Seafood supply chain quality management
Loc, V.T.T.

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Chapter 3

Seafood Supply Chain Quality Issues
And Discussion In The Mekong Delta, Vietnam

As mentioned in the chapter devoted to a review of the literature, nowadays throughout the food chain, food safety in general and HACCP implementation in particular are main concerns in the international food trade, as well as for food companies around the world. In addition, constraints on management and technology, which ensure food safety in the supply chain, are big challenges in developing countries. The role of the government and industry is also still important in managing and ensuring supply chain food safety. The situation in the shrimp supply chain in the MD has been made of the results of a chain survey. The survey relevant issues will be explained in more detail below.

3.1 Data collection by questionnaire

3.1.1 Questionnaire design
The questionnaire is designed as an important tool in establishing the research activities that are shown as series of steps in Figure 3.1.

- Step 1: Listing the information needed regarding seafood quality and the contents of quality standards applied at the SFCs in the MD.
- Step 2: Using both direct and indirect methods of interviews for collecting data and information.
- Step 3: Formulating 38 questions that set by 306 variables.
- Step 4: Using both unstructured and structured questions to ask.
- Step 5: Translating English questions into Vietnamese questions for collecting data.
- Step 6: Making sure the questions arranged from easy to difficult and from general to more specific.
Chapter 3

- Step 7: Structuring four parts in the questionnaire – (1) general information of the interviewee and company business, (2) Company’s shrimp quality through the chain, (3) the current situation of the company’s quality management, (4) The HACCP and other quality standards.
- Step 8: Reproducing the questionnaire in a professional way.
- Step 9: Improving the questionnaire by a pilot survey conducted at the university and at the SFCs.

Figure 3.1 Questionnaire design process
quality in processing and in the distribution process. The third part includes questions describing the current situation of the company’s quality control management. It comprises questions concerning leadership, supplier quality management, processing control and improvement, quality system improvement, employee participation, education and training, and consumer focus. The topics in part three are discussed in terms of scale questions – using a 5-point scale (gradual level of agreement: 1. Strongly disagree...and 5. Strongly agree). In addition, at the end of each topic question the respondents are asked to give their reasons for choosing that number. The fourth part focuses on food quality standards such as GMP, SSOP, ISO, TQM, SQF, BRC, and particularly on the HACCP procedures and principles that have been implemented by the company. These are (1) assembling an HACCP team; (2) description of the product and its distribution; (3) identification of intended use and consumers; (4) development of process flow diagrams; (5) inspection of the process and verification of the flow diagram; (6) assessing the hazards (Principle 1); (7) determination of Critical Control Points (Principle 2); (8) establishing critical limits for Critical Control Points (Principle 3); (9) establishing a procedure for monitoring critical limits (Principle 4); (10) establishing corrective action (Principle 5); (11) establishing procedures for verification that the HACCP system is working correctly (Principle 6); (12) establishing effective record-keeping systems (Principle 7). In total there are 38 main questions to be answered and 306 variables.

Before filling out the questionnaire, the SFC leaders and staff members responsible for answering the questions in the questionnaire were asked for basic information related to the individual and the company. The remaining part of the questionnaire concentrated on instructing the interviewee on how to fill out the questionnaire and send it back to the researcher after two weeks. Interviewing by telephone was also used to edit or improve the quality of the answers, if answers were missing or unclear.

In short, the structure of the questionnaire focuses mainly on supply chain quality management in general and HACCP implementation in particular for current SFCs in the MD. After receiving the completed questionnaires, the data were coded and analyzed. The results can be found in the next section.

3.2 The survey results: general information

3.2.1 Interviewee general information
Thirty-two people representing the 32 SFCs filled out the questionnaires; 75% were male and 25% female. The average age of the interviewees was 37 (minimum 26 and maximum 51). Most of them were heads of quality control
departments (71.9%) and the others were directors and vice directors of the companies. Regarding their educational level, 78.2% of the interviewees held Bachelor’s and/or Master’s degrees (Appendix 3).

3.2.2 Company general information

Thirty-two of the total number of 52 SFCs in the region were interviewed (accounting for 61.3%). The study focused only on 32 SFCs that had a minimum of two years in business. Twenty-eight of the total of 32 exported seafood products, including shrimp. Four companies without shrimp exports answered the questionnaire. Companies interviewed were located in the twelve provinces of the MD. Most of the seafood companies were small-medium size* (71%) and were owned by the State (68.8%). Their average business time was approximately 13 years. The SFCs’ product structure included shrimp (87.5%), fish (46.9%) and other seafood products 40.6% (mollusk, cuttlefish). All three kinds of ownerships (SOE, private SFC and Stock SFC) export their products to three main markets (Japan, the US and the EU). Specifically, of the SFCs 87.5% exported products to the US, 78.1% to Japan, 59.4% to the EU, and 25% to Korea. Their main problems, advantages and disadvantages are illustrated in Table 3.1.

Table 3.1 General information about the companies interviewed

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Total seafood companies interviewed: 32 (100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Kind of ownership</td>
<td>SOEs: 65.6% Private SFCs: 28.1% Stock SFCs: 6.3%</td>
</tr>
<tr>
<td>2. Range of employee</td>
<td>500 - 999: 50% 1000 – 1500: 21% &gt; 1500: 29%</td>
</tr>
<tr>
<td>3. Years in business</td>
<td>Average: 13 years; Maximum: 50 years; Minimum: 2 years</td>
</tr>
<tr>
<td>4. Profit level in 2001</td>
<td>Low profit: 68.8% High profit: 21%  Break even &amp; loss: 9.4%</td>
</tr>
<tr>
<td>5. Main export product</td>
<td>Shrimp and other seafood</td>
</tr>
<tr>
<td>6. Main export market</td>
<td>Japan, EU and the US</td>
</tr>
<tr>
<td>7. Main problems</td>
<td>Infection hazards in the chain</td>
</tr>
<tr>
<td>8. Main advantages</td>
<td>Support from Fisheries Ministry, VASEP and NAFIQAVED</td>
</tr>
<tr>
<td>9. Main disadvantages</td>
<td>Lack of managerial knowledge, technology and equipment</td>
</tr>
</tbody>
</table>

Source: survey result (Loc, 2002)

(*) According to decree No.91/2001/CP-ND of the Vietnamese government, SMEs "are independent business entities, which have registered their business in accordance with prevailing laws, with registered capital of not more than VND 10 billion or an annual average number of employees of not more than 300 people".
Once the questionnaire has been developed, it is sent to some people in the survey population as a pilot survey (10 pilot questionnaires). Respondents to the pilot survey are quality controllers, deputy of the SFC’s leaders and some teachers of Cantho University who are involved in fisheries quality subjects. The purpose of the pilot survey is to make sure that the questions are clear and easy to answer, and that they add more alternative questions/answers or cancel some unnecessary questions/alternatives in the questionnaire. Then, the questionnaire is adjusted, reproduced and used for the official survey. Primary data and information are collected through direct interviews with the SFCs’ leaders and indirect interviews by sending questionnaires to 32 seafood companies. Primary data and information are also collected from local departments and other institutions/organisations in the twelve provinces of the MD.

3.1.2 Questionnaire contents
Data and information in the study come from interviews with SFCs and their chain stakeholders. The interviews were implemented directly with the SFC leaders and indirectly through a questionnaire for the people who are responsible for the company’s quality control and who are involved in the chain.

The bases for establishing the questionnaire were the research objective, the interview results from ten SFC exploratory interviews in the MD and the research results from 94 SFCs in Ho Chi Minh City, research information requirements (seafood supply chain), literature reviews, and procedures of HACCP and other relevant quality standards. Then the questionnaire was modified for some pilot surveys in order to ensure that every question and its response alternatives were clear to the responder. People interviewed for the pilot survey included teachers who major in quality management and fisheries, leaders and quality controllers in each company. Finally, the research questionnaire was edited and used as the official survey for 32 SFCs in the region.

The research questionnaire contains four parts (see Appendix 1 for details). The first part consists of general information on the interviewee and the company. The information related to the interviewee concerns name, age, sex, function/duty, and level of education. These indicators describe the role, experience and position of the interviewees in the company. Moreover, the questions regarding general information about the SFCs also aim to provide a basic picture of the managerial activities and business operations of the company. This information not only reflects the company itself but also compares the company with other SFCs in the MD. All questions in this section were answered by representatives of the company’s leaders. The second part of the questionnaire was answered by staff members of the company’s quality control department. It focuses on issues related to quality in the shrimp supply chain of the SFCs in the MD. It includes the supplier’s shrimp quality, shrimp
With regard to their business results, most of the SFCs (68.8%) earned over US$2 million, and the remaining 21.9% made between US$1 million and US$2 million profit per year. Major advantages for the SFCs’ business operation were stable raw materials and knowledge of quality control by managers. In contrast, they have also faced many difficulties, such as lack of capital, a low level of investment in processing technology as well as in other investments for improving product quality (e.g., limited application of quality standards – HACCP, ISO, etc.). Moreover, knowledge of quality control is at a high level for managers – they are trained by VASEP in general managerial knowledge, quality control management, international quality control standards, etc.; however employees have not been sufficiently trained so far.

3.2.3 Quality management of the interviewed SFCs

3.2.3.1 Leadership
From the data it can be observed that top management itself has actively participated in QC activities as well as in the improvement of quality control management. Top managers are informed by the quality control staff on relevant quality control issues. They are involved in decision-making on all quality control activities in the company, but they are not included on the quality control team. In addition, empowerment of employees to solve quality control problems is limited, as these are only solved by those directly responsible. Regarding quality and yields, 78.1% of the companies have focused more on product quality than on yields. Other data and information relating to leadership is shown in the following table.

Table 3.2 Leadership related to QM of interviewed companies

<table>
<thead>
<tr>
<th>Statement</th>
<th>% of the answers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Top management actively participates in QM* activities</td>
<td>96.9</td>
</tr>
<tr>
<td>2. Top management learns quality-related concepts and skills</td>
<td>93.7</td>
</tr>
<tr>
<td>3. Top management strongly encourages employee involvement in QM activities</td>
<td>96.9</td>
</tr>
<tr>
<td>4. Top management empowers employees to solve quality problems</td>
<td>75.0</td>
</tr>
<tr>
<td>5. Top management arranges adequate resources for employee education and</td>
<td>93.8</td>
</tr>
<tr>
<td>training</td>
<td></td>
</tr>
<tr>
<td>6. Top management discusses quality-related issues in top management meetings</td>
<td>93.8</td>
</tr>
<tr>
<td>7. Top management focuses on product quality rather than yields</td>
<td>78.1</td>
</tr>
<tr>
<td>8. Top management pursues long-term business success</td>
<td>96.9</td>
</tr>
</tbody>
</table>

Source: survey result (Loc, 2002)

3.2.3.2 Supplier quality management
Approximately 93.8% of the SFCs had established long-term good relations with their suppliers and received feedback on the production of the suppliers’ shrimp. Nevertheless, 25% of them did not regard shrimp quality as the most
important factor in selecting their suppliers – they also considered other relevant factors, such as management, reputation, loyalty, capital, knowledge, as well as awareness. According to the leaders interviewed, the limitations of the SFCs are that they are not informed about the suppliers’ performance in detail and that they do not audit the suppliers’ quality regularly.

3.2.3.3 Quality control and improvement in processing
Almost all SFCs (96.9%) are kept neat and clean. Processing capacity has met production requirements. Production equipment is well maintained according to the maintenance plan and various types of inspections have been effectively implemented (e.g., processing and final products).

3.2.3.4 Quality system improvement
The quality standards that the SFCs followed are GMP (93.8%), SSOP (93.8%), TQM (6.2%), ISO (34.4%), SQF (31.3%), BRC (6.3%), and HACCP (96.9%). The TQM and ISO standards are applied to a few large companies because they have enough finance to cover the costs of implementation, while the BRC standard is still very new for them. Of the answers, 87.5% showed that their quality control systems are continuously being improved. Almost all SFCs have a clear quality control manual (90.7%), clear procedural documents (93.8%) and clear working instructions (93.8%).

3.2.3.5 Employee participation
Of the SFCs, 93.8% have cross-functional teams but only 72% of them have several QC circles (within one function). However, there is only a small percentage of employees who are actively involved in quality control-related activities. Their suggestions are only listened to by mid-level top management because of the employees’ low level of education and knowledge of quality control.

3.2.3.6 Education and training
The interviewees mentioned that their employees were encouraged to seek education and training on quality control management and specific work skills, free of charge. However, only a small percentage of them were trained on how to use quality control management tools because the companies only focus on the managers at each processing point.

3.2.3.7 Customer focus
All of the interviewed companies have had extensive complaint information from customers. Quality control related customer complaints are treated with top priority because of the warranty provided to customers on their products, and so the companies have been customer oriented for a long time. However, the SFCs
could not conduct customer surveys every year or perform market research in order to gather suggestions for product improvement due to a lack of financial means and marketing research experience. They have received customer information from the import companies or agencies in Vietnam who order the shrimp products. As a result, the companies sometimes found themselves in difficulties when satisfying customer demands as to product quality during production and processing because customers seemed to be continuously changing their consumption behaviour.

3.3 The role of the government and industry

Along with the main survey of SFCs in the MD, unstructured interviews of local government agencies (Department of Fisheries, Extension Centre, Department of Agriculture and support organizations (VASEP and NAFIQUAVED) were conducted. According to them, seafood safety and quality in general, and shrimp in particular, cannot be free from hazards without a contribution by government and industry. Because HACCP has not been implemented in primary production, or in other issues regarding seafood supply chain safety and quality, the role of government and industry is vital. The following figure shows the managerial structure and process for the Fisheries Ministry as related to fishery safety and protection. The Department of Science & Technology plays an important role in fishery research, which helps the Ministry of Fisheries to issue suitable policies for sustainable development and environmental protection. In addition, the department provides information and new techniques, including culture techniques, exploitable techniques and processing techniques, to the agricultural departments of local governments. The Department of Fisheries Resource Development and Protection (FRDP) and NAFIQUAVED help the Ministry of Fisheries issue the appropriate policies and regulations regarding food safety and quality management. They also expand and inspect national quality assurance programs at the local government level. Along with NAFIQUAVED, VASEP is also a support organization for SFCs in various ways. Both the roles of management and the support of VASEP and NAFIQUAVED are dealt with in detail in Chapter 1, Section 1.2.1. Generally speaking, the Ministry of Fisheries and local governments together manage the operation of SFCs.

The Ministry of Fisheries is the highest authority for the issuance of all decrees and regulations in the fields of food safety and quality, environmental protection, fisheries resource development and protection, veterinary drug use and production, and training on food safety and quality. At the local government level, the Department of Fisheries is responsible for implementing and expanding the decrees and regulations to other relevant departments, lower management authority, SFCs, and farmers, as well as receiving their feedback.
At the present time, the Vietnamese government continues to encourage and promote appropriate and practical policies and programs for developing the fisheries industry. In other words, the government has implemented programs that are effective for food safety and quality in general and seafood in particular throughout the whole chain. The government also deals with feed production – ingredients in feed must ensure the growth of fisheries in general, and shrimp in particular, free from banned residues. In addition, the inspection of HACCP implementation in the companies should be conducted and audited by the VASEP and NAFIQAVED frequently in order to ensure that the procedures and principles of HACCP and prerequisite programs are applied completely and effectively at the company level (Ministry of Fisheries, 2003).

The role of the government and industry, as well as that of support organizations, will be discussed in detail below for each stage of the chain.

### 3.4 Shrimp supply chain quality issues and resulting discussion in the MD

The shrimp supply chain in the MD as shown in the following figure includes five stages – hatchery, farm/capture, collector/wholesale buyers, the SFCs and distribution. HACCP should have been applied at all stages of the chain, but only the SFCs in the chain have implemented the HACCP, according to the survey results of 32 SFCs in the MD. Other stages of the chain are given support by the Vietnamese government in order to improve and ensure seafood quality and safety. As a result, approximately 38% of the interviewed companies had their products refused by customers due to antibiotic infection (choramphenicol) and other contaminants in 2002. Moreover, in 2003 Vietnam’s seafood had weekly warnings from the US and EU markets due to infection by contaminants.
Regarding hazards which have occurred throughout the chain, 25% of the companies said that their products were infected by microbiological hazards (E.coli, coliform, and salmonella). Similarly, 15.6% and 9.4% answered that the products were infected by chemical (Cloramphenicol and sulffit) and physical hazards (pieces of metal), respectively. More specifically, although the companies have good control over the temperature and the hygiene of the equipment in the shrimp purchasing process, they could not control or audit the level of antibiotic infection or the ice hygiene, although they have good relations with the suppliers. Both the company and suppliers lack equipment to uncover these hazards. In processing, almost all SFCs (96.9%) have controlled those hazards active in shrimp procedures – shrimp material receiving, handling, classification, frame, freeze, ice-plated, metal check, packaging and storage. The following will detail the issues of shrimp supply chain quality in the MD.

### 3.4.1 Hatchery production

Almost all 900 hatcheries in the MD are of small-medium size (two-thirds) and are managed under private ownership (95%). The hatcheries’ activities are simple – low construction and operation costs, and low technical input. The operation is flexible, depending on the season and supply of wild seed. This type of hatchery often has disease and water quality problems, but they are easily and quickly disinfected and re-opened without serious losses. Some hatcheries use large tanks, low stocking densities, and low rates of water exchange. These issues lead to difficulty for governmental support organizations to give helps in
seed quality and safe assurance due to tattered production without control (Sinh, 2002).

According to the research by Sinh (2002), since the beginning of the 1990s shrimp propagation research in the MD has focused on the maturation of P. monodon broodstock, which is considered the bottleneck for shrimp hatcheries and farming in the MD. Artificial P. monodon post larvae were imported from the Central region to overcome this bottleneck. The import of post larvae from the Central region has thus been a major source of shrimp seed for grow-out activities in the region. About 900 hatcheries in the MD provided 3,877 million post larvae, which equals 18.9% of the total demand for shrimp seed purchased by the shrimp grow-out farms in the region. According to the provincial Departments of Fisheries Source Protection, approximately 20%-50% of total shrimp seed sold in the market are inspected at their source for disease. However, the inspection is simple – done visually – so low quality shrimp seed from uncontrolled sources is common in the region. This has affected shrimp yield and quality at the farm (Figure 3.4).

In order to better manage the shrimp seed, there have been several regulations and government policies concerning hatchery development in order to provide high shrimp seed quality and quantity, but these have had minimal effect. For example, regulations for the protection and conservation of natural aquatic sources were issued by the Ministry of Fisheries in 1987. The regulations on the production of shrimp seed and on nurseries for post larvae from PL12 to PL35-45 have been implemented since 1998 (Ministry of Fisheries, 1998). However, the management of post larvae quality and trading has not been improved. A lack of ‘high-tech’ checking methods and facilities is associated with those problems caused by the special transportation network involved (Ministry of Fisheries, 2000-2003).

As a result, policies and regulations set by the government have been changed so as to accept the import of shrimp broodstock and shrimp seed from neighbouring countries. In 2002, a total of 10,919 shrimp broodstock were imported from Singapore, China, Myanmar and Australia. However, 2,668 shrimp died immediately upon reaching Vietnam for various reasons. Import of a diversity of shrimp species is being given consideration along with the import and artificial propagation of Penaeus vanamei. Starting in 2003, the production of about 3 billion post larvae of this species is expected per year, of which 2 billion in the Central Region, and 1 billion in the MD (Ministry of Fisheries, 2003). The demand for shrimp seed may vary for many reasons. The changes in the international market for shrimp products is particularly variable, and the level of intensification of shrimp farm development, as well as the success of both shrimp seed production and breeding activities, can change rapidly over time.
Figure 3.4 Shrimp problems in hatchery and farm productions

1. Hatchery Production
   - Limited equipment & technology
   - Quality of shrimp parents
   - Uncontrolled shrimp seed
   - Diseases
   - Low quality of Post larvae

2. Farm Production
   - Disease
     - Disease Generating Factors
     - Limited farmer’s quality awareness
     - Polluted breeding environment
     - Shrimp feed
     - Chemical residues
     - Use of veterinary
     - Use chemical & other substances
     - Shrimp diseases
     - Chemical & microbiological residues
     - Infection of chemical and microbiological hazards to shrimp materials
The Ministry of Fisheries (2001) explained that at the beginning of 2001, around 110,000 hectares of rice fields were converted into rice-shrimp areas in the coastal provinces of the region, mainly in Ca Mau, Bac Lieu, Soc Trang, and Kien Giang provinces. But shrimp crop losses were observed in 50%-70% of these areas in the first crop of the year with about 3 billion shrimp seed being washed away. This was thought to be a result of the low level of shrimp seed quality and lack of technical skills, in addition to possibly unsuitable conditions in the new ponds. The large increase in the culture areas and the big loss of shrimp seed has raised the demand for shrimp seed. This has increased the risk in shrimp production, since pressure is placed on the quantity and quality of the shrimp seed supplied. At the same time, the development of the shrimp industry is strongly dependent on the quantity and quality of the shrimp seed supplied. Many attempts have been made by different institutions to improve both shrimp seed production and grow-out, but the results are still varied and risky.

In short, the improvement of the quality of larvae depends on the quality and the reproductive capacity of the shrimp broodstock, and on a number of other factors relating to the stocking of broodstock and the rearing of larvae in the shrimp hatcheries. In addition, quality control knowledge and hatchery staff responsibility are still limited. Several methods have been designed to check the quality of post larvae before buying and stocking them into the breeding ponds. Quality testing of post larvae using the Polymerase Chain Reaction Method (the PCR test) has become very important for intensive breeding farms along with the government’s support in management and quality control assurance of shrimp seed.

3.4.2 Farm production

There are three typical practices of shrimp grow-out farming in Vietnam and in the MD (Appendix 5). These three farming systems – extensive, semi-intensive and intensive systems – were applied to 80%, 15% and 5% of the total shrimp culture areas in 1995 (Rosenberry, 1996). The Ministry of Fisheries (2000) showed that these percentages were similar in 2000 – 81.2%, 17.5%, and 1.3%, respectively. Currently, the integration of mangrove-shrimp and rice-shrimp farming, and improved extensive mono shrimp practices are common in the MD.

The farmers who produce shrimp materials to sell to the SFCs include two groups – free farmers (their shrimp sold to the collectors) and fixed farmers (their shrimp bought, where produced, by the SFCs). All farmers are supported by provincial extension centres where farmers can be instructed in shrimp breeding techniques. However, the SFCs cannot ensure the quality of shrimp product from both free and fixed farmers because shrimp quality is affected by many factors beside culture techniques, factors such as shrimp feed, veterinary drugs and environmental hygiene. These issues are not the responsibility of the
extension centres. In contrast, fixed farmers (21.5%) include both the farmers who regularly sell their shrimps independently to the SFCs and the farmers set up by the company. Although bred shrimp from fixed farmers are monitored by extension staff or technicians or both, hazards cannot be completely eliminated from products because the staff/technicians do not check for diseases of shrimp seed, banned residues in shrimp feed and veterinary techniques. In addition, a polluted breeding environment and farmers who have only a limited awareness of quality control are major factors which cause chemical hazards in shrimp materials either directly or indirectly (Figure 3.4).

Shrimp disease outbreaks in the MD have been occurring since the end of 1993, due to many factors. The main causes are lack of suitable planning; low levels of technical and farm management knowledge; degradation of the environment, especially water quality and deforestation of the mangrove forest; and a poor supply of shrimp seed in terms of both quantity and quality. For the period 1994-1999, only 20-30% of farms were successful in shrimp culture (Truong and Tham, 1996; Ministry of Fisheries, 1995, 1997, 1999 and 2000; Sinh and Binh, 1996). We remind that at the beginning of 2001, about 110,000 hectares of rice fields in Soc Trang, Bac Lieu and Ca Mau provinces were converted into rice-shrimp areas, but 50-70% of these areas lost the first crop of the year. Shrimp production has become a sector with high levels of risk. In order to obtain more satisfactory outcomes, a number of things need to be improved, especially a better supply of shrimp seed in terms of quantity, quality, and the timing of supply. Many experiments have been conducted, including studies on the diversity of species, but the results have not been clear and production remains risky. In 2002, diseases occurred on 74,128 hectares, accounting for 27.6% of the total cultured areas (Ministry of Fisheries, 2001-2003). As a result, lots of different antibiotic and other medicines used have affected the quality of raw shrimp materials.

In addition, in recent years the Vietnamese government has played an important role in encouraging and promoting quality control in seafood products, from primary production to distribution. In primary production, the government has issued a great many policy directives and regulations related to fisheries safety and hygiene, environmental protection, fisheries development in terms of development of culture areas, the level of antibiotic usage, as well as veterinary drugs and other medicines for fishery safety. However, the effectiveness of these policies and regulations has not been evaluated at a high level because the implementation of policies and governmental programs by local governments is not being synchronously monitored by the Department of Fisheries, Department of Agriculture and Rural Development throughout the provinces of the MD. Nowadays, the role of extension training is very important in the field of support for farmers in breeding techniques, protection of the breeding environment, even in propagation of the government’s policies and decrees as related to fishery
safety and sustainable development, and implementation of instructions. Nevertheless, demand for extension staff in the MD now exceeds supply in terms of quantity and quality. At present, the number of experienced staff is very limited, and this does not meet the requirements for fishery development.

According to the opinions of interviewees, their business success has so far resulted from good quality control and stable sources of shrimp materials – from fixed agents and farmers (93.8%) and from their own investment (46.9%). Nowadays, some large SFCs use their capital to invest in shrimp or fish breeding for farmers. In addition, they also participate in quality control management by providing technicians to observe and control as well as guide the farmers on how to manage the quality of shrimp materials. However, approximately 38% of the interviewed companies had products that were refused by customers due to antibiotic infection (choramphenicol) and other contaminants.

3.4.3 Catching activities
Regarding the marine catch of fisheries, after a period of rapid growth in the late 1980s and early 1990s, the fishing industry experienced a downturn due to sagging efficiency: the yield of fishing boats, which was on average 0.92 ton/horsepower in 1990, fell to 0.62 ton/horsepower. This was due to objective factors (inshore fishing has exceeded the norm of permissible catch by 10%) and subjective factors (backward machinery and equipment, lack of means and experience in high sea fishing, poor qualifications of the work force). In recent years, all offshore fishermen have been supported by a loan concessionary policy for equipment and boat investment in order to increase productivity but the loan amount is still limited. Also, the offshore fishermen lack the techniques and equipment for the storage of raw materials. More specifically, although offshore shrimp materials are seldom infected by hazards, storage techniques and equipment, lack of quality control knowledge, as well as a long storage time offshore (about 7 days), are the main factors affecting shrimp materials.

3.4.4 Collector/Wholesale buyer
According to the survey of SFCs, approximately 61.8% of the input shrimp materials of the SFCs are bought from collectors. Collectors’ activities are simple – buying, storing and transporting shrimp for the SFCs (which takes a maximum 3 days), but they are the ones affecting shrimp quality according to the SFC leaders interviewed. Capital, maintenance techniques and means are the main factors in the collectors’ activities. Collectors’ capital used to buy shrimp materials comes from three sources – from collectors themselves, from loans and from the SFCs. Some SFCs can provide money in advance to collectors in order to buy shrimp materials (one of the methods for ensuring collectors’ loyalty to the companies). In addition, the supplier’s own conditions themselves are limited – lack of capital, quality awareness and equipment for inspecting and maintaining shrimp materials, as well as low educational levels in understanding
and applying quality control knowledge. In particular, they do not understand the importance of quality control in final products traded in the world market. They have even used banned chemicals and other substances in maintaining shrimp materials before selling them to the SFCs (Figure 3.5). Regarding the inspection of shrimp input, both the company and the collectors only use visual controls to inspect shrimp materials, which are of course, an insufficient means for uncovering hazards. According to interviewed SFCs, they were most concerned with the quality requirements of shrimp materials because approximately 56.3% of the total shrimp materials was assessed as being of good quality, and this was thanks to a good supply of shrimp.

The collectors themselves are the main factor affecting the quality of shrimp. They inject chemical substances, edible seaweed, shrimp meat or nails to add to shrimp size and weight before transporting them to the companies. In addition, there is intense competition in buying raw shrimp in the MD for the supply of raw shrimp to the SFCs in the region and outside the region. In point of fact, SFCs in the MD themselves have used various policies to safeguard collector’s loyalty and shrimp quality, especially by promoting a pricing policy and advance payment. Therefore, in order to improve the collector’s shrimp quality, the SFCs play a very important role in terms of instruction in maintenance techniques, quality control awareness, even participating in the collector’s own operations in terms of auditing and inspecting shrimp material. Also, it is necessary to maintain support from the government, both for loan service and in implementing severe punishment for collectors who cheat.

In short, nobody (the government, the extension centre, the farmers, the collectors or the companies) can ensure 100% quality in shrimp materials, keeping them free from the disease, hazards and other contaminants, when even shrimp controlled strictly by the company fall short due to uncontrollable hazards from shrimp seed, feed and veterinary drug use.
Figure 3.5 Shrimp problems at the collector/wholesale buyer stage
3.4.5 Manufacturing process

Generally speaking, the companies did not satisfy quality requirements for shrimp materials. On the one hand, this was due to the fact that their plants are located far from the sources of shrimp materials. On the other hand, there are not enough control conditions set up for quality control of shrimp materials. The SFCs realized that the quality of shrimp materials is a very important factor that affects the quality of the finished product. In addition, a company’s reputation in terms of business success and flexible policies on price (43.8%), and quick payment (50%) are important elements that the SFCs use to maintain suppliers’ loyalty. Moreover, almost all SFCs in the MD have to compete fiercely in buying shrimp materials with both internal and external SFCs in the region (93.8%). As a result, uncontrolled shrimp materials are still being regularly distributed in the MD.

During the shrimp processing procedure, hazards can occur at any stage from receiving input shrimp to the distribution phase. According to the interviewees, the factors that affected the final shrimp quality in processes are (1) quality of shrimp materials (81.3%); (2) storage process (50%); (3) processing technology (56.3%); (4) processing techniques (68.6%) and (5) inventory time of finished products (53.1%). To keep final shrimp products free from hazards and to ensure hygiene, safety and quality, HACCP procedures and principles are a crucial tool. At present, the SFCs in the MD have implemented prerequisite programs before applying the HACCP, such as GMP and SSOP, as well as other methods related to initial changes in management and human resources, needing to be adapted to their specific conditions. However, according to the survey results, although 96.9% of the SFCs applied the procedures and principles of HACCP, they have not been completely implemented inside the company. The reasons for this are a lack of capital to invest in modern technology and testing equipment; a lack of experts or specialists with high capabilities and skills in quality management, supply chain management and statistical knowledge; the low level of employee quality control awareness; and the intransigence of quality control behavior. Also, as we have seen other international standards have hardly been applied at all – only 6.2%, 34.4%, 31.3% and 6.3% for application of TQM, ISO, SQF and BRC, respectively. As a result, final shrimp products are still not completely free from hazards (Figure 3.6).
Figure 3.6 Shrimp problems in the manufacturing process

The Seafood Companies

- Lack of testing equipment
- Processing techniques
  - Unsure ice hygiene
  - Factory hygiene
  - Personal hygiene
  - Long processing time
  - Use of disinfectants
- Limited quality management
- Backward technology
- Unsure storage conditions

- Uncontrolled shrimp materials
- Physical hazards
- Long processing time
- Microbiological hazards

Infection of chemical, physical and microbiological hazards to final shrimp products
Almost all companies in the MD (96.9%) have established an HACCP team. Adapted to the organizational structure of each company, each team includes a quality control specialist (78.1%), a production specialist (71.9%), an engineer (71.9%), a member of the management (43.8%), and one other specialist (buyers, operators, packaging experts, distribution experts, or hygiene managers). It is the responsibility of the team to describe the product and its distribution, elements such as the composition and physical features of the final product (87.5%), processing information (production methods used – 81.3%), method of packaging (78.1%), required shelf life (87.5%), storage and distribution conditions along the chain (81.3%), legislative product requirements (71.9%), and instructions for use and storage by consumers (68.8%). In addition, 87.5% of the companies have developed process flow diagrams.

Table 3.3 shows indicators regarding setting flow diagrams conducted by SFCs. This result indicates that SFCs in the MD have not sufficiently implemented data collection and saved enough of it in order to develop process flow diagrams. On the one hand, the statistical knowledge of the staff is limited. On the other hand, the development of process flow diagrams in some cases, according to HACCP managers, is not deemed necessary.

<table>
<thead>
<tr>
<th>Indicators</th>
<th>(%) of SFCs applied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All raw materials/ingredients and packaging used</td>
<td>65.6</td>
</tr>
<tr>
<td>2. Time/temperature history of the chain</td>
<td>71.9</td>
</tr>
<tr>
<td>3. Process conditions</td>
<td>68.8</td>
</tr>
<tr>
<td>4. Storage and distribution conditions</td>
<td>68.8</td>
</tr>
<tr>
<td>5. Product loops for recycling or rework</td>
<td>37.5</td>
</tr>
<tr>
<td>6. Routes of potential cross-contamination</td>
<td>62.5</td>
</tr>
<tr>
<td>7. High/low risk area segregation</td>
<td>62.5</td>
</tr>
<tr>
<td>8. Overview of floors and a layout of equipment</td>
<td>62.5</td>
</tr>
<tr>
<td>9. Features of equipment design</td>
<td>46.9</td>
</tr>
<tr>
<td>10. Efficacy of cleaning and disinfection procedures</td>
<td>65.6</td>
</tr>
<tr>
<td>11. Personal hygiene practices</td>
<td>75.0</td>
</tr>
<tr>
<td>12. Consumer-use instructions</td>
<td>65.6</td>
</tr>
<tr>
<td>13. Inspected the process and verified the flow diagrams</td>
<td>87.5</td>
</tr>
</tbody>
</table>

Source: Survey result (Loc, 2002; Appendices 6 & 7)
Regarding Critical Control Points (CCPs) mentioned in Table 3.4, only 71.9% of the SFCs use the CCP to check input shrimp materials, 59.4% concentrate on shrimp processing, and 56.3% on the packaging process. The reasons for determining CCPs are that hazards have often occurred during these processes. In addition, the companies have also established critical limits for these CCPs – 71.9% of the SFCs have established critical limits to control microbiological hazards, similarly, 84.4% and 81.3% for chemical and physical limits, respectively. In point of fact, the companies have very simple procedures for monitoring critical limits – they do not have clear procedures as to “what to monitor, why to monitor, how to monitor, where to monitor, who monitors, and when to monitor?” Moreover, the procedure is most often managed by one quality control head who cannot observe the whole process at the same time. As a result, corrective actions after monitoring were only concentrated on a few of the main processes.

Table 3.4 The percentage of SFCs that have established CCPs

<table>
<thead>
<tr>
<th>Contents</th>
<th>% of SFCs that determined CCPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Purchase of raw materials</td>
<td>71.9</td>
</tr>
<tr>
<td>2. Shrimp material receiving and handling</td>
<td>43.8</td>
</tr>
<tr>
<td>3. Shrimp processing</td>
<td>59.4</td>
</tr>
<tr>
<td>4. Packaging</td>
<td>56.3</td>
</tr>
<tr>
<td>5. Storage</td>
<td>18.8</td>
</tr>
<tr>
<td>6. Distribution</td>
<td>3.10</td>
</tr>
</tbody>
</table>

Source: Survey result (Loc, 2002)

In addition, most of the interviewed companies have in fact established effective record-keeping systems, such as CCP records (96.9%), critical limit records (96.9%), records associated with deviations (90.6%), records and verification (100%), records review and retention (90.6%), and regulatory access (93.8%). The extent to which the HACCP system was working correctly depended very much on the conditions in each company. The results of the interviews showed that 81.3% of the SFCs have applied some prevention procedure, CCP verification (87.5%), and HACCP program verification (87.5%).
3.4.6 Distribution stage

As far as quality control in distribution is concerned, the company can only implement quality assurance in the storage and transportation stages in the chain inside the company because these can be managed and controlled directly by the company itself. However, storage conditions are generally not strong or safe enough to keep up with the quantity and quality (temperature, old warehouses and technology) of the products. According to the primary data, the quality of shrimp final products was affected by storage conditions (50%), inventory time (53.1%), and transportation conditions (40.6%) (Figure 3.7). Other stages, such as selling and receiving orders, transportation and storage outside the company, buying and consumer usage, have not been handled by the company as they lay beyond the company’s control. Moreover, so far the company only gets customer complaints from external foreign agencies, and not from market information and analysis.

As in other stages of the chain, during the distribution process the government has provided support by acting as interlocutor to help the SFCs with troubles related to customs formalities, as well as giving the SFCs’ one voice in import market problems regarding quality standard levels, product label, and product devaluation. But the effectiveness of this support is still limited because of the companies’ lack of knowledge and experience in international business negotiation and business conflict cases.
Figure 3.7 Shrimp problems in Distribution stage

- Storage conditions:
  - temperature
  - old warehouse
  - warehouse hygiene
  - storage time
  - backward technology

- Transportation conditions:
  - temperature
  - transportation means
  - hygiene of the means
  - transportation time

- Infection of microbiological hazard to shrimp materials

- Infection of chemical, physical and microbiological hazards to final shrimp products
3.5 The supply chain deficiencies in shrimp quality assurance

At the company level, the survey results showed some supply chain deficiencies (D) in quality assurance that affect final shrimp products (Figure 3.8). As for the first deficiency, SFC management has no influence on hatchery management, hence it cannot participate in any quality control of shrimp seed supplied to the farmers. The quality of shrimp seed completely depends on conditions within the hatcheries themselves and on State regulations and management including NAFIQAVED support on testing shrimp seed quality. Deficiency 1 cannot be solved by the SFCs at present or in the near future because of managerial and technological conditions.

In addition, the SFCs cannot control the quality of shrimp materials delivered from the farmers to the company via the collectors/wholesale buyers because it would take too much time and expense to control such vast areas of shrimp culture. Moreover, the companies cannot manage breeding techniques at the farmer level and feed quality at the feed wholesaler level.

Deficiency 2: wholesale buyers/collectors themselves do not have optimal conditions in the fields of quality and technical knowledge, or sufficient capital to help the farmers guarantee shrimp quality. So far, the companies have not put any effort into stimulating wholesale buyers/collectors to improve their shrimp materials. Deficiency 2 affects the quality of shrimp materials outside the company the most because most of the shrimp materials are sold to the SFCs through this channel.

Deficiency 3: although the companies can partly participate in quality assurance of shrimp materials at the farmer level when the company invests in the farm, they cannot also manage the farmer’s feed quality and veterinary drugs used during breeding time.
Deficiency 4: The SFC only has knowledge of customer information and requirements from import companies and agencies or from other companies or from common communication sources, such as websites, magazines and newspapers. The specific indicators on technical barriers to trade and sanitation performance standards are very strict in international business. Moreover, import nations always use modern equipment to inspect and discover hazards from seafood products in the lowest level, while the SFCs and NAFIQAVED are unable to eliminate those hazards before export, due to an incomplete program of quality assurance (e.g. HACCP application) and modern equipment shortage.

Generally speaking, to correct shrimp supply chain deficiencies it is necessary to enhance the role of the government in State management of quality, hygiene, veterinary drugs and feed in fishery production, as well as the role of organization and management within the hatcheries themselves. Likewise, it is necessary to enhance the support of VASEP and NAFIQAVED in quality training, inspection and international negotiation.

Moreover, emphasizing the role and responsibilities of the SFCs in the domain of quality improvement not only within the companies (manufacturing process) themselves, but also with their suppliers through supplier quality management is very important. The SFCs should establish a bridge between their quality requirements and the activities of their chain stakeholders, as well as with local governments (provincial agricultural departments). The SFCs and local governments should join forces to guarantee shrimp quality and improve quality throughout the whole chain. In addition, the companies need to enhance quality improvement and assurance (the HACCP programs) inside the company, in addition to making technological improvements, enhancing managerial knowledge and skills, as well as improving organizational behaviour in quality control.

Briefly, although the SFCs are supported by the government in terms of priority for capital loans to invest in modern processing technology and equipment, along with VASEP and NAFIQAVED support in quality education and training, market information and inspection of final products before exporting, the SFCs are still getting their information on hazard infection after the fact from import markets like EU and the US. In reality, along with support from the government the SFCs need to implement and follow HACCP programs as well as other standards in order to improve their final products just in order to meet market requirements and expectations. However, the HACCP standard cannot be applied at the primary production and supplier level in the MD any time soon due to limiting conditions in companies, suppliers and farmers themselves. The company is only able to use appropriate policies and knowledge of supplier quality management in order to encourage and promote supplier loyalty and quality assurance. Similarly, the SFCs are unable in the next few years to
manage and control the distribution stage from port to consumer due to the
companies’ limited expertise in market research, and due to the fact that
agencies are responsible for the distribution of the products to end customers.

3.6 Summary

The present chapter summarizes the survey procedure and results of the SFC
status quo in the MD. They comprise the supply chain seafood problems in
general and shrimp product in particular, from hatchery production to
distribution, quality management and HACCP implementation in the SFCs, and
the role of government and industry in ensuring food safety and quality. All data
and information compiled were collected by structured/unstructured interviews
and the questionnaire. This data and information are one of the main bases for
developing a seafood supply chain quality control management framework. The
next chapter will introduce the framework for improving and assuring safety and
quality in the seafood in general and shrimp supply chain in the MD in
particular.