using pre-determined choices, more quantitative information on changes in (1) price of output; (2) volume of output; (3) rejection rate at the inspection sites; (4) improved product shelf-life; and (5) lower production wastage within the firm. For instance, respondents were asked the question "*Were you able to negotiate a higher price after HACCP compliance?*" to determine benefits related to price change. If the response was "yes", a follow up question was asked about the percentage change: 1-3 percent, 4-6 percent, 7-9 percent, 10-12 percent, 13-15 percent, or other. Aside from the actual changes in price and quantity, respondents were also asked about their future expectations, i.e., expected

changes in price and quantity associated with HACCP adoption.

3 Alternative Markets

Another set of questions relates to alternative markets, difficulties of shifting markets, and perceptions about missed opportunities in terms of products and markets. For instance, the questions asked to respondents include *"What would be your alternative market if you did not adopt EU HACCP certification?"* Follow-up questions address price differential between existing markets and alternative markets; costs and difficulty in finding buyers and shifting markets; and the likely impact of a hypothetical non-adoption scenario on the nature and scale of future business.

APPENDIX 9 – COMPARISON OF INTERVIEW AND SECONDARY DATA ON PRICE DIFFERENTIALS

In general, shrimp are the most expensive seafood products, followed by squid & cuttlefish, clams, scallops, octopus, milkfish, and shrimp paste (Appendix Table 5). Canned tuna and frozen tuna are among the least expensive products on the average. Average prices decreased in all product forms for non-HACCP-requiring countries and in most product forms for non-HACCP-requiring countries except for frozen tuna and other seafood, which registered significant increases.

Appendix Table 5. Nominal price difference before and after the mandatory regulation on HACCP systems was enforced (in US$/kg; average across product forms)

Product Form	Period	HACCP-requiring countries /1	Non-HACCP-requiring countries /2	EU	US	Japan
Canned tuna	Before /3	2.27	2.46	2.29	2.24	2.91
	After	1.89	2.11	1.98	1.80	2.08
Frozen tuna	Before	3.84	1.29	2.89	4.79	2.12
	After	4.23	1.05	3.57	4.88	1.44
Shrimp	Before	10.93	9.36	10.07	11.79	12.52
	After	8.79	8.10	7.96	9.63	10.04
Octopus	Before	3.29	3.34	3.23	3.35	3.75
	After	2.64	2.71	2.38	2.89	5.16
Milkfish	Before	3.29	2.75	3.44	3.15	3.86
	After	3.23	2.66	3.28	3.19	2.83
Shrimp Paste	Before	2.78	2.62	2.79	2.78	2.92
	After	2.54	2.42	2.42	2.61	2.67
Others	Before	3.32	4.54	3.07	3.06	4.96
	After	4.49	3.84	2.82	2.78	3.82

Source: DTI – Tradeline.

Note: /1 Includes EU and US; /2 Includes all countries except EU, US and Japan; /3 "Before" means before the mandatory regulation on HACCP systems was imposed; and the data analyzed capturing this are the years 1995-1998; and "after" means after the regulation on HACCP systems was imposed and the data covers 1999-2004.

For EU and US price difference, for shrimp paste, the opposite was observed based on the interviews. This may be due to the very limited number of observations, i.e., two respondents, which apparently was not able to capture the general pattern of all shrimp paste processors. The EU-Other Market price difference for octopus and canned tuna appeared to be negative in the secondary data while reported to be positive based on the interviews with respondents. This may be due to the perception of alternative markets that respondents have and the perceived difficulty of changing alternative markets. For instance, some octopus and canned tuna processors reported that it would be difficult for them to find new buyers in other markets. They envision the difficulty of shifting to markets, difficulty of finding new buyers and were realistic in saying that if they do not comply with the new requirements of their existing markets, they would go out of business. This reflects the possibly large transaction costs faced by firms to shift markets and buyers. These added costs of searching and negotiating with buyers (i.e., transaction costs) were implicitly included by the respondents when they reported price differentials across markets.

APPENDIX 10 - NEW NBC ESTIMATES BASED ON SENSITIVITY ANALYSES

Appendix Table 6. New net present value of NBC for representative firms and entire fisheries industry based on sensitivity analyses (9-year period, US$ 000)

Scenario	Certified					De-certified				NVA *
	C	VS	S	M	L	VS	S	M	L	
Base	**-1.6**	**-13.1**	**34.5**	**105.8**	**2177.0**	**-32.6**	**-54.7**	**-82.4**	**-254.1**	**192.5**
	[-0.5]	***[-0.7]***	***[0.2]***	***[0.5]***	***[1.2]***	***[-1.7]***	***[-0.2]***	***[-0.4]***	***[-0.1]***	
(1)	-1.7	-13.2	34.6	105.9	2180.0	-32.6	-54.7	-82.4	-254.1	194.0
	[-0.6]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(2)	-1.6	-13.1	34.2	105.5	2171.0	-32.6	-54.7	-82.4	-254.1	191.9
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(3)	-1.7	-13.0	34.6	105.8	2179.0	-32.6	-54.7	-82.4	-254.1	192.7
	[-0.6]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(4)	-1.6	-13.3	34.5	105.6	2166.0	-32.6	-54.7	-82.4	-254.1	192.3
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(5)	-1.6	-13.0	34.7	107.0	2181.0	-32.6	-54.7	-82.4	-254.1	194.0
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(6)	-1.5	-13.2	34.3	105.6	2174.0	-32.6	-54.7	-82.4	-254.1	192.1
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(7)	-1.6	-13.2	34.7	106.0	2179.0	-32.6	-54.7	-82.4	-254.1	192.7
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(8)	-1.6	-13.1	34.4	105.7	2170.0	-32.6	-54.7	-82.4	-254.1	191.9
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(9)	-1.6	-13.2	34.9	108.0	2179.0	-32.6	-54.7	-82.4	-254.1	194.6
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(10)	-1.6	-13.2	33.3	103.8	2167.0	-32.6	-54.7	-82.4	-254.1	192.3
	[-0.5]	*[-0.7]*	*[0.2]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(11)	0.0	-11.1	40.5	105.8	2177.0	-32.6	-54.7	-82.4	-254.1	193.4
	[-0.0]	*[-0.3]*	*[0.7]*	*[0.5]*	*[1.2]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(12)	-1.6	-13.3	33.0	115.0	2235.0	-32.6	-54.7	-82.4	-254.1	240.6
	[-0.5]	*[-0.6]*	*[0.1]*	*[0.3]*	*[1.3]*	*[-1.7]*	*[-0.2]*	*[-0.4]*	*[-0.1]*	
(13)	4.2	17.8	628.0	797.0	7245.0	0.0	550.0	609.9	4824.0	197.3
	[1.0]	*[0.8]*	*[2.8]*	*[3.2]*	*[3.7]*	*[0.0]*	*[2.4]*	*[2.6]*	*[2.5]*	
(14)	3.2	17.9	625.6	798.2	7138.4	0.0	536.4	623.0	4707.4	194.4
	[1.0]	*[0.8]*	*[2.8]*	*[3.2]*	*[3.7]*	*[0.0]*	*[2.4]*	*[2.6]*	*[2.5]*	
(15)	-1.6	-12.7	35.6	109.0	2242.3	-31.6	-53.0	-80.0	-246.5	198.3
	[-0.6]	*[-0.8]*	*[0.3]*	*[0.7]*	*[1.5]*	*[-1.9]*	*[-0.4]*	*[-0.6*	*[-0.2]*	

*Note: Figures in square brackets are the percentage to output value. * Net present value (9-year period) of NVA of the fisheries sector (in US$ millions).*

APPENDIX 11 – DIFFICULTIES IN HACCP ADOPTION

Again, the questions and approaches used in analyzing the difficulties in HACCP adoption are mainly based on Maldonado et al. (2005) and Henson et al. (1999).[154] The respondents were then asked to indicate how much of a problem each of the listed issues had been when implementing HACCP systems using a Likert scale. Appendix Table 7 provides the list of these potential difficulties that may be experienced by firms and the summary of responses by firms from Maldonado et al. (2005) and Henson et al. (1999). Both studies suggested that the major difficulties were associated with staffing, i.e., the need to retrain and to manage attitude/motivation of production and supervisory/managerial staff (Appendix Table 7).

Appendix Table 7. List of potential difficulties faced by firms in HACCP implementation and summary of firms' responses from two previous studies*

Problems associated with HACCP implementation	Maldonado et al. (2005)	Henson et al. (1999)
Need to retrain production staff	1.7	4.1
Need to retrain supervisory/managerial staff	2.7	3.7
Attitude/motivation of production staff	3.4	4.0
Attitude/motivation of supervisory/managerial staff	3.7	3.8
Recouping costs of implementing HACCP	3.8	3.1
Reduced staff time available for other tasks	3.9	3.6
Reduced flexibility to introduce new products	4.0	2.3
Reduced flexibility of production staff	4.2	2.9
Reduced flexibility of production process	-	3.0

** Respondents were asked to rank the difficulties faced in implementing HACCP systems. The ranks are from "one" for major importance to "eight" for minor importance for Maldonado et al. (2005); and from "one" of minor importance to "nine" for major importance for Henson et al. (1999)*

Moreover, Herath and Henson (2005; 2006) have shown in their study that internal budgetary constraints and difficulty in obtaining external funding were major

154 These are modified versions of earlier studies such as Small Business Research Trust (1994); Institute of Quality Assurance (1991); Vanguard Consulting (1993); Tompkin (1994).

barriers faced by firms in implementing HACCP systems. Moreover, the perception that "other investments/priorities more important" and that the "current food safety control adopted by the firm is sufficient" also appeared to be major constraints faced by firms in adopting HACCP systems. Thus, this paper added the four categories above in the list of problems associated with HACCP systems presented to the respondents. Likewise, based on key informant's interviews and questionnaire pre-testing, majority of the initially interviewed respondents mentioned that one major difficulty that they faced is the overwhelmingly numerous changes to be done to adopt HACCP and the time needed to digest and adjust to these changes. Moreover, many mentioned that they were having difficulty in accessing reliable raw material that would pass laboratory testing as required by the HACCP system. These two categories were then added in the list of problems or difficulties presented to the respondents to rank.

APPENDIX 12 – COST ESTIMATION RESULTS FOR UNPOOLED 2000 AND 2003 DATA

Chow Test

The Chow test is commonly used to test for structural change in some or all of the parameters of a model in cases where the disturbance term is assumed to be the same in both periods. The null hypothesis is: coefficients of some or all of the explanatory variables are the same between two groups and it is valid to pool the data across these groups. Consider the model:

$$y = \alpha + \beta 1 * x1 + \beta 2 * x2 + \varepsilon$$

where y is the dependent variable; x1 and x2 are explanatory variables; α, β1,β2 are the parameters to be estimated; and ε is the error term. There are two groups of data. We could estimate that model on the two groups separately or estimate a single, pooled regression:

$$y = \alpha + \beta 1 * x1 + \beta 2 * x2 + \varepsilon \qquad \textit{for group == 1}$$

$$y = \alpha + \beta 1 * x1 + \beta 2 * x2 + \varepsilon \qquad \textit{for group == 2}$$

$$y = \alpha + \beta 1 * x1 + \beta 2 * x2 + \varepsilon \qquad \textit{for both groups}$$

For the Chow test, the fomula is:

$$\frac{\dfrac{ess_c - (ess_1 + ess_2)}{k}}{\dfrac{ess_1 + ess_2}{N_1 + N_2 - 2*k}}$$

where, ess_c = sum of squared errors (from combined regression);

ess_1 = sum of squared errors (from group==1 regression);
ess_2 = sum of squared errors (from group==2 regression);
k = number of parameters;
N_1 = number of observations (from group==1 regression); and
N_2 = number of observations (from group==2 regression).

This test is similar to using the *test* command in Stata. First, a dummy for the group is generated, say *g2*, where *g2=1* if *group==2* and *g2=0* otherwise, and then multiplying the explanatory variables with *g2*. In Stata, the commands are:

. generate g2 = (group==2)

. generate g2x1 = g2*x1

. generate g2x2 = g2*x2

. regress y x1 x2 g2 g2x1 g2x2

. test g2 g2x1 g2x2

In the HACCP cost context, let the groups be time (2000 and 2003) and the dummies are *tt=1* if *time=2003* and *tt=0* if *time=2000*. We ran the estimation given in equations 34, 38, and 39 (Chapter 4), with added interaction terms of all explanatory variables with *tt*. Then we test the joint significance of *tt* and its interactions with explanatory variables.The Stata results are shown below:

F(28, 62) = 2.03

Prob > F = 0.15

The result above indicates that we cannot reject the null hypothesis, and thus, we conclude that it is statistically valid to pool the data.

APPENDIX 13 – TESTING FOR CONDITIONS ON THEORETICAL VALIDITY OF COST FUNCTION

1 Condition 1: Non-negative Marginal Costs of Production

Appendix Table 8. Marginal costs of production

Observation	2003	2000	Observation	2003	2000
1	0.0001	0.0000	31	0.0004	0.0002
2	0.0000	0.0000	32	0.0019	0.0014
3	0.0007	0.0006	33	0.0014	0.0020
4	0.0043	0.0054	34	0.0019	0.0020
5	0.0009	0.0008	35	0.0047	0.0028
6	0.0007	0.0008	36	0.0034	0.0040
7	0.0159	0.0164	37	0.0709	0.1435
8	0.0211	0.0229	38	0.0709	0.1435
9	0.0320	0.0290	39	0.2409	0.2896
10	0.0193	0.0382	40	0.0173	0.0280
11	0.0195	0.0191	41	0.0351	0.0208
12	0.0992	0.2885	42	0.0704	0.0163
13	0.0160	0.0224	43	0.0702	0.0844
14	0.0012	0.0007	44	0.3659	0.3648
15	0.0001	0.0001	45	0.0353	0.0325
16	0.0016	0.0011	46	0.0016	0.0019
17	0.0021	0.0014	47	0.0133	0.0133
18	0.0006	0.0003	48	0.1430	0.1426
19	0.0013	0.0011	49	0.0010	0.0007
20	0.0050	0.0043	50	0.0009	0.0007
21	0.0064	0.0054	51	0.0001	0.0001
22	0.0000	0.0001	52	0.0063	0.0048
23	0.0003	0.0003	53	0.0194	0.0243
24	0.0019	0.0015	54	0.0713	0.0860
25	0.0048	0.0049	55	0.0001	0.0001
26	0.0120	0.0089	56	0.0013	0.0010
27	0.0076	0.0148	57	0.0016	0.0018
28	0.0004	0.0003	58	0.1069	0.1222
29	0.0016	0.0048	59	0.1223	0.1429
30	0.0048	0.0053			

2 Condition 2: Positive Cost Shares

Appendix Table 9. Factor cost shares related to conventional production of Y

Obs.	CS_M^P		CS_L^P		CS_E^P		CS_K^P		Obs.	CS_M^P		CS_L^P		CS_E^P		CS_K^P	
	2003	2000	2003	2000	2003	2000	2003	2000		2003	2000	2003	2000	2003	2000	2003	2000
1	0.52	0.55	0.25	0.23	0.06	0.06	0.17	0.16	31	0.68	0.71	0.12	0.11	0.05	0.04	0.15	0.14
2	0.51	0.52	0.25	0.24	0.06	0.07	0.17	0.18	32	0.63	0.66	0.18	0.16	0.05	0.04	0.14	0.13
3	0.69	0.69	0.12	0.10	0.05	0.05	0.15	0.15	33	0.66	0.66	0.16	0.15	0.05	0.05	0.14	0.14
4	0.60	0.64	0.21	0.18	0.05	0.05	0.14	0.13	34	0.58	0.59	0.22	0.21	0.05	0.06	0.14	0.15
5	0.64	0.67	0.17	0.15	0.05	0.04	0.14	0.14	35	0.67	0.70	0.15	0.14	0.04	0.04	0.13	0.12
6	0.71	0.71	0.11	0.10	0.04	0.04	0.14	0.15	36	0.60	0.60	0.23	0.22	0.05	0.05	0.13	0.13
7	0.62	0.65	0.19	0.17	0.06	0.05	0.14	0.13	37	0.64	0.64	0.23	0.21	0.04	0.04	0.10	0.11
8	0.65	0.68	0.16	0.15	0.05	0.05	0.13	0.13	38	0.64	0.64	0.23	0.21	0.04	0.04	0.10	0.11
9	0.62	0.65	0.19	0.17	0.05	0.05	0.13	0.12	39	0.65	0.65	0.22	0.21	0.03	0.04	0.09	0.10
10	0.61	0.61	0.19	0.18	0.06	0.07	0.14	0.14	40	0.61	0.61	0.23	0.23	0.04	0.05	0.11	0.12
11	0.64	0.65	0.18	0.16	0.05	0.05	0.13	0.14	41	0.62	0.62	0.23	0.22	0.04	0.04	0.11	0.11
12	0.60	0.67	0.23	0.17	0.05	0.04	0.12	0.12	42	0.67	0.68	0.20	0.19	0.03	0.03	0.10	0.10
13	0.68	0.69	0.16	0.15	0.04	0.04	0.12	0.12	43	0.68	0.68	0.19	0.18	0.03	0.03	0.10	0.10
14	0.70	0.71	0.12	0.10	0.04	0.05	0.14	0.14	44	0.63	0.63	0.25	0.23	0.03	0.04	0.09	0.10
15	0.53	0.56	0.24	0.22	0.06	0.05	0.16	0.16	45	0.59	0.59	0.26	0.25	0.04	0.04	0.11	0.11
16	0.67	0.70	0.15	0.13	0.04	0.04	0.14	0.13	46	0.59	0.62	0.21	0.19	0.05	0.05	0.14	0.14
17	0.68	0.71	0.15	0.13	0.04	0.04	0.13	0.13	47	0.75	0.75	0.10	0.09	0.03	0.04	0.11	0.12
18	0.61	0.64	0.19	0.17	0.05	0.05	0.15	0.14	48	0.64	0.64	0.21	0.20	0.04	0.05	0.11	0.11
19	0.71	0.72	0.09	0.08	0.05	0.05	0.15	0.15	49	0.60	0.60	0.19	0.17	0.06	0.06	0.16	0.16
20	0.65	0.69	0.17	0.15	0.04	0.04	0.13	0.12	50	0.73	0.74	0.09	0.08	0.04	0.04	0.14	0.14
21	0.63	0.66	0.17	0.15	0.05	0.05	0.14	0.13	51	0.52	0.53	0.25	0.24	0.06	0.06	0.17	0.17
22	0.52	0.53	0.24	0.23	0.06	0.07	0.18	0.18	52	0.65	0.66	0.17	0.16	0.05	0.05	0.13	0.13
23	0.61	0.62	0.18	0.17	0.05	0.05	0.15	0.16	53	0.65	0.68	0.17	0.15	0.05	0.05	0.13	0.13
24	0.68	0.71	0.14	0.12	0.04	0.04	0.13	0.13	54	0.59	0.58	0.25	0.25	0.05	0.05	0.12	0.12
25	0.63	0.67	0.19	0.17	0.05	0.04	0.13	0.13	55	0.52	0.53	0.25	0.23	0.06	0.06	0.17	0.17
26	0.70	0.73	0.13	0.11	0.04	0.03	0.12	0.12	56	0.75	0.78	0.09	0.07	0.04	0.03	0.13	0.12
27	0.61	0.65	0.21	0.18	0.05	0.04	0.13	0.13	57	0.73	0.74	0.09	0.07	0.04	0.04	0.14	0.14
28	0.62	0.65	0.18	0.16	0.05	0.05	0.15	0.14	58	0.65	0.65	0.22	0.21	0.04	0.04	0.10	0.11
29	0.59	0.62	0.20	0.18	0.06	0.05	0.15	0.14	59	0.65	0.65	0.22	0.21	0.04	0.04	0.10	0.10
30	0.66	0.67	0.18	0.17	0.04	0.04	0.12	0.12									

Appendix Table 10. Factor cost shares related to HACCP system

Obs.	CS_M^H		CS_L^H		CS_E^H		CS_K^H		Obs.	CS_M^H		CS_L^H		CS_E^H		CS_K^H	
	2003	2000	2003	2000	2003	2000	2003	2000		2003	2000	2003	2000	2003	2000	2003	2000
1	0.02	0.01	0.14	0.16	0.27	0.20	0.57	0.63	31	0.01	0.01	0.13	0.14	0.27	0.20	0.59	0.65
2	0.02	0.02	0.15	0.16	0.28	0.21	0.55	0.61	32	0.01	0.01	0.10	0.11	0.26	0.19	0.63	0.70
3	0.01	0.01	0.14	0.15	0.31	0.23	0.54	0.60	33	0.01	0.01	0.12	0.13	0.26	0.18	0.62	0.68
4	0.01	0.01	0.08	0.09	0.29	0.22	0.62	0.67	34	0.01	0.01	0.10	0.12	0.23	0.16	0.65	0.71
5	0.01	0.01	0.11	0.12	0.30	0.22	0.58	0.65	35	0.01	0.01	0.08	0.09	0.19	0.12	0.73	0.79
6	0.01	0.01	0.12	0.13	0.31	0.24	0.55	0.62	36	0.01	0.01	0.07	0.08	0.21	0.14	0.71	0.77
7	0.01	0.01	0.08	0.09	0.20	0.13	0.72	0.78	37	0.00	0.00	0.00	0.01	0.09	0.01	0.92	0.98
8	0.01	0.01	0.07	0.09	0.19	0.12	0.73	0.79	38	0.00	0.00	0.00	0.01	0.09	0.01	0.92	0.98
9	0.01	0.01	0.06	0.07	0.17	0.10	0.77	0.82	39	0.00	0.00	-0.02	-0.01	0.03	-0.04	0.99	1.05
10	0.02	0.01	0.10	0.11	0.46	0.38	0.43	0.49	40	0.00	0.00	0.03	0.04	0.14	0.07	0.82	0.89
11	0.01	0.01	0.08	0.09	0.19	0.12	0.73	0.78	41	0.00	0.00	0.02	0.03	0.11	0.04	0.87	0.93
12	0.00	0.00	0.03	0.04	0.05	-0.02	0.92	0.97	42	0.00	0.00	0.00	0.01	0.09	0.02	0.91	0.97
13	0.00	0.00	0.04	0.06	0.14	0.07	0.82	0.87	43	0.00	0.00	0.00	0.02	0.09	0.02	0.91	0.97
14	0.01	0.01	0.11	0.12	0.25	0.19	0.63	0.68	44	0.00	-0.01	-0.04	-0.03	0.01	-0.06	1.03	1.09
15	0.01	0.01	0.13	0.14	0.24	0.17	0.61	0.68	45	0.00	0.00	0.01	0.02	0.11	0.04	0.88	0.94
16	0.01	0.01	0.10	0.11	0.20	0.13	0.69	0.75	46	0.01	0.01	0.09	0.11	0.23	0.16	0.67	0.73
17	0.01	0.01	0.09	0.10	0.19	0.12	0.71	0.78	47	0.01	0.00	0.07	0.09	0.17	0.10	0.75	0.81
18	0.01	0.01	0.11	0.12	0.24	0.17	0.64	0.70	48	0.00	0.00	0.01	0.02	0.06	-0.02	0.93	0.99
19	0.01	0.01	0.13	0.14	0.22	0.15	0.64	0.70	49	0.01	0.01	0.13	0.14	0.22	0.14	0.64	0.70
20	0.01	0.01	0.07	0.08	0.22	0.15	0.70	0.76	50	0.01	0.01	0.12	0.13	0.23	0.16	0.64	0.70
21	0.01	0.01	0.10	0.11	0.21	0.13	0.69	0.75	51	0.01	0.01	0.14	0.15	0.25	0.18	0.59	0.66
22	0.02	0.02	0.16	0.17	0.31	0.23	0.52	0.58	52	0.01	0.01	0.07	0.08	0.21	0.14	0.71	0.78
23	0.01	0.01	0.12	0.14	0.27	0.20	0.59	0.66	53	0.01	0.01	0.07	0.08	0.16	0.09	0.76	0.82
24	0.01	0.01	0.09	0.10	0.23	0.16	0.67	0.73	54	0.00	0.00	0.02	0.04	0.08	0.00	0.89	0.96
25	0.01	0.01	0.07	0.08	0.22	0.15	0.70	0.76	55	0.02	0.01	0.15	0.16	0.28	0.20	0.56	0.62
26	0.01	0.01	0.07	0.08	0.22	0.15	0.71	0.77	56	0.01	0.01	0.10	0.11	0.25	0.18	0.64	0.69
27	0.01	0.01	0.06	0.07	0.16	0.10	0.77	0.83	57	0.01	0.01	0.12	0.13	0.24	0.18	0.63	0.68
28	0.01	0.01	0.12	0.13	0.26	0.19	0.61	0.67	58	0.00	0.00	0.00	0.01	0.07	0.00	0.94	1.00
29	0.01	0.01	0.11	0.12	0.20	0.12	0.69	0.75	59	0.00	0.00	-0.01	0.00	0.06	-0.01	0.94	1.01
30	0.01	0.01	0.06	0.08	0.20	0.13	0.73	0.79									

3 Condition 4: Concavity

Appendix Table 11. Leading principal minors for testing concavity

Obs	First		Second		Third		Fourth		Obs	First		Second		Third		Fourth	
	2003	2000	2003	2000	2003	2000	2003	2000		2003	2000	2003	2000	2003	2000	2003	2000
1	-0.71	-0.57	0.02	0.00	-0.12	-0.08	0.41	0.33	31	-0.04	-0.03	0.00	0.00	0.01	0.01	0.01	0.01
2	-0.75	-0.59	0.02	0.01	-0.13	-0.09	0.47	0.37	32	-0.21	-0.15	0.00	0.00	-0.01	0.00	0.07	0.05
3	-0.03	-0.03	0.00	0.00	0.00	0.01	0.01	0.01	33	-0.13	-0.10	0.00	0.00	0.00	0.00	0.03	0.02
4	-0.55	-0.34	0.01	0.00	-0.04	-0.02	0.25	0.15	34	-0.68	-0.52	-0.01	-0.02	-0.03	-0.02	0.18	0.14
5	-0.16	-0.12	0.00	0.00	-0.01	0.00	0.07	0.05	35	-0.12	-0.09	0.00	0.00	0.00	0.00	0.03	0.02
6	-0.03	-0.03	0.00	0.00	0.01	0.01	0.01	0.01	36	-1.01	-0.77	0.02	0.00	-0.09	-0.06	0.40	0.31
7	-0.35	-0.26	-0.01	-0.01	-0.01	0.00	0.06	0.04	37	-1.52	-1.07	0.05	0.02	-0.08	-0.06	0.30	0.22
8	-0.18	-0.13	0.00	0.00	0.00	0.00	0.02	0.02	38	-1.47	-1.07	0.05	0.02	-0.08	-0.06	0.29	0.22
9	-0.38	-0.28	-0.01	-0.01	-0.01	0.00	0.05	0.04	39	-1.56	-1.20	0.04	0.01	-0.04	-0.03	0.18	0.15
10	-0.46	-0.34	-0.01	-0.01	-0.01	-0.01	0.21	0.15	40	-1.54	-1.20	0.04	0.01	-0.11	-0.08	0.45	0.36
11	-0.24	-0.15	0.00	0.00	0.00	0.00	0.03	0.02	41	-1.57	-1.20	0.04	0.01	-0.09	-0.07	0.37	0.29
12	-0.95	-0.27	-0.02	-0.01	0.00	0.00	0.09	0.02	42	-0.75	-0.59	0.02	0.01	-0.04	-0.03	0.12	0.10
13	-0.19	-0.13	0.00	0.00	-0.01	0.00	0.03	0.02	43	-0.58	-0.44	0.01	0.00	-0.02	-0.02	0.08	0.07
14	-0.04	-0.03	0.00	0.00	0.00	0.01	0.01	0.01	44	-3.06	-2.20	0.10	0.04	-0.05	-0.04	0.38	0.30
15	-0.72	-0.54	0.02	0.00	-0.11	-0.07	0.38	0.29	45	-3.26	-2.60	0.11	0.04	-0.20	-0.16	1.00	0.83
16	-0.09	-0.06	0.00	0.00	0.00	0.01	0.02	0.02	46	-0.45	-0.34	0.01	0.00	-0.04	-0.02	0.16	0.12
17	-0.09	-0.07	0.00	0.00	0.00	0.01	0.02	0.02	47	-0.04	-0.03	0.00	0.00	0.00	0.00	0.00	0.00
18	-0.23	-0.17	0.01	0.00	-0.02	-0.01	0.09	0.07	48	-0.95	-0.72	-0.01	-0.02	0.00	0.00	0.09	0.07
19	-0.02	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	49	-0.19	-0.14	0.00	0.00	0.00	0.00	0.04	0.03
20	-0.20	-0.15	0.00	0.00	-0.01	0.00	0.06	0.05	50	-0.02	-0.01	0.00	0.00	0.01	0.01	0.00	0.00
21	-0.18	-0.13	0.00	0.00	0.00	0.00	0.03	0.02	51	-0.78	-0.60	0.02	0.01	-0.13	-0.09	0.44	0.33
22	-0.53	-0.40	0.01	0.00	-0.09	-0.06	0.36	0.26	52	-0.21	-0.16	0.00	0.00	-0.01	0.00	0.05	0.04
23	-0.18	-0.14	0.00	0.00	-0.01	0.00	0.08	0.06	53	-0.18	-0.13	0.00	0.00	0.00	0.00	0.02	0.02
24	-0.08	-0.06	0.00	0.00	0.00	0.01	0.02	0.02	54	-2.13	-2.19	-0.03	-0.07	0.05	0.11	0.30	0.33
25	-0.31	-0.22	0.01	0.00	-0.02	-0.01	0.10	0.07	55	-0.69	-0.49	0.02	0.01	-0.12	-0.08	0.43	0.31
26	-0.09	-0.06	0.00	0.00	0.00	0.00	0.02	0.01	56	-0.02	-0.02	0.00	0.00	0.01	0.01	0.00	0.00
27	-0.52	-0.31	0.01	0.00	-0.03	-0.01	0.13	0.08	57	-0.02	-0.01	0.00	0.00	0.00	0.01	0.00	0.00
28	-0.19	-0.14	0.00	0.00	-0.01	0.00	0.08	0.06	58	-1.24	-0.98	0.03	0.01	-0.05	-0.03	0.18	0.16
29	-0.33	-0.24	0.00	0.00	-0.02	-0.01	0.08	0.06	59	-1.18	-0.93	0.02	0.01	-0.04	-0.03	0.16	0.14
30	-0.31	-0.24	0.01	0.00	-0.02	-0.01	0.09	0.07									

APPENDIX 14 – CORRELATION OF INPUT AND OUTPUT PRICES

The price of materials is highly correlated with the output price level as presented in Appendix Table 12.

Appendix Table 12. Correlation analysis of input and output prices.

Variables	Correlation coefficient
Price of materials versus Output price	**0.99 ***
Price of capital versus Output price	0.27
Price of labor versus Output Price	0.07
Price of materials versus Price of capital	0.23
Price of labor versus Price of materials	0.12
Price of labor versus Price of capital	-0.02

* *Significant at < .01 level*

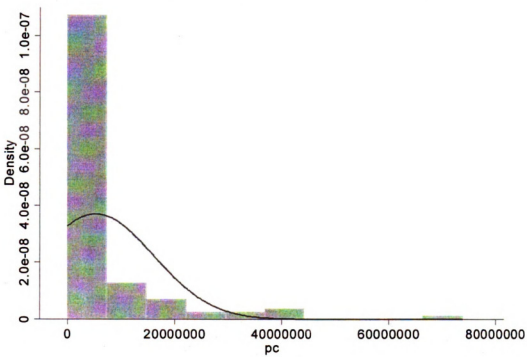
APPENDIX 15 – TEST FOR ENDOGENEITY OF OUTPUT IN PRODUCTION COST

```
. test  Yhat
( 1)    Yhat = 0
        F( 1,   34)     =       1.91
        Prob > F        =       0.1755
```

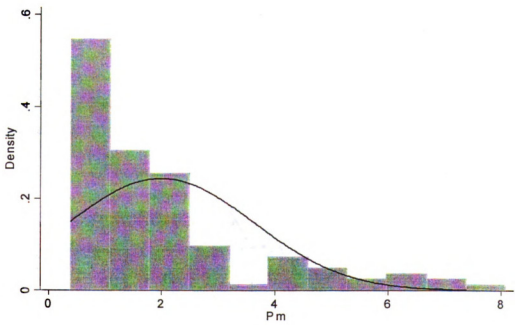
We conclude that we cannot reject the null hypothesis of exogeneity; therefore, we use output (*Y*) as exogenous variable in the production cost (*PC*) model estimation.

APPENDIX 16 – HISTOGRAM

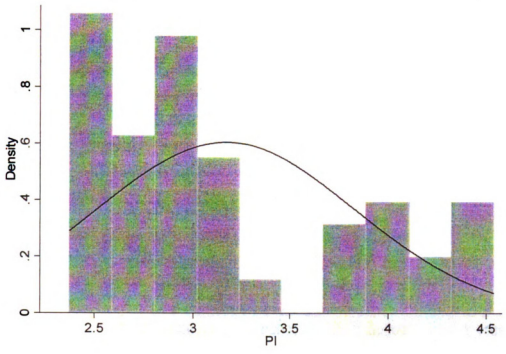
Appendix Figure 1. Histogram of production cost (PC)



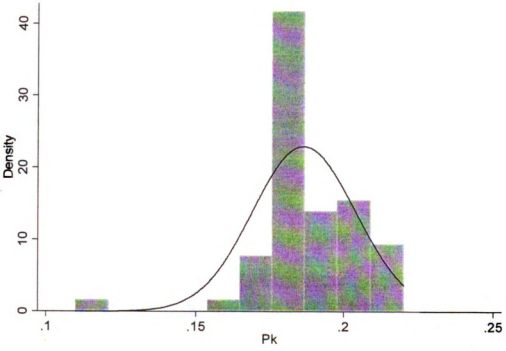
Appendix Figure 2. Histogram of price of materials (PM)



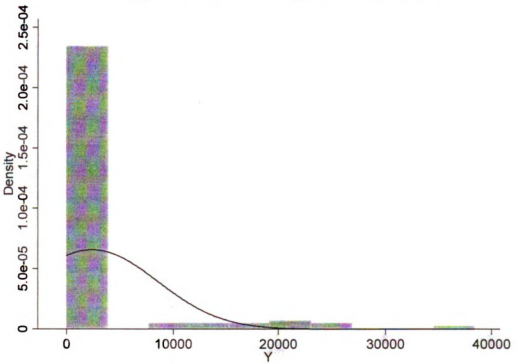
Appendix Figure 3. Histogram of price of labor (PL)



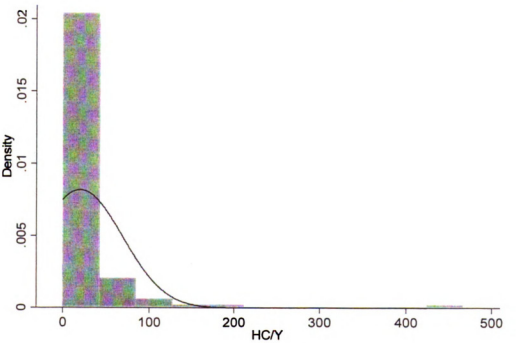
Appendix Figure 4. Histogram of price of capital (PK)



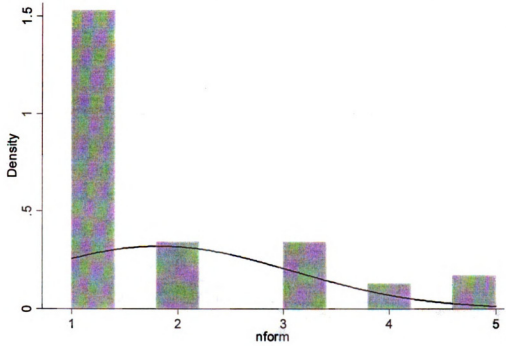
Appendix Figure 5. Histogram of output (Y)



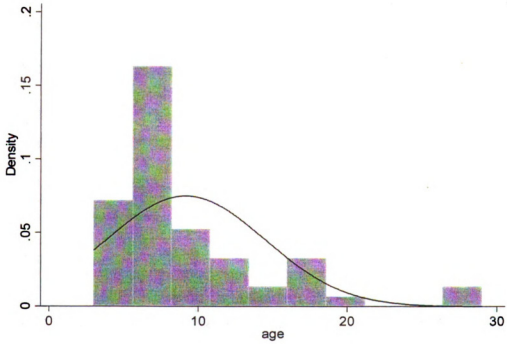
Appendix Figure 6. Histogram of HACCP cost (HC)



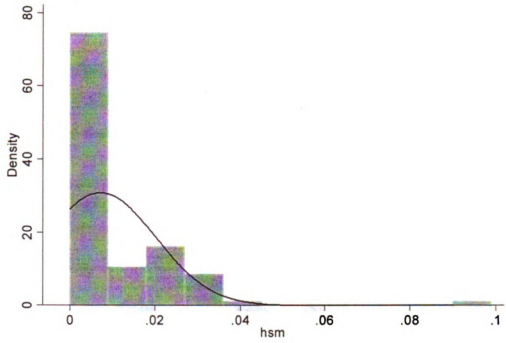
Appendix Figure 7. Histogram of number of product forms (Nform)



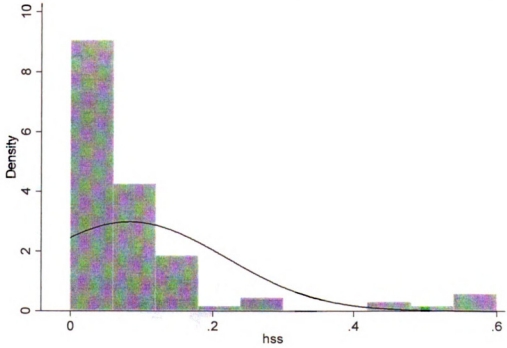
Appendix Figure 8. Histogram of age (Age)



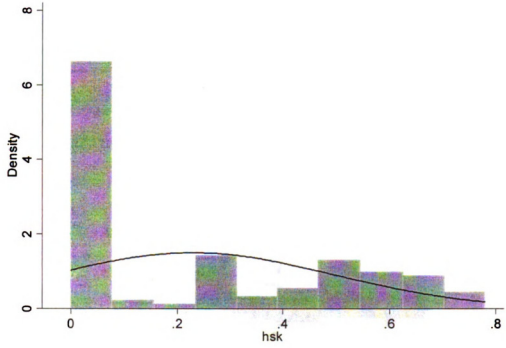
Appendix Figure 9. Histogram of HACCP cost share for materials (HSM)



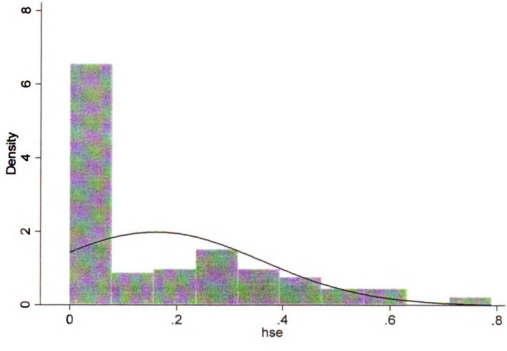
Appendix Figure 10. Histogram of HACCP cost share for labor (HSL)



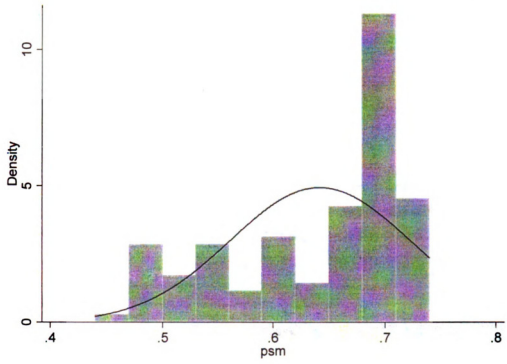
Appendix Figure 11. Histogram of HACCP cost share for capital (HSK)



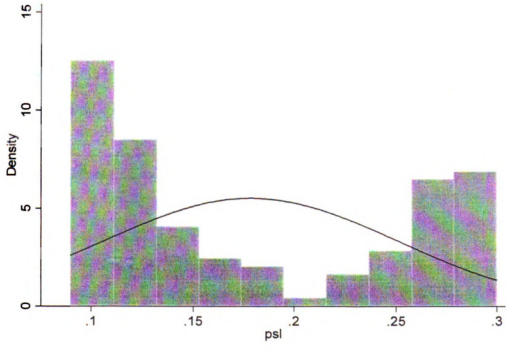
Appendix Figure 12. Histogram of HACCP cost share for energy (HSE)



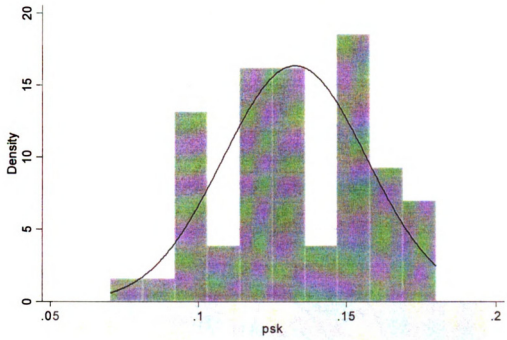
Appendix Figure 13. Histogram of production cost share for materials (PSM)



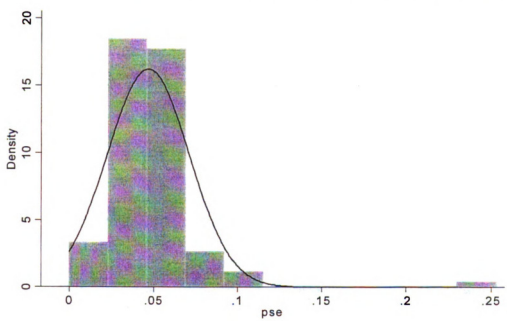
Appendix Figure 14. Histogram for production cost share for labor (PSL)



Appendix Figure 15. Histogram of production cost share for capital (PSK)

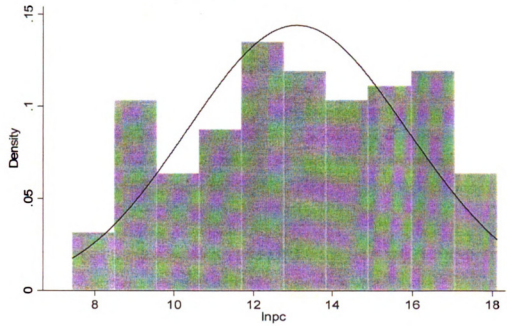


Appendix Figure 16. Histogram of production cost share for energy (PSE)

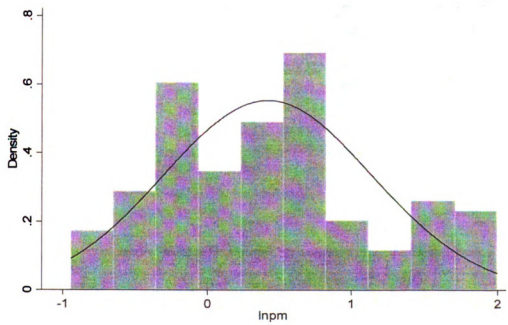


APPENDIX 17 – SKEWNESS TEST OF LOGARITHMIC FORMS OF THE VARIABLES AND NORMALITY TEST OF RESIDUALS

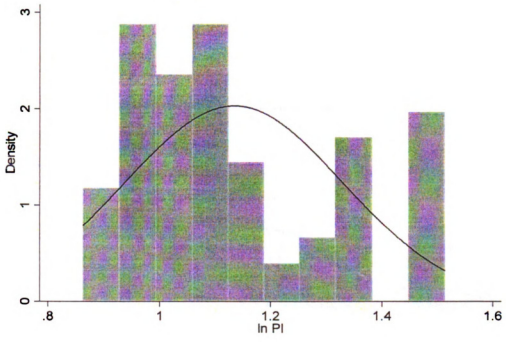
Appendix Figure 17. Histogram of ln PC



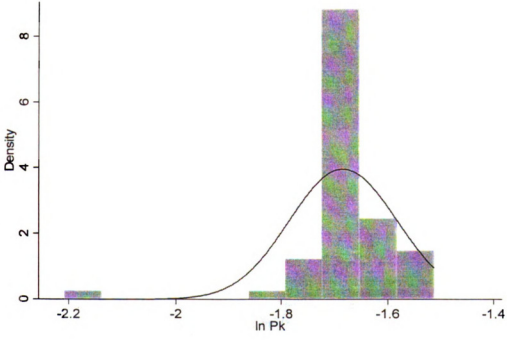
Appendix Figure 18. Histogram of ln PM



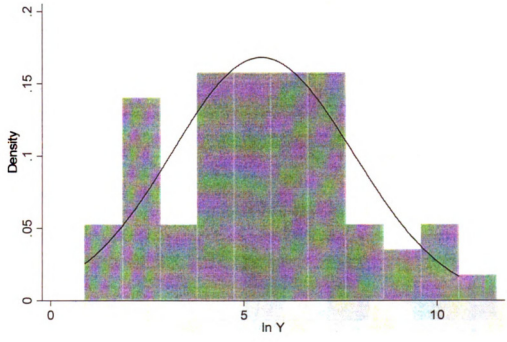
Appendix Figure 19. Histogram of ln PL



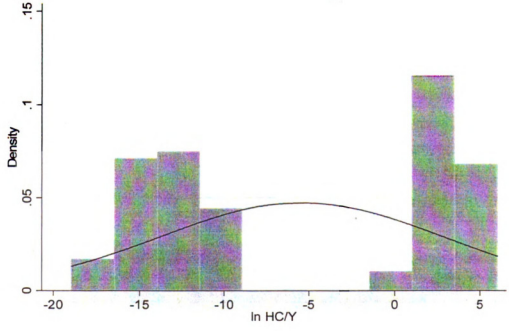
Appendix Figure 20. Histogram of ln PK



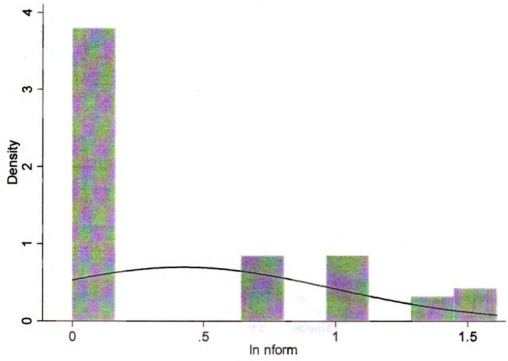
Appendix Figure 21. Histogram of ln Y



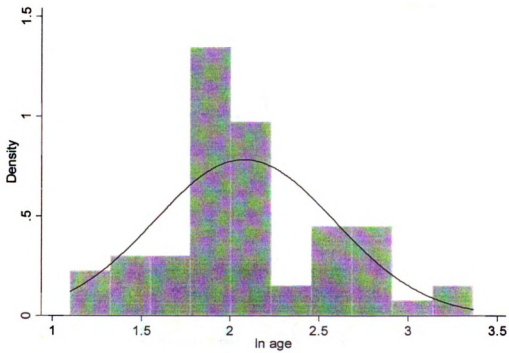
Appendix Figure 22. Histogram of ln HC



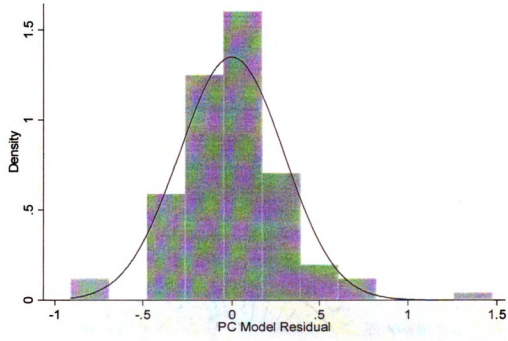
Appendix Figure 23. Histogram of ln Nform



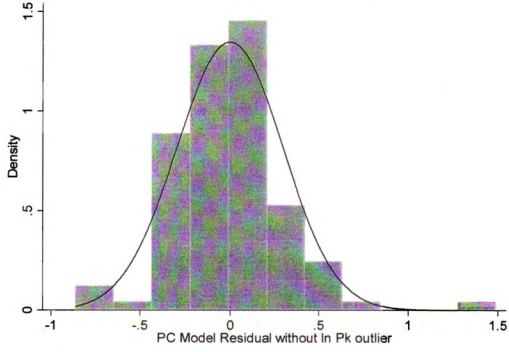
Appendix Figure 24. Histogram of ln Age



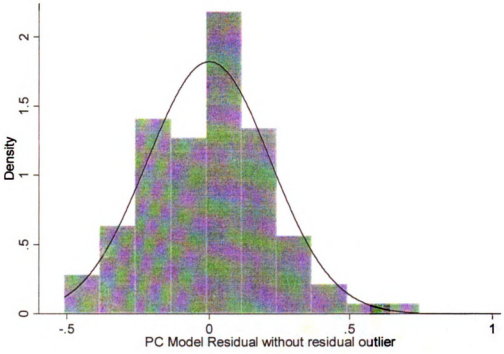
Appendix Figure 25. Histogram of the residuals of PC model



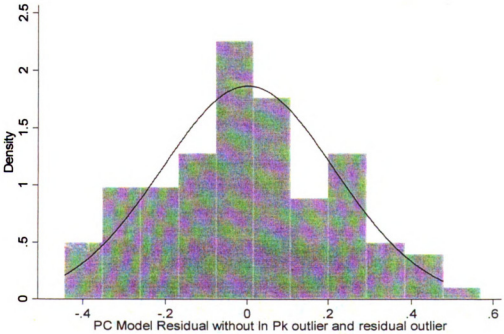
Appendix Figure 26. Histogram of the residuals of PC model (excluding outliers in the log-transformed data)



Appendix Figure 27. Histogram of the residuals of PC model (excluding outliers in the residuals)



Appendix Figure 28. Histogram of the residuals of PC model (excluding outliers in the log-transformed data and outliers in the residuals of the PC model)



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