Processed seafood and mariculture value chain analysis and upgrading strategy

Myeik, Palaw and Kyunsu townships, Tanintharyi Region

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International Labour Organisation, Myanmar

Norad

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Contents

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The research design was developed by ILO Technical Officer, Jonathan Bird; with input from Lead Consultant, Ansen Ward. Data collection and analysis was carried out by the Lead Consultant, Ansen Ward; ILO Technical Officer, Jonathan Bird; Fisheries Development Consultant, U Khin Maung Aye; Food Safety Consultant, Daw Win Win Kyi; and ILO Research Assistant, Htet Aung Myo. This report was prepared by Ansen Ward and Jonathan Bird.

Abbreviations

ASEAN	Association of Southeast Asian Nations
CPUE	Catch per unit effort
DOF	Department of Fisheries
EU	European Union
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
FFI	Flora and Fauna International
GHP	Good Hygienic Practice
ILO	International Labour Office
IUCN	International Union for the Conservation of Nature
MDFF	Myeik District Fisheries Federation
MFF	Myanmar Fisheries Federation
MSG	Monosodium glutamate
SME	Small medium enterprise
SWOT	Strengths Weaknesses Opportunities Threats
UNDP	United Nations Development Programme
VC	Value chain
VCA	Value chain analysis
VISS	Unit of measurement equivalent to 1.6kg
WCS	World Conservation Society

Executive Summary

In 2014, the ILO initiated two projects to support entrepreneurship and MSME development in Myanmar. One is funded by SECO and focuses on the tourism sector. The other is funded by NORAD and is cross-sectoral. Together, these projects expect to contribute to the start-up of 1,000 enterprises and the creation of 3,800 jobs. As part of the NORAD-funded work, the project planned to carry out value chain analyses to identify current constraints for MSMEs and opportunities for MSME upgrading in value chains with high potential. In May 2016, a consultant reviewed potential value chains and geographical areas the project could focus on. The consultant recommended that value chains in the fisheries sector in Tanintharyi Region should be explored in more detail. In November 2016, a value chain analysis team then carried out a mission in and around Myeik to select value chains with high potential for MSME growth, to analyse these value chains and to produce strategies for the upgrading of each value chain. The key findings are summarised below. It should be noted that the Myeik component of the analysis only focused on SMEs and does not include analysis of larger processed seafood companies operating in this area.

Processed seafood value chains

Three processed seafood value chains were analysed: shrimp paste, dried shrimp and dried fish. While there are differences between the value chains, the key findings were similar and are summarized together for all three chains below.

Market opportunities

In the short to medium-term, domestic markets were deemed more realistic for processed seafood SMEs to access. The research identified two domestic markets with particularly high potential:

Supermarkets and chain-minimarts

The network of supermarkets and chain-minimarts is expanding rapidly across Myanmar. They are recommended as a target market because they want to buy high quality, packaged and labelled products, which attract higher prices than those for bulk products sold to wholesalers.

Yangon value-added processors

These companies purchase processed seafood and carry out additional processing, then package, label and sell to retailers. They are attractive because they can buy large volumes and some are willing to pay higher prices for products which meet quality and food safety standards.

Upgrading strategies

Access new markets

The majority of processed seafood products in the target value chains are being sold in bulk at relatively low prices to wholesale traders in Bayint Naung market in Yangon. It is proposed that Myeik actors target two new markets. Firstly, Yangon value-added processors, who are willing to pay more for higher quality products. Secondly, sell packaged and labelled products to high value retailers, such as supermarkets and chain-minimarts

Capitalise on the reputation of Myeik processed seafood products

Processed seafood from Myeik, particularly shrimp paste, has a reputation for quality, but at present most products coming from Myeik do not specify their origin. Labelling products as originating from Myeik would help make this clear to the consumer and would promote Myeik as a distinct brand.

Sell packaged and labelled products

It is proposed that more processors in Myeik sell packaged and labelled products. Combined with accessing new markets, would allow Myeik actors to capture more value from the same raw material.

Develop new products

It is also recommended that SMEs diversify into producing new products. In particular, ngapi daung - a ready made shrimp, garlic and chilli paste - is highlighted as a product with high potential.

Improve quality and food safety standards

If SMEs are to access higher value markets, they will need to meet food safety standards and gain FDA approval for their products. In addition, research should be carried out on low-cost options for drying and processing machinery that can improve the quality of products.

Sustainable management of fisheries

To ensure the sustainability of processed seafood production, it is crucial that fisheries are managed effectively.

Improve business management skills

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new market channels.

Increase access to finance

Access to affordable finance will be required for SMEs to upgrade processing activities, produce value-added products and access new markets.

Mariculture

Two processed seafood value chains were analysed: barramundi and blood cockle. While there are differences between the value chains, the key findings were similar and are summarized together for both chains below.

Market opportunities

Barramundi

There are significant export markets for Barramundi. In particular, Australia, Indonesia, Thailand and China present major opportunities.

Blood cockle

There is a strong market for blood cockle in Thailand, which Myeik actors already have access to. Other Asian markets such as China, Indonesia and Malaysia, also present major opportunities.

Upgrading strategies

Sustainable expansion of production

In the face of declining catches per unit effort from wild capture, mariculture could offer an alternative source of supply to wild capture and could help reduce overall fishing effort in Tanintharyi region. There are also strong domestic and export markets for barramundi and blood cockle, yet production is limited at present. With this in mind, it is proposed that production is increased. In the case of barramundi, an increase in the capacity of hatcheries is crucial in order to enable the expansion of cage culture. To ensure expansion is sustainable, it is important that potential negative impacts are assessed and that management strategies are put in place to reduce these impacts.

Research about production practices and mitigation of negative impacts of production

To optimise the efficiency of production, it is critical that a rigorous and locally-relevant knowledge-base is developed. This should include research on relevant aspects of production at both the hatchery and farm level. In addition, to minimise the risks involved in the expansion of production, research should be carried out to assess potential and actual negative impacts of mariculture activities. Increasing the capacity of local researchers to carry out this research would be highly advisable, in order to ensure its sustainability.

Development of production input markets and advisory service providers

Various types of input are essential for effective and efficient production at farm and hatchery level. Currently, the majority of inputs, such as feeds and artemia, are expensive and need to be purchased in Thailand. Developing low cost local distribution of these inputs would make production more efficient. Likewise, advisory services need to be improved, to enable potential farmers to learn the production practices required to start cage culture and to ensure that best practice is adopted by new and existing farmers.

Cost-saving opportunities for barramundi hatcheries

Energy costs at hatchery level are significant and there is a reliance on diesel generators. Identifying appropriate solar technologies and other ways of reducing diesel costs will increase the profitability of these operations and may help increase the rate of their expansion.

Access new markets and consider certification options

There are many export markets that are interested in purchasing barramundi and blood cockle. Further research is necessary to identify specific buyers and their requirements. Certification to standards, such as Global GAP Aquaculture, should also be considered.

Develop processing

There are five large processor-exporter companies in Myeik. If appropriate markets exist, there could be opportunities for processing barramundi into other product formats, such as gutted, filleted and skinless. Opportunities for SMEs to produce these formats should also be explored.

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new markets.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce new products and access new markets.

Introduction

In 2014, the ILO initiated two projects to support entrepreneurship and MSME development in Myanmar. One is funded by SECO and focuses on the tourism sector. The other is funded by NORAD and is cross-sectoral. Together, these projects expect to contribute to the start-up of 1,000 enterprises and the creation of 3,800 jobs. As part of the NORAD-funded work, the project planned to carry out value chain analyses to identify current constraints for MSMEs and opportunities for MSME upgrading in value chains with high potential. In May 2016, a consultant reviewed potential value chains and geographical areas the project could focus on. The consultant recommended that value chains in the fisheries sector in Tanintharyi Region should be explored in more detail.

In November 2016, a value chain analysis team then carried out a mission in and around Myeik to select value chains with high potential for MSME growth, to analyse these value chains and to produce strategies for the upgrading of each value chain. This report presents the findings from the research. It focused on five selected value chains: shrimp paste, dried shrimp, dried fish, barramundi and blood cockle. For each value chain, it presents an analysis of the value chain, followed by a proposed upgrading strategy.

Approach and methodology

The field research was conducted by a team of 4 specialists with expertise in fisheries development, Myanmar fisheries, value-chain development, SME development and food safety. The approach taken to the analysis included three main research activities: secondary data review; primary data collection using focus groups and semi-structured interviews; and a validation and planning workshop. It should be noted that the Myeik component of the analysis only focused on SMEs and does not include analysis of larger processed seafood companies operating in this area.

1. Secondary data review

A review of available secondary sources of information was undertaken as part of the preparation process. The data sources came from the internet, the ILO value-chain analysis team and key stakeholders met during the primary data collection process.

2. Primary data collection

A research framework and work-plan were developed in advance of the mission by the ILO Technical Officer and the consultant. The framework was used to identify and plan the primary data collection activities. Primary research was then carried out on a mission which took place from 31st October 2016 to 19th November 2016. Focus group and key informant semi-structured interviews were undertaken in Yangon, Myeik city and islands on the Myeik archipelago. A summary of actors interviewed is provided below:

Yangon

- Federations and associations: Myanmar Fisheries Federation; Myanmar Fish Paste, Dried Fish, Fish Sauce Entrepreneurs Association; Food Science and Technology Association; Food and Drug Administration (interviewed shortly before the mission)
- Wholesale traders at Bayint Naung
- Retailers: supermarkets, minimarts and retailers at traditional dry markets
- Projects: Myanmar Trade Development Programme, World Fish

Myeik city

- Government: SME Development Department, Department of fisheries
- Federations and associations: Myeik District Fisheries Federation, Squid Fishers Association
- Research: Myeik University
- Projects: Tanintharyi Regional Fisheries Partnership, Our Futures Initiative
- Barramundi hatchery management staff
- Souvenir shop owners
- Packaging and printing companies
- Collectors of shrimp paste, dried shrimp, dried fish and blood cockle

Myeik archipelago

- Primary data collection was carried out in 2 villages in Palaw (Shat Pone and Kyauk Kar villages) and 5 villages in Kyunsu township (Lin Ma Lo, Pan Zin, Sa Khan Htit, Kan Maw, Yae Kan Taung)
- Focus groups were carried out with mixed groups of fishers; fish and blood cockle farmers; shrimp paste, dried shrimp, dried fish processors; collectors of shrimp paste, dried shrimp, dried fish and blood cockle
- Further interviews and site visits were carried out in the villages, to observe fishing and fish farming gear, processing units and collection sites

Where relevant, insights from the ILO's previous work in the fisheries sector in Tanintharyi Region were also used as input for the analysis.

3. Analysis and drafting of the upgrading strategy

The information from the research process was analysed by the research team on an ongoing basis and the team held a day-long meeting on the 14th November to consolidate the analysis draft the upgrading strategies for each value chain

4. Validation and planning workshop

The analysis and upgrading strategies were then presented to private sector stakeholders from the relevant value chains at a workshop in Myeik on 16th November. During the workshop, focus group discussions were held where the participants discussed the validity of the analysis presented and the feasibility of the upgrading strategies, and then presented feedback and changes to both. The feedback at the workshop indicated that the core findings of the analysis and proposed upgrading strategies were broadly in line with participants' own understandings and aspirations, and several changes were also suggested.

Presentation of results in this report

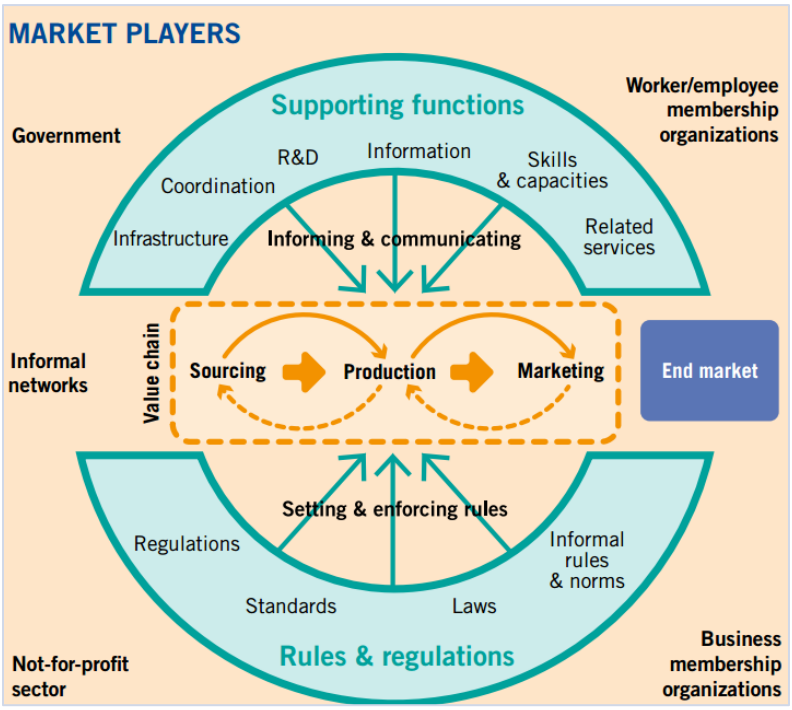
The findings in this report are presented in accordance with the M4P framework's categorisation of the key components of market systems. These are:

- **Core value chain**: "the full range of activities that are required to bring a product or service from conception, through the intermediary phases of production and delivery to final consumers, and final disposal after use"[1]. This includes activities such as design, production, marketing, distribution and support services up to the final consumer.
- **Supporting functions:** these include infrastructure, financial services and skills training, among others. The presence of these functions can improve the performance of actors in the core value chain. Equally, the underperformance of the chain can often be traced back to a lack of, or weaknesses in, these functions
- **Rules**: These include labour legislation, regulations at all levels of government, quality standards and government policies. They also include informal norms and values, which are the customary rules of behaviour

[1] Kaplinski & Morris:

that shape interactions and ideas about what is good, right, fair and just. These may be explicit or implicit. Absent or inadequate rules or poor enforcement can reduce the performance of a value chain.

Figure 1: the market system, including the value chain[2]



[2] Adapted from The Springfield Centre (2004) Operational Guide to Making Markets Work for the Poor

Value-chain analysis

This section of the report presents the findings of the value chain analysis for three related processed seafood value-chains - shrimp paste, dried shrimp and dried fish- as well as two mariculture value chains - barramundi and blood cockle. Information on the products, markets, value-chains, supporting functions and rules are presented, followed by proposed upgrading strategies for each value chain.

Shrimp paste (Ngapi)

Product description

Shrimp paste, or Ngapi[3] in Myanmar language, is usually made by fermenting shrimp that is salted, ground and sun dried. Many variations exist. Several different types of shrimp species are used depending on the local availability. These include *Mysid spp.* and *Acetes spp.* of shrimp. The type of shrimp is known to influence the final product colour. In the study areas, shrimp of *Mysid spp.* were reported to be the predominant species used.

Figure 2: Shrimp paste

In Myanmar, raw shrimp paste is not intended for direct consumption, but is a cooking ingredient, used as a condiment or additive in many dishes. Shrimp paste made from marine shrimp provides a source of iodine, which is likely to be beneficial for inland consumers whose diet may be iodine-deficient and who do not have access to iodized salt. The high salt content and the fact that the product is semi-dried enable it to be stored and remain edible for long periods of time, which aids its distribution and availability throughout the year. Storing is also said to enhance the flavour of the final product, rather like a maturing process.

Market analysis

Shrimp paste is consumed extensively in Myanmar, India, Bangladesh, Indonesia, Laos, Malaysia, Singapore, Southern China, Thailand, Vietnam and the Philippines (Needham and Funge-Smith, 2015[4]). There is also a small, but growing number of consumers in the US and Europe. All these countries have their own preferences in relation to product characteristics. It should also be noted that some countries have significant Myanmar expatriate populations that share preferences with Myanmar consumers.

[3] In Myanmar language, Ngapi is a generic term for pungent pastes made of either fish or shrimp. Though this value chain analysis focuses solely on shrimp paste.

[4] Needham, S. and Funge-Smith, S. J. (2015). The consumption of fish and fish products in the Asia-Pacific region based on household surveys. *Bangkok, FAO Regional Office for Asia and the Pacific*.

At present, the shrimp paste produced in Tanintharyi Region is not able to meet the standards required for export to other countries in the ASEAN region and beyond. Collectors in Myeik reported that in the past they had exported shrimp paste to Thailand, but that Thai buyers had stopped purchasing because the products do not meet required standards. It should also be noted that formal export markets will require the standard documentation for food products such as sanitary certificate and certification of the producer by the FDA. Furthermore, the potential for official exports is thought to restricted at the moment by a lack of FDA certified producers and the lack of recognition of the Myanmar FDA by some potential import countries, such as Singapore and Malaysia.

Bearing in mind the current low capacity of shrimp paste processors in Tanintharyi Region, the value chain analysis team recommend that accessing higher value markets within Myanmar would be a logical first step, rather than attempting to export immediately. As such, the remainder of this section focuses on analysing the domestic market. If processors in Tanintharyi manage to access higher value domestic markets and have an interest to find additional markets, then as a second step it would be useful to carry out a detailed analysis of export markets.

Analysis of overall domestic demand and supply

Demand

Average consumption of shrimp paste in Myanmar is 1.6 Kg per capita per year (Needham and Funge-Smith, 2015). Given a population of 54,000,000, estimated total consumption in Myanmar is approximately 88,714 tonnes per year. Demand is likely to remain strong for shrimp paste due to the fact that shrimp paste is a well-established traditional component of the Myanmar diet and the population is increasing (0.87% per annum). Furthermore, if increases in the population of middle class consumers continue, per capita consumption may also increase. Some predictions have estimated that Myanmar's 'consuming class' may grow from 2.5 million in 2010 to 19 million by 2030 and consumer spending could triple from USD 34bn to USD 98bn by 2030 (Chhor *et al*., 2013[5]).

Shrimp paste is consumed across all states and regions of Myanmar. Shrimp paste from Myeik has a reputation for being better quality and is more expensive than shrimp paste from other areas of Myanmar. For example, selling price at Bayint Naung wholesale market in Yangon for Myeik shrimp paste in November 2016 was 1,500-2,800 Kyats/viss (0.72-1.35 USD/Kg), whereas the price for shrimp paste from Ayeyarwaddy region was 500-700 Kyat/viss (0.24-0.34 USD/Kg). As such, it is probable that low income households have lower demand for Myeik shrimp paste, due its higher price.

Supply and competition

Shrimp paste is produced in a number of coastal areas in Myanmar, including the Ayeyarwaddy Delta area, as well as Tanintharyi Region. Production of shrimp paste is seasonal, with most production taking place from November to May. Production during the rainy season is greatly reduced and processing is difficult due to the unfavourable drying conditions. Although no concrete data was identified, all communities in the study area reported that catches of the shrimp species used in shrimp paste production have significantly reduced in the last 5 years.

The total supply to domestic consumers is not fully known. Given that there are limited imports and exports of shrimp paste, it is likely to be broadly similar to the 88,714 tonnes consumed, which is highlighted in the estimate above. There are no clear figures for the exact volume produced in Myeik.

As mentioned above in the section on demand, shrimp paste from Myeik has a reputation for being better quality and is more expensive than shrimp paste from other areas of Myanmar. Research identified very limited types and volumes of shrimp paste from other countries for sale in Myanmar. Those types which were identified were mainly Thai shrimp paste products which are 'ready-mixed' with various spices and other ingredients and these were only identified in high-end supermarkets.

[5] Chhor, H., Dobbs, R., Hansen, D.N., Thompson, F., Shah, N. and Streiff, L. (2013). Myanmar's moment: Unique opportunities, major challenges. McKinsey Global Institute, June. http://www. mckinsey. com/insights/asia-pacific/myanmars_moment.

Analysis of domestic markets

This research identified three major existing and potential domestic markets for shrimp paste produced in Myeik: Yangon value-added processors; wet markets/home shops; supermarkets and mini marts. In addition, hotels, restaurants and souvenir shops provide further niche markets. Each have different consumers, requirements and likely trends for the future. These are presented below.

Yangon value-added processors

The scale and level of sophistication of Yangon processors varies from the small-scale household level to sophisticated factory scale production. The largest employ up to 30 people, use machinery for processing and produce large volumes. They package and label their products and are well connected to buyers, particularly the supermarket chains. They also focus mainly on higher value ready-made products, such as Ngapi Daung.

They have relatively high standards in terms of quality and food safety, due to the fact that their products are sold in higher-end retail outlets, which are fairly demanding. More information about the requirements of specific retailers is provided below.

Typically, Yangon value-added processors purchase shrimp paste from wholesale markets in Yangon. Purchasing through wholesalers has its weaknesses, because it is harder to develop relationships with individual suppliers and to guarantee the quality of their products. As such, there is an opportunity for Myeik actors to develop more direct relationships with these companies. Individual processors would probably not be able to supply the volumes required by these actors, so it is likely that a collector, or other actor who could source shrimp paste from various sources, would be best positioned to develop relationships with these companies.

Wet market retailers/home shops

Perhaps the most established consumer outlet for shrimp paste are the traditional wet markets and home shops. These offer a wide variety of fresh foods and are conveniently located. They are frequented by all classes of consumer. Most consumers at the wet markets are sensitive to price and most are also concerned with quality. The characteristics of good quality are that the paste contains at least 90% shrimp (one indicator that consumers use is the number of shrimp eyes); the paste is a reddish colour (not dark), but artificial colouring has not been used; and there is no sand in the product. The majority of consumers shopping at the wet markets do not require that shrimp paste is packaged and labelled.

Supermarkets and mini marts

Supermarkets are currently present in most large urban centres and networks are rapidly expanding. They offer consumers a one-stop shop experience, with a wide choice of food products for sale. The consumers that shop in supermarkets are less-price sensitive than those shopping at the wet markets. They are also more interested in quality of products. In addition, they are more concerned with food safety and they require products with attractive packaging and labelling. They are also interested in alternative packaging formats, such as single use packs. In relation to shrimp paste, a key point to note is that it was reported that consumers do not tend to buy raw shrimp paste from these retailers. At present, they still prefer to buy this from the wet markets. However, they do purchase ready-mixed shrimp paste products, such as Ngapi Daung[6], from these retailers.

Supermarkets are constantly looking for new suppliers and are open to trialling products that meet their requirements. Some supermarkets have started requesting suppliers to produce shrimp paste in accordance with Good Hygienic Practices (GHP). In addition, some have requested that suppliers have been registered and approved by the FDA, and that products are labelled in way that conforms to labelling legislation. One major retailer reported that products that meet the basic requirements for food safety and labelling must then meet further consumer preferences. In particular, they need to have attractive labelling and to meet customer packaging preferences, including appropriate sizes (Popular retail pack sizes for shrimp paste were reported to be 160g and 320g). The products are also sensory evaluated by the

[6] Ngapi daung: shrimp paste which is cooked and mixed with chilli, garlic and other ingredients

supermarket. If products meet these requirements, the supermarket will trial the product. The supplier must then provide a minimum of 20 packets of a product for one store. The product will be stocked for one month and then sales assessed. If products are successful and the supermarket stocks them on an ongoing basis, they will then require suppliers to supply large volumes throughout the year. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores.

Mini-marts are small shops, which have a limited range of products on sale. There are two main types. First are chain-minimarts, which are chain stores operating as part of larger companies. Examples are Grab and Go, Union Mart, City Mart and ABC. These may have over 50 branches per city. The product requirements and procurement practices of these chains are broadly similar to those of the supermarkets. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores. Second are family minimarts, which are not affiliated to large chains, but operate as independent, family-run stores. In these cases, procurement practices may differ from those of supermarkets. Most notably, the quality, food safety, packaging and labelling requirements are often lower than those required by supermarkets. In addition, lower volumes are required than for supermarkets.

Given the increase in the 'consuming class', which was highlighted in the demand section above, it is probable that supermarkets and mini-marts will expand rapidly in the near future, making them an increasingly important market.

Hotels and restaurants

Hotels and restaurants that sell Myanmar cuisine are another market for shrimp paste. With the growth of the 'consuming class' and tourism, the number of these establishments is likely to increase dramatically in the near future. However, at present most of these outlets buy directly from wet markets or supermarkets. Though there may be niche opportunities to develop relationships with individual hotels and restaurants, as well as chains, that want a consistent supply of premium quality shrimp paste, which meets food safety requirements.

Souvenir shops

In Myeik and other coastal towns with large numbers of tourists, souvenir shops exist which sell a variety of traditional processed seafood products to tourists, including business tourists. At present, there are eight souvenir shops in Myeik city. This is a niche market, but the number of tourists and business travellers in Myeik is likely to increase in the near future. Souvenir shops in Myeik look for the same quality characteristics which were outlined under the wet markets section.

Recommendations for markets to target

Based on the market analysis conducted so far, Yangon value-added processors, as well as supermarkets and chain-minimarts offer the best markets to target. Yangon value-added processors are attractive because they can buy large volumes and some are willing to pay higher prices for raw shrimp paste which meets quality and food safety standards. If Myeik collectors sell to this channel, this would shorten the chain between processor and buyer, which would also increase the flow of information between these actors, making it easier for processors to understand the needs of the end-market and deliver shrimp paste which meets their requirements.

Supermarkets and chain-minimarts are recommended because they want to buy high quality, packaged and labelled products, which attract higher prices than those for bulk products sold on the wet markets. In addition, they are willing to purchase large volumes of these products and the rapid expansion of these retail outlets means that they are likely to increase the volumes which they purchase in the future. They also offer a distribution service if products are delivered to a central location. However, it is important to note that they are primarily interested in ready-made products, such as Ngapi Daung, because the majority of consumers still purchase raw shrimp paste from the wet markets.

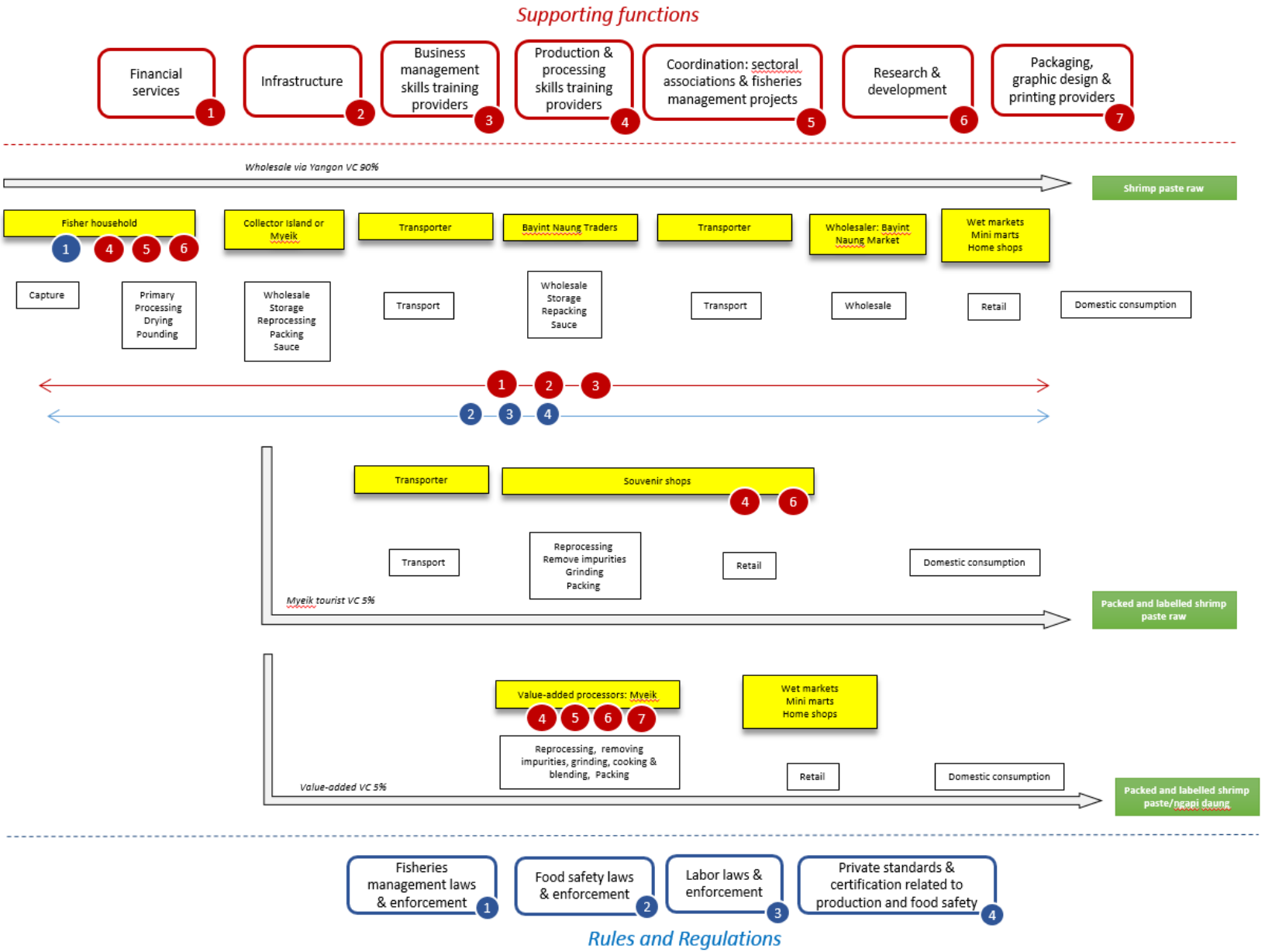
The fact that they demand that quality and food safety requirements are met, and that FDA approval has been granted, reduces competition for these markets. It also provides an incentive which can help drive improvements in quality and

food safety at the fisher and processor level. If these actors can meet the necessary standards, they will be able to command a better price for their products.

Finally, selling to these buyers will also help form relationships where feedback is provided about the preferences of high end consumers want. This can create a flow of market information which makes it possible to continually improve and react to changing requirements in the future. Selling in bulk to wholesalers does not provide this feedback.

Value chain map

Figure 3: Shrimp paste value chain map



Value chain actors

The table below summarises the key actors in the shrimp paste value chain and the available data on their location, population and volumes of product traded, as well as average price received. This is followed by a description of each actor's activities. The value-chain map above summarises the process and flow of product through the chain.

Table 1: Key actors in the shrimp paste value-chain

	Function	Location	Number	Employees: number & gender	Volumes	Selling price (Kyat / viss)
Fisher/processor households	Catch shrimp 2 times per month. Dry and pound. Sell to collectors and traders.	Islands & coastal villages	500-1000	4 – 5 Men Women	240 to 4000 viss (384 - 6400 Kg) per household per 6 month season	1300 – 1500 / viss (0.6-0.7 USD /Kg)
Collector: villages	Accumulate product from processors. Grind paste and remove impurities. Sell on. Provide credit to fisher/processors.	Islands & coastal villages	50-150	4 – 5 Men Women	2500 -5000 viss (4000-8000 Kg) per 6 month season	2000 / viss (0.93 USD/Kg)
Collector: Myeik city	Accumulate product from processors. Grind paste and remove impurities. Sell on.	Myeik	5	4 - 5 Men	Approx. 10,000 viss (16,000 kg) per annum	2000 / viss (0.93 USD/Kg)
Souvenir shops	Grind paste and remove impurities. Package and label. Sell to tourist market	Myeik	8	2 -6 Men Women	n/a	3000 / viss (1.39 USD/Kg)
Ngapi daung producers: Myeik	Produce ready mixed Ngapi daung product. Package and label	Myeik	30-50	2-5 Women	Up to 300 viss (480 Kg) per month	7000 / viss (packaged) ((3.24 USD/Kg)
Bayint Naung Traders	Receive in sacks from collectors. Store and sell	Yangon	7	5 – 15 Men	Up to 3,500,000 viss (5.6 tonnes) per month	1500 - 2800 / viss (on behalf of collector) (0.69- 1.3 USD/Kg)
Yangon processors	Grind paste and remove impurities. Package and label. Distribute to retail outlets	Yangon	10-30	Up to 30 Men Women	Up to 16 tonnes per annum	7000 / viss (incl packaging) (3.24 USD/KG)
Intermediate wholesalers	Buy from Bayint Naung traders in Yangon. Transport and sell on	Urban centres	n/a	n/a	n/a	n/a
Wet markets, Mini marts, home shops	Provide purchase point for consumers	Urban centres	n/a	n/a	n/a	Shrimp paste: 5000-6000/viss (2.32-2.78 USD/Kg) Ngapi daung: 10,000 / viss (4.63USD/Kg)

Fisher/processors

In the townships studied, the majority of households involved in the processing of shrimp paste also carry out the capture of shrimp. With this in mind, the following section covers both capture and processing. It should also be noted that these SMEs were found to operate only in coastal villages and on the islands, with no shrimp paste fisher/processor SMEs operating in Myeik city.

The majority of fisher/processor households are found on islands. They are relatively poor with low levels of capital and business skills. Men from the household are engaged in shrimp harvesting and women are involved in drying and processing. Fishing and processing continue for approximately 6 months per year, from November-May. Processing is affected by the weather, so activities are reduced during the rainy season.

Fisher/processor households catch small shrimp (Mysid spp.) using either stow nets, push nets or tidal trap gears. The communities that harvest and produce shrimp paste are those where these fishing gears can be easily deployed e.g. the tidal and shore conditions are conducive. Unfortunately all fishers interviewed reported that shrimp catches are generally declining due to fishing pressure and hence improved fishery management is a key issue going forward.

The shrimp are first sundried for several hours and then pounded. Salt at 20 – 30% by weight of fresh shrimp is added and the drying and pounding process carried out up to six times before the product is deemed ready for sale to collectors and traders. The salt used in producing shrimp paste is important. White salt from the Delta with large crystals is said to produce the best shrimp paste.

The mashing of the shrimp to paste is done using a wooden pole and/or feet. The use of feet poses obvious food safety and quality risks. No processors reported the use of machinery to remove impurities and refine the paste. Evidence suggests that the bulk if not all shrimp paste leaving the islands is packed in sacks without proper labelling.

Various processing practices could be improved to achieve Good Hygeine Practices and improve quality. Although it was not possible to observe shrimp paste harvesting and processing first hand, key issues reported were: the lack of adequate access to potable water and the likely use of nearshore polluted seawater for any washing of shrimp or facilities; drying the shrimp on the ground which is open access for people and animals; and the lack of personal hygiene standards. Furthermore the configuration of the household, where much of the processing takes place, is often not conducive to good processing practice. There is no adequate space for raised drying racks and household and other activities overlap processing space, which creates a risk of cross contamination.

The fact that the shrimp paste has to be further processed by collectors to remove impurities is an indication that handling is sub-standard at the processor level. It was reported that in the past, shrimp paste was exported to Thailand, but this trade was halted because of concerns by the Thai market regarding the processing standards in Myanmar.

Households produce between 240 and 4000 viss (384 – 6400Kg) of shrimp paste per season. Most sell to collectors or Myeik-based ‘souvenir shops’. Processors are often indebted to collectors (see next section) who advance money to secure supplies of paste from processors.

Collectors

Collectors purchase shrimp paste from processors and aggregate this, before selling it on. They are akin to wholesale traders and are based on islands where processors are, and on the mainland in Myeik.

Some collectors carry out additional processing of the shrimp paste, including further pounding or grinding and removing impurities such as bits of shell, leaves and fish. This renders the paste suitable for sale to consumers or for further processing into value-added products. The colour of the paste is important (red is good, dark is bad) and in order to improve its colour, dyes are added by some collectors. It is likely that some of these dyes are not suitable for use on foods, creating food safety issues.

Figure 4: Shrimp paste collector's re-processing and storage unit

Collectors pack the paste into sacks. A sack (white polypropylene) of paste weighs between 35 to 50 viss (56 to 80 kg) and is the unit of measurement and packaging used for wholesale distribution throughout the country. The sacks of paste can be stored and during this period will exude liquid which is collected and sold as shrimp sauce. One collector in Myeik has started to experiment with different wholesale packaging e.g. plastic buckets containing 24 Kg of paste, as opposed to sacks. One objective of this practice is to avoid the reduction in weight caused by the loss of this liquid, which leads to reduced prices during sale at the Bayint Naung wholesale market.

Figure 5: Shrimp paste in a collector's storage unit

Typically, collectors based on the islands sell between 2,500-5,000 viss (4,000-8,000Kg) per season. One collector in Myeik interviewed sells an estimated 10,000 viss (16,000Kg) per annum of paste. Collectors usually purchase from processors that they are familiar with. When demand is high, collectors will visit or employ someone to visit processors to purchase product. The dominant trading practice is that collectors buy outright from the processors and then sell the product on, rather than collecting a broker's fee to arrange a deal between a buyer and a seller.

Figure 6: Impurities removed from shrimp paste

Collectors sometimes advance money to processors in order to secure the supply of paste after processing. The collectors do not normally charge interest on these loans. Instead, they negotiate a reduction in the sales price.

Most collectors sell their shrimp paste through[7] wholesale traders in Bayint Naung market in Yangon. Shrimp paste is typically transported to Yangon by truck or by boat. The reason for selling through this channel is that

[7] The majority of wholesale traders in Bayint Naung act as brokers, arranging sales between buyers and sellers, and taking 5% commission for each sale.

Bayint Naung traders are consistently able to purchase large volumes. However, many collectors reported that they had been cheated in various ways by Bayint Naung traders on weights and prices, and that Bayint Naung traders take too long to pay them. Some collectors also sell to local souvenir shops in Myeik in limited volumes.

Collectors tend to deal in large volumes of paste and have the storage space and capital required to do this. This is a clear advantage for any collector who wishes to supply larger retailers in the future. However, collectors reported that they had not made any concerted efforts to find buyers other than wholesale traders at Bayint Naung market.

Souvenir shops

Myeik already receives a significant number of tourists, including many business tourists, and is likely to see further growth in tourism in the near future. A number of souvenir shops in Myeik cater to the needs of tourists who want to buy seafood products from the area. These shops tend to stock a variety of dried fish and shrimp products which are packaged and labelled. Shrimp paste is one of the products sold in a variety of pack sizes.

The shops will often source shrimp paste from particular communities or collectors with whom they have an ongoing relationship. They often refine the paste after buying and impurities such as shells and leaves are removed. The paste is then weighed, packed in plastic bags and put into simple plastic trays or wrapped in waxed paper and labelled. The packaging and labelling certainly makes the product more attractive, but there is significant scope to further improve the quality of both the packaging and labelling.

Some souvenir shop owners are aware that their products could be sold in other outlets such as supermarkets in Yangon and Mandalay. However, they are constrained by a limited understanding of such new markets and the ability to carry out market research. In addition, packaging and labelling options available locally are limited and expensive.

On the other hand, there is scope to make use of recent improvements in the road network to distribute products to other parts of the country. There is also scope to market products based on their origin, including labelling which mentions the specific island they were produced on.

Wholesale traders - Yangon

The majority of shrimp paste from Myeik goes from Myeik-based collectors to wholesale traders in Bayint Naung market in Yangon. It is transported there by boat or truck. Bayint Naung market is a major conduit for dried seafood products from all over the country. Approximately 15% of the shrimp paste arriving at the market is said to be from Myeik. The traders receive the product, store and sell it on to wholesalers from different parts of the country. As mentioned above, the majority of wholesale traders in Bayint Naung act as brokers, arranging sales between buyers and sellers, and taking 5% commission for each sale. Orders are placed by phone and the sacks of paste are transported by truck to the intermediate wholesalers. The proceeds from the sales are passed on to the collector. The traders in Bayint Naung collude to set the selling prices for products. They can also make financial advances to collectors and processors. During storage, the sacks of shrimp paste exude a liquid which is kept and sold by the traders as shrimp sauce. The traders have access to many buyers and sellers and run what appears to be a relatively low risk business. Shrimp paste is sold to buyers all over the country. Only a limited amount of shrimp paste is exported to Thailand.

Large volumes of product from many different suppliers make it difficult for the Bayint Naung wholesalers to guarantee consistent quality. The market environment is also not conducive to good handling and storage

practices. Many collectors reported that they had been cheated in various ways by Bayint Naung traders on weights and prices, and that Bayint Naung traders delay sending money back to collectors after sales.

Value-added processors

Value-added processors purchase semi-processed[8] shrimp paste; carry out further processing, which may include removal of impurities, refining the paste, adding ingredients and cooking processes; then package and label it. There are significant differences between value-added processors in Yangon and Myeik. As such, these are presented separately below.

Myeik value-added processors

Several of the souvenir shops highlighted in the above section carry out additional processing, as well as packaging and labelling of products. Aside from this group of actors, there are approximately 30-50 additional processors in Myeik that produce 'Ngapi Daung', a ready to eat relish that accompanies curries and various other dishes. It is produced by cooking shrimp paste with garlic and chilli. The processors in Myeik identified were producing this within their households. They were packaging it in various pack sizes, from single-use 8g packs to 200g tubs and it was being sold to a variety of retailers in Myeik, including souvenir shops, supermarkets, mini-marts and home shops. One Ngapi daung processor in Myeik reported that she can process up to 300 viss (480 Kg) per month.

Packaging materials such as tubs and bags are either made in Yangon or imported from Thailand and China. Packaging materials are said to be expensive and limited in terms of type and style.

These value-added businesses can be low cost and often provide employment for women who process and pack the products. However, smaller businesses in Myeik are constrained by limited working capital and poor access to affordable finance to expand their business. Packaging is also an issue for processors in Myeik, because it must be sourced from Yangon.

A lack of knowledge of GHP and proper labelling is compounded by the operating environments of some processors which make the application of GHP difficult. Furthermore, whilst some SMEs in Myeik are interested in expanding and tapping into new markets e.g. supplying to retailers in Yangon, they lack market information and relationships with such outlets. The electricity costs in Myeik are also higher than in Yangon, which increases their operating costs.

[8] Shrimp paste which has undergone the basic processing at the fisher/processor level (see above section)

Figure 7: Ngapi daung processor Myeik

Figure 8: Packing ngapi daung in Myeik

Yangon value-added processors

The scale and level of sophistication of Yangon processors varies from the small-scale household level to sophisticated factory scale production. The largest of these processors identified was purchasing approximately 10,000 viss (16,000 Kg) of shrimp paste from collectors per year and employing 30 people. It should be noted that this differs from Myeik, which does not have any factory scale value added processing companies.

Typically, Yangon value-added processors purchase shrimp paste from wholesale markets in Yangon, though one such processor reported that he sourced shrimp paste from his home-village in Tanintharyi Region, because this made it easier to control the quality.

The Yangon value-added processors carry out further processing of shrimp paste purchased. This can include the use of adapted machinery to remove impurities and refine the paste. They then package and label their products. These products are then distributed to mini-marts, supermarkets and home shops as well as exported to neighbouring countries. After packing, the paste has a one year shelf life.

The Yangon value added processors benefit from cheaper electricity costs than those in Myeik and they are closer to the headquarters of the major retailers in Yangon. However, they are also further from the fishers and processors, which may make it harder for them to collaborate directly with these actors to improve standards at the fishing and primary processing levels.

Figure 9: Value-added shrimp paste, produced in Yangon

Retailers

Shrimp paste is retailed to the final consumer through wet markets, home shops, mini-marts, supermarkets, hotels and restaurants. Please refer to the above section on ‘analysis of domestic markets’ for a description of these actors.

Supporting functions

The performance of SMEs in this value chain is influenced by a number of supporting functions. These are outlined below.

Infrastructure

Both boat and road transport function adequately, given that the product is robust and has a relatively long storage life. Road infrastructure has improved over the last decade and this has helped the distribution of fish from production areas to markets.

For processors on the islands, various types of infrastructure required to support GHP are lacking. In particular, there is limited access to potable water and fish landing infrastructure is inadequate.

Electricity would be required for packaging and labelling, and the use of some improved technologies such as mechanical driers. At present electricity for island processors is expensive[9] and only available to purchase from generators that operate at night.

Telecommunications infrastructure has improved greatly in recent years. Myeik city has strong mobile phone and 3G network coverage. Coverage on the islands is more variable.

Packaging, graphic design and printing services

Some packaging materials are available in Myeik, sold through a limited number of retailers. In general, the variety and quality of packaging materials available in Myeik is lower than Yangon and the prices are more expensive. In response, some food processors in Myeik purchase their packaging materials directly from suppliers in Yangon.

Graphic design services in Myeik are not well developed. Local food processors normally ask local printing/IT shops to produce designs, which are very basic. Some of the souvenir shops contact graphic designers in Yangon who are able to produce better designs, though these are still not as attractive and professional as those used by larger Yangon food processors. There are also several printing shops in Myeik, which are able to print a fairly wide variety of labels. However, they are not as advanced as competitors in Yangon.

Competing with processors in Yangon for a share of the value-added retail market will require access to improved packaging and labelling services. This could be achieved either by accessing improved services in Yangon or developing the services in Myeik.

[9] The cost of mains power in Yangon is said to be between USD 0.038 – 0.083 per kWh, whereas generator electricity costs in Myeik are between USD 0.20 and 0.30 per kWh

Figure 10: Packaging material supplier, Myeik

Processing equipment suppliers

At present there are no suppliers of shrimp paste processing machinery in Myeik. In Yangon, some larger processors use machinery for refining the paste and removing impurities, though this is likely to have been custom-built, rather than a standard model marketed for shrimp paste processing.

Financial services

Very limited formal microfinance is available to SMEs in Tanintharyi Region. Myeik Public Corporation is providing 100,000 Kyat (74 USD) loans to retailers, with 2.5% interest charged per month on the loans. Pact is creating Village Development Committees, which will administer Village Development Funds. These could provide finance to processed seafood SMEs in the villages where the project operates.

Informal finance for processors is widespread. In particular, collectors and wholesale traders provide loans to processors. However, some processors reported that they are permanently indebted to local moneylenders and find it difficult to repay loans.

Skills, information and learning

Marketing skills, information and learning

One of the barriers to improved market access for collectors, souvenir shops and value-added processors in Myeik is the fact that they lack information on new markets, the preferences of consumers and food safety requirements. A major cause of this lack of information is the fact that most shrimp paste is being sold to Bayint Naung wholesale market, which will purchase a wide variety of types and quality of shrimp paste and has no incentive to communicate the preferences of other markets. It is also caused by the fact that SMEs in Myeik lack key marketing skills, particularly the capacity to carry out market research independently. In addition, the flow of market information from collectors to processors is fairly weak and there is limited trust between these actors.

Production skills, information and learning

Processors already have the skills to deliver either a basic raw paste product or a packaged and labelled processed product such as ngapi daung to the final consumer. Targeting new markets will require improved quality and food safety, which involves upgrading production practices.

Larger processing companies in Myeik are able to identify and recruit consultants to upgrade their production practices to meet market requirements. However, the financial limitations of SMEs producing shrimp paste mean that this is not feasible for these actors. There are no local training providers in Myeik that offer training on either shrimp paste production or food safety, though 10 companies were identified in Yangon that provide training in generic food safety standards. Upcoming projects in the fishery sector in Tanintharyi region could potentially provide relevant training, though as yet there are no plans to provide training on these specific topics.

Given that the 3G network is relatively widespread, there is theoretical potential for websites and apps in Myanmar language that provide basic information on these topics. However, at present there is very limited information available through these channels.

Other business management skills, information and learning

In addition to marketing and production skills, shrimp paste SMEs will need to improve a variety of other business management skills to meet the requirements of new markets and to expand their businesses. These include financial management, HR and stock control skills. One provider of business management training was identified in Myeik. However, the training is rather infrequent and given limited efforts to promote the training, it is very unlikely that island based processors would be aware of the course.

Coordination

The Myeik Fisheries Federation (MFF) is the umbrella organization for all private sector stakeholders in the seafood sector in Myanmar. MFF has 10 member associations for different sectors within the industry. One of these is the Myanmar Fish Paste, Dried Fish, Fish Sauce Entrepreneurs Association. However, the shrimp paste processors in the study areas are not linked to this organisation.

The Myeik District Fisheries Federation (MDFF) provides local representation of MFF. Large scale processor-exporters are well-represented in MDFF, but SMEs engaged in the shrimp paste value chain are not currently well-represented.

At village level, various projects are initiating committees and associations, which could provide forums for coordination. Tanintharyi Regional Fisheries Partnership is forming associations in coastal villages across Tanintharyi Region. A PACT project is forming Village Development Committees in selected project villages. Fisheries management projects by Flora and Fauna International, as well as the World Conservation Society and DANIDA/Department of Fisheries will also form groups for fisheries management, which are likely to include large numbers of individuals engaged in seafood processing. But above village level, there is very limited coordination between shrimp paste processors.

It is also worth noting that souvenir shops in Myeik have recently formed an association.

Research and development

The Marine Science Department of the University of Myeik carries out research on biological and socio-economic issues related to fisheries, though in the last eight years there have been no studies on Mysid *spp*. of shrimp or on shrimp paste processing. Companies can also commission research on topics which are of use to their work. However, this is beyond the financial capacity of SMEs that produce shrimp paste.

In terms of market research and the development of new products, large processing firms in Myeik can identify and recruit national or international consultants that can carry out these processes. However, the financial limitations of SMEs producing shrimp paste mean that this is not feasible for these actors.

Rules

Fisheries management

The Myanmar Marine Fisheries Law (1990), which is currently being revised, provides the overarching legal framework for the management of the fisheries sector. The Department of Fisheries produces more specific regulations for each state or region, which are revised regularly; issues licenses to fishers; and monitors fishing activity. The navy is responsible for the enforcement of laws relating to fishing operations. At community level, there may also be informal rules related to fisheries management which are agreed between fishers.

Although it was beyond the scope of this study to explore this topic in detail, discussions during this study and as part of the previous process of drafting the 'Guidelines on sustainable practices for Myeik District Fisheries Federation' suggest that enforcement related to fisheries operations is fairly weak. Infringements of rules related to fishing grounds and closed seasons were reported to be common, and fishing without licenses was also reported to occur.

Food safety

Government

The Department of Fisheries has issued a number of directives related to food safety and quality within the framework of the Marine Fisheries Law No 9/1990, which are detailed in Annexe 2. Collectively, these directives seek to minimize health risks associated with fish and crustacean production and guarantee an acceptable quality of production.

Figure 11: Poor beach sanitation creates a weak environment for GHP

The Department of Food and Drug Administration is responsible for over-seeing and ensuring food safety and the safe production of foods for sale to consumers. According to the National Food Law (1997), food businesses should be registered and certified by the FDA. To gain certification, the FDA must inspect the business. In practice, the exact criteria against which the inspection is carried out are slightly unclear, however, with some processors reporting that they were given a specific 'checklist' and some not. In addition, the FDA is hampered by a lack of resources, which makes it difficult to certify and monitor food safety across such a large sector.

Other organizations involved in ensuring product quality are the Ministry of Health, whose laboratory is capable of biological and chemical analysis, and the Ministry of Industry, whose food control laboratory aids it in its function of licensing food manufacturing establishments. Lastly, the Food Industries Development Supporting Laboratory of the Myanmar Food Processors and Exporters Association conducts quality and safety analyses on food and water.

The Department of Fisheries is the EU appointed competent authority responsible for issuing catch and health certificates, inspection of factories, landing sides and farms and the implementation of the Residue Monitoring Plan.

There is a fisheries inspection and quality control unit - The Yangon Division of the Department of Fisheries Research and Development Unit- within the Institute of Fisheries Technology and Marine Fisheries Research. In some parts of the country, it has organised capacity building on topics such as fisheries inspection and quality control. However, no capacity building activities were identified in Myeik.

Private standards and certification

Globally a variety of private standards exist in relation to food safety, such as ISO 22000 Food Safety Training and Assessment; FSSC Food Safety System Certification; Hazard Analysis Critical Control Points (HACCP); and Good Hygiene Practices (GHP). Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research also identified 10 companies in Yangon which are able to provide training in one or more of these standards.

Cross-cutting considerations

Labour

At the fishing and processing level, a mixture of household and hired labour is used to carry out the main tasks. This work is predominantly part-time or seasonal. The use of household labour in fishing and processing introduces a risk that child labour may occur, though further research is required to confirm the exact extent. There may also be occupational health and safety issues related to fishing and processing operations, though further study is required to confirm this.

Gender

Men are engaged in fishing and more physically demanding labouring work. They also dominate the collection activities and are involved in trading. Women undertake processing at the household level, collection of shrimp paste, manage or are employees in souvenir shops, work in and manage value-added processing SMEs and are engaged in trading activities particularly at the retail level.

The development and growth of SMEs is therefore likely to benefit both men and women, particularly through employment creation, albeit seasonal, at the fisher/processor level. The expansion of production of value added products, such as ngapi daung, may be particularly beneficial to women, who already dominate this sector.

Environmental

From an environmental perspective the major issue is the relatively open access nature of the fishery, which makes sustainable management of the fishery problematic.

Conflict and security

Anecdotal evidence suggests there is some conflict between the small-scale shrimp fishers and inshore fishing vessels which encroach into the nearshore shrimp fishing grounds.

SWOT analysis

The following table presents the results of a SWOT analysis of the shrimp paste value chain, drawing on the information collected about markets, value chain actors, supporting functions and rules.

Figure 12: SWOT analysis of the shrimp paste value chain

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Shrimp paste processor	Quality of Myeik paste and Myeik brand highly regarded Provides employment opportunities for women and men Knowledge of how to process shrimp	Process small-quantities of paste and production is limited by supply shortages Impact of rainy season on drying and processing Lack of awareness and application of GHP Indebtedness to collectors limiting options for price negotiation and accessing new markets Lack of record keeping/financial management Seasonal production – mainly for 3 to 6 months of year Living conditions and access to services not conducive to improving processing practices Variability of shrimp	Scope to improve quality of paste before sent to collector Well established traditional product consumed by a high % of population Co-management initiatives Microfinance initiatives Storage life of the product is long Robust product can withstand transport and distribution	Declines in catches of shrimp Incursion of off-shore vessels into near shore areas Net fence fishing leading to overfishing of mysid shrimp Increase in fishing efforts Use of non-approved food colourings Thai importation of mysid shrimp rather than paste

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
		species in catch with colour variations		
Shrimp paste collector, islands	Have sufficient capital to advance to processors and accumulate paste at good price Provide a quality control role Market linkages with Myeik and Yangon Ability of some to store paste for long period of time if need be	Limited understanding of markets and capacity to collect information Limited access to capital for expansion Communications with mainland difficult (rely on boats and mobile phone) Need to reprocess paste before selling on Need for GHP Energy costs on islands limiting use of equipment and value-addition Limited access to packaging and labelling services/supplies Mind-set of some limits interest in new ideas Lack of business management skills	Potential to deal direct with retailers in Yangon Value-added products: retail packaging & labelling, alternative packaging for small-scale wholesalers and home-shops Prawn sauce as a niche product Growing population and increasing demand for fish	Competition for paste from other collectors and increasing number of souvenir shops Sustainability of supply Lower priced paste from other areas Improvements in quality of paste from other areas
Shrimp paste collector, Myeik	Have capital to invest Able to reduce costs by bulk buying Ability to collect large quantities of paste from a diversity of suppliers Provide a quality control role Market linkages with Myeik and Yangon Ability of some to store paste for long period of time if need be Access to packaging and labelling services/supplies	Limited understanding of markets and capacity to collect information Need to reprocess paste before selling on Need for GHP/GMP and requirements of major retailers Energy costs limiting use of equipment and value-addition Costs of packaging and labelling locally more expensive also quality of labelling not as good as Yangon	Potential to deal direct with retailers in Yangon Reputation of Myeik products Value-added products: retail packaging & labelling, alternative packaging for small-scale wholesalers and home-shops e.g. 10 kg, 5kg tubs Prawn sauce as a niche product Growing population and increasing	Competition for paste from other collectors and increasing number of souvenir shops Declining availability of shrimp and sustainability of supply Lower priced paste from A and improvement in quality Dependent on Bayint Naung wholesalers and weak bargaining power leading to lower

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	Some have mind set geared to accessing new markets and new ideas Social/business network and links to Yangon Basic branding of product (eg. brand sacks)	Mind-set of some limits interest in new ideas Lack of marketing skills Delays in receiving money from wholesalers in Bayint Naung	demand for fish Transport improvement – road development provides more market opportunities Bus transport for bucket packaged products Lowering of future energy costs with installation of new gas power plant in 5 years time Market information on demand in retail outlets, wet markets, home shops	prices and cash flow problem
Souvenir shops	Packaging and labelling used for value-added products Customer services skills Strong awareness of the tourist market in Myeik Some have capital to invest Ability to collect paste from a diversity of suppliers Provide a quality control role Access to packaging and labelling services/supplies Some have mind set geared to accessing new markets and new ideas Social/business network and links to Yangon	Limited understanding of new markets and capacity to collect information Need to reprocess paste before selling on Need for GHP and understanding of standards e.g. City Mart Energy costs limiting use of equipment and value-addition Costs of packaging and labelling locally more expensive Mind-set of some limits interest in new ideas Lack of marketing skills	Likely growth of tourism industry in future Potential to deal direct with retailers in Yangon New port development in Dawei offers an important future market Potential to improve packaging and labelling Growing population and increasing demand for shrimp paste Transport improvement – road development provides more market opportunities Lowering of future energy costs with installation of new gas power plant in 5 years	Growth in new souvenir shops leading to stiff competition for paste Sustainability of supply Increasing costs of renting retail space

	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
			time Scope for distributor in Yangon to distribute products in Yangon Product traceability to certain islands and uniqueness	
Small-scale shrimp paste ngapi daung producer	Well known traditional product High value product 1 month shelf life Employment for women Simple low cost operation	Limited by working capital Access to finance to expand business Low production volumes Knowledge of GHP and proper labelling Home based production limiting application of GHP Lack of access to packaging types and variety Packaging expensive locally so sources from Yangon	Growth of middle class urban consumer creating a growing demand for this ready-to-eat product Growth in supermarkets Improving labelling and packaging High existing demand	Vulnerable to implementation of FDA standards Larger scale new entrant or expansion of production out competing existing producers
Shrimp paste wholesaler, Bayint Naung	Control of main if not only existing market channel Set selling price of paste collectively Element of collectivism amongst traders Access to capital Opportunity to export Access to many buyers and sellers Relatively low risk business based on commission	Poor handling and storage practices & food safety standards Cannot guarantee quality	Continuing demand for shrimp paste Capacity to diversify business interests	Reputation as untrustworthy Ability to meet health and safety standards

Upgrading strategy

Based on the understanding generated from the research and analysis, the following upgrading strategy is proposed.

New market channels

Apart from a small amount of product which is sold through souvenir shops or is processed into ngapi daung for sale locally, the bulk of shrimp paste from Myeik leaves the area in sacks for sale at a relatively low price via traders in Bayint Naung market in Yangon. It is proposed that Myeik actors target two new markets. Firstly, sell raw shrimp paste to Yangon value-added processors. Secondly, sell some of their shrimp paste as packaged and labelled products to high value retailers, such as supermarkets and chain-minimarts, in cities such as Yangon, Mandalay, Sagaing and Dawei (particularly once the Special Economic Zone has been completed). It should be noted that the market research suggests that ready-made products, such as ngapi daung, have far greater potential for sale to these retailers than raw shrimp paste.

Capitalise on the reputation of Myeik shrimp paste

Myeik shrimp paste has a reputation for high quality and commands a wholesale price 300 to 400% higher than similar products from other areas of the country. But at present most shrimp paste coming from Myeik does not specify its origin. Labelling shrimp paste as originating from Myeik would help make this clear to the consumer and would promote Myeik as a distinct brand.

Packaging and labelling: retail, small-scale wholesalers and home-shops

It is proposed that more processors in Myeik start to package and label their shrimp paste. Retail packaging and labelling of shrimp paste for retailers is a simple and relatively straightforward means to add value and increase profits for SMEs, while at the same time making a high quality product more convenient for urban consumers. Producing labels which meet FDA labelling requirements would also help consumers to be aware of relevant food safety issues, such as expiry dates.

Although processors can purchase packaging and labelling materials from suppliers in Yangon, it would be advantageous if local suppliers were able to provide services that are competitive with those in Yangon. As such, a related objective is the improvement of packaging and labelling service providers in Myeik.

New products

It is also recommended that SMEs diversify into producing new products. One example is ngapi daung, which is a particularly high value product which already has a well established demand. This ready-made product is well placed to satisfy the needs of urban consumers that lack the time to produce the home-made version. It is also recommended that other new products are explored. One example is shrimp sauce, sold in small bottles. But there may be many other products which have high potential.

Improve quality and food safety standards of shrimp paste at processing and collection

SMEs will need to respond to new market requirements and standards if higher value markets are to be accessed and developed. This will entail the application of GHP and efforts to reduce or eliminate the contamination of paste at processing with shells, leaves and other impurities. The importance of food safety should not be underestimated, particularly in terms of protecting the Myeik brand, which would be harmed by any link to food borne illness or malpractice in terms of the use of additives and product handling. Options

for shrimp paste processing machinery should be researched to establish whether there are any appropriate technologies that would benefit processors.

Sustainable management of fisheries

To ensure the sustainability of shrimp paste production will require careful attention to resource management. Fishers reported that catch per unit effort has been declining over the last five years. The government has the mandate to ensure sustainable management of fishery resources and there are planned co-management initiatives, implemented with development partners, to try to improve the management of shrimp and other fishery resources in Myeik.

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new market channels.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce value-added products and access new markets. Finance would be required for working capital, upgrading facilities and procuring equipment, as well as packaging materials and perhaps training and advisory services.

Dried shrimp

Product description

Dried shrimp ('bazun-chauk') are boiled, sundried and peeled shrimp. Various Penaeidae *spp*. of shrimp which inhabit the coastal waters of Myanmar are used to produce this product.

In Myanmar, dried shrimp is used widely in salads, soups and condiments. Shredded dried prawns are used to prepare condiments such as ngapi kyaw and balachaung kyaw. Dried shrimp is also used in stock for soups. Dried shrimp are a source of protein, vitamin B12 and selenium, vitamin A, vitamin E, vitamin B6, iron, magnesium, sodium (salt), zinc and copper.

Market analysis

Dried shrimp are widely eaten in Myanmar, China, Hong Kong, Indonesia, Cambodia, Thailand, the Philippines, Malaysia and Vietnam. Dried shrimp are sold in markets and specialist dried fish outlets in major cities in all these countries and it is a relatively high value product. For example, in retail markets in Yangon during the study, the highest price observed was 30 USD/Kg. Due to its popularity in South East Asia, it can be found on sale in specialist food shops in countries outside the region where people from the region have emigrated to. There are also markets for dried shrimp in the Americas e.g. Brazil, Mexico and Louisiana in the US.

Bearing in mind the current low capacity of dried shrimp processors in Tanintharyi Region, the value chain analysis team recommend that accessing higher value markets within Myanmar would be a logical first step, rather than attempting to tap into the export market. As such, the remainder of this section focuses on analysing the domestic market. However, it is also acknowledged that if standards can be met, there are major export opportunities for dried shrimp. . As such, if processors in Tanintharyi manage to access higher value domestic markets and have an interest to find additional markets, then as a second step it would be useful to carry out a detailed analysis of export markets. It is important to note that accessing export markets will require the standard documentation for food products such as sanitary certificate and certification of the product producer by the FDA. The potential for official exports is thought to be restricted at the moment by a lack of FDA certified producers and the lack of recognition of the Myanmar FDA by some potential import countries such as Singapore and Malaysia. Nevertheless, dried shrimp is currently exported from Myanmar to China, Hong Kong, Malaysia, Singapore and Thailand.

Analysis of overall domestic demand and supply

Demand

Average consumption of dried shrimp in Myanmar is 0.4 Kg per capita per year (Needham and Funge-Smith, 2015). Given a population of 54,000,000, estimated total consumption in Myanmar is approximately 21,600 tonnes per year. Broadly speaking, it is a popular product in Myanmar, though it is relatively expensive, which limits its accessibility to low income consumers.

The likely future trend is one of strengthening demand and increasing prices, because shrimp catches have reduced dramatically in the last five years, dried shrimp is a well-established traditional component of the Myanmar diet and population is increasing constantly (0.87% per annum).

Supply and competition

Dried shrimp is produced in several coastal areas of the country, including Ayeyarwaddy Region, Rakhine State and Tanintharyi Region. The availability of supply is seasonal, with most production taking place during the summer season from November onwards for approximately 6 months. There is some production during the rainy season, but drying is more problematic. However, artificial dryers, using firewood, are used during this period. The total supply to domestic consumers is not fully known. However, based on data from value chain actors in Myeik, approximately 22,500 viss (14 tonnes) of dried product pass through Myeik collectors on average per month. Although no rigorous research data on catch per unit effort is available, all communities in the study area reported that catches of the shrimp species used in dried shrimp production have significantly reduced in the last 5 years.

The dried shrimp from Myeik is different to that from other areas of the country. It is known to be of a paler colour and is curled in shape rather than straight. It is understood that dried shrimp from the Ayeyarwady are more desired in Yangon due to their red colour and straightness. According to traders in Yangon the best quality dried shrimp comes from the Delta and sells for 65,000 Kyats/viss (30 USD /Kg).

Analysis of domestic markets

This research identified three major existing and potential domestic markets for dried shrimp: Yangon value added processors; wet markets/home shops; and supermarkets and mini marts. In addition, hotels, restaurants and souvenir shops provide further niche end markets. Each have different consumers, requirements and likely trends for the future. These markets are summarised below.

Across all of these markets there are several characteristics that determine the price of dried shrimp. Size is very important, with consumers requiring different sized shrimp for different dishes and generally paying a higher price per viss for larger shrimps. Consumers also pay a higher price for whole shrimp, rather than those which are broken up; for shrimp which have all the shell removed; and for the 'right' colour (red/pink), with lower prices paid undesirable colours (white or dark). However, consumers are increasingly aware about the use of dyes and are less willing to purchase shrimp that they suspect has been dyed. Lower quality shrimp can only be used for a limited number of cooking purposes, such as pounding to put into curries and soups and using in powdered form as a substitute for MSG.

Yangon value-added processors

In Yangon there are a number of medium and large scale value-added processors who operate in different ways. Some are currently purchasing dried shrimp from Bayint Naung market in Yangon, grading it, then packaging and labelling it. These processors then sell the majority of their products to mini marts and supermarkets in urban centres within Myanmar.

They have relatively high standards in terms of quality and food safety, due to the fact that their products are sold in higher-end retail outlets, which are fairly demanding. More information about the requirements of specific retailers is provided below.

Typically, Yangon value-added processors purchase from wholesale markets in Yangon. Purchasing through wholesalers has its weaknesses, because it is harder to develop relationships with individual suppliers and to guarantee the quality of their products. As such, there is an opportunity for Myeik actors to develop more direct relationships with these companies. Individual processors would probably not be able to supply the volumes required by these actors, so it is likely that a collector, or other actor who could source dried shrimp from various sources, would be best positioned to develop relationships with these companies.

Wet market retailers/home shops

Traditional wet markets and home shops offer a wide variety of fresh foods and are conveniently located. Most retailers of this type keep the dried shrimp in large storage boxes, then weigh it and put it into bags when they make a sale. They are frequented by all classes of consumer. Consumers at the wet markets are fairly sensitive to price and most are also concerned with quality. Some consumers will accept lower quality shrimp than those shopping at supermarkets, provided the price is also appropriately reduced. The majority of consumers shopping at the wet markets do not require that dried shrimp is packaged and labelled.

Supermarkets and minimarts

As mentioned in the shrimp paste analysis, supermarkets and minimarts are present in most large urban centres and the consumers that shop in them are less-price sensitive than those shopping at the wet markets. They are also more interested in quality of product, more concerned with food safety and require products with attractive packaging and labelling. These retailers sell dried shrimp either loose, to be weighed and packed for the consumer, or already packed in plastic bags and labelled in a variety of pack sizes.

The product requirements and procurement practices of supermarkets differ from those of minimarts. Supermarkets are constantly looking for new suppliers and are open to trialling products that meet their requirements. Some have started requesting suppliers to produce dried shrimp in accordance with Good Hygienic Practices (GHP). In addition, most have requested that suppliers have gained FDA registration and approval, and that products are labelled in way that conforms to labelling legislation. One major retailer reported that products that meet the basic requirements for food safety and labelling must then meet further consumer preferences. In particular, they need to have attractive labelling and to meet customer packaging preferences. The products are also sensory evaluated by the supermarket. If products meet these requirements, they will trial the product. Sales will then be assessed and, if they decide to stock the product on an ongoing basis, they will require suppliers to supply large volumes throughout the year. One large supermarket interviewed reported that suppliers sometimes cannot meet the volumes requirements required, especially during the rainy season. In addition, they indicated that they would like to see more vacuum packed products in future. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores.

Mini-marts are small shops, which have a limited range of products on sale. There are two main types. First are chain-minimarts, which are chain stores operating as part of larger companies. Examples are Grab and Go, Union Mart, City Mart and ABC. These may have over 50 branches per city. The product requirements and procurement practices of these chains are broadly similar to those of the supermarkets. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores. Second are family minimarts, which are not affiliated to large chains, but operate as independent, family-run stores. In these cases, procurement practices may differ from those of supermarkets. Most notably, the quality, food safety, packaging and labelling requirements are often lower than those required by supermarkets. In addition, lower volumes are required than for supermarkets.

Given the increase in the ‘consuming class’, which was highlighted in the demand section above, it is probable that supermarkets and mini-marts will expand rapidly in the near future, making them an increasingly important market.

Hotels and restaurants

Hotels and restaurants that sell Myanmar cuisine are another market for dried shrimp. With the growth of the ‘consuming class’ and tourism, the number of these establishments is likely to increase dramatically in the near future. However, at present most of these outlets buy directly from wet markets or supermarkets. However, there may be niche opportunities to develop relationships with individual hotels and restaurants, as

well as chains, that want a consistent supply of premium quality dried shrimp, which meets food safety requirements.

Souvenir shops

In Myeik and other coastal towns with large numbers of tourists, souvenir shops exist which sell a variety of traditional processed seafood products to tourists, including business tourists. At present, there are eight souvenir shops in Myeik city. These retailers sell dried shrimp either loose, to be weighed and packed for the consumer, or already packed in plastic bags and labelled in a variety of pack sizes. This is a niche retailer, but the number of tourists and business travellers in Myeik is likely to increase in the near future.

Souvenir shops in Myeik look for the same quality characteristics which were outlined in the introduction to the domestic market analysis. They will not purchase low quality dried shrimp, though they will purchase shrimp of mixed sizes, because they often carry out size grading themselves. In general, they are not interested in purchasing packaged and labelled dried shrimp, because they prefer to carry out the packaging and labelling themselves.

Recommendations for markets to target

Based on the market analysis conducted so far, Yangon value-added processors, as well as supermarkets and chain-minimarts offer the best markets to target. Yangon value-added processors are attractive because they can buy large volumes and some are willing to pay higher prices for dried shrimp which meets quality and food safety standards. If Myeik collectors sell to this channel, this would shorten the chain between processor and buyer, which would also increase the flow of information between these actors, making it easier for processors to understand the needs of the end-market and deliver dried shrimp which meets their requirements.

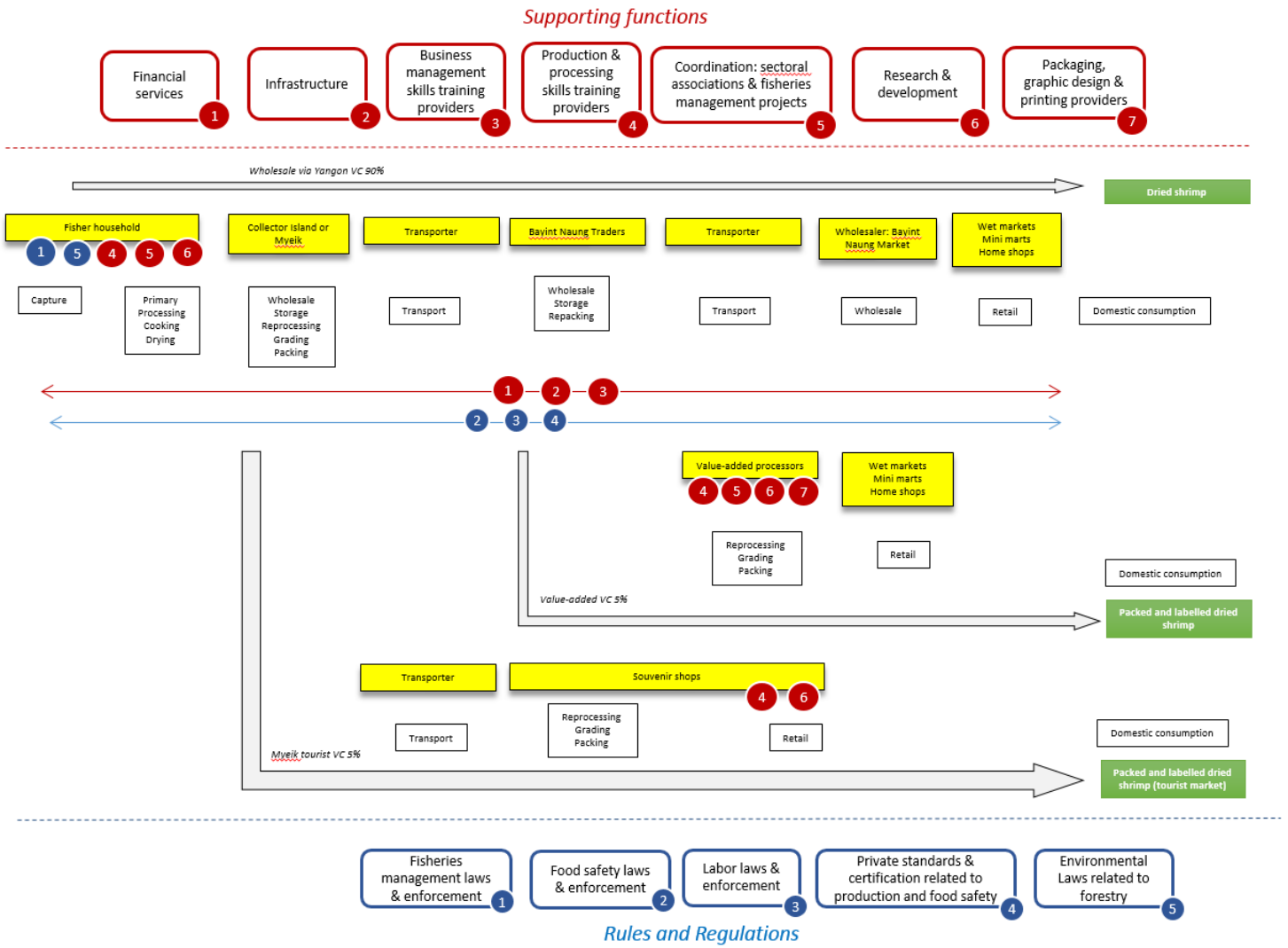
Supermarkets and chain-minimarts are recommended because they want to buy high quality, packaged and labelled products, which attract higher prices than those for bulk products sold on the wet markets. In addition, they are willing to purchase large volumes of these products and the rapid expansion of these retail outlets means that they are likely to increase the volumes which they purchase in the future. They also offer a distribution service if products are delivered to a central location.

The fact that they demand that quality and food safety requirements are met, and that FDA approval has been granted, reduces competition for these markets. It also provides an incentive which can help drive improvements in quality and food safety at the fisher and processor level. If these actors can meet the necessary standards, they will be able to command a better price for their products.

Finally, selling to these buyers will also help form relationships where feedback is provided about the preferences of high end consumers want. This can create a flow of market information which makes it possible to continually improve and react to changing requirements in the future. Selling in bulk to wholesalers does not provide this feedback.

Value chain map

Figure 13: Dried shrimp value chain map



Value chain actors

The table below summarises key actors in the dried shrimp value chain and the available data on their location, population and volumes of product traded as well as average price received. This is followed by a description of each actor.

Table 2: Key actors in the dried shrimp value chain

	Function	Location	Number	Employees	Volumes	Selling price (Kyat/viss)
Fisher/processor households	Catch shrimp. Process shrimp: drying and de-shelling. Sell to collectors and traders.	Islands & coastal villages	200-400	4 – 5 Men: 70% Women: 30%	20 to 300 viss (32 – 480Kg) / month	20,000 – 26,000 / viss depending on size (9.26-12.03 USD/Kg)
Collector: islands	Accumulate product from processors. Additional drying. Grade according to size. Sell on. Provide credit to fisher/processors.	Islands & coastal villages	n/a	4 – 5 Men Women	n/a	n/a
Collector: Myeik, large	Accumulate product from processors. Additional drying. Sorting and grading. Packing. Sell on.	Myeik	5	4 - 6 Men	3000 to 4000 viss (4800 – 6400 Kg)/ month	20 - 30,000 / viss depending on size and quality (9.26-13.89 USD/Kg)
Collector: Myeik, small	Accumulate product from processors. Grading. Packing. Sell on.	Myeik	10	1-2 Men	500 viss (800Kg) / month	n/a
Souvenir shops	Package and label. Sell to tourist market	Myeik	8	2 -6 Men Women	n/a	25-30,000 viss, depending on size 11.57-13.89 USD/Kg)
Bainyt Naung Traders	Receive in sacks from collectors. Store and sell	Yangon	30	5 - 10	n/a	n/a
Yangon processors	Package and label for distribution to retail outlets	Yangon	n/a	Men Women	n/a	n/a
Intermediate wholesalers	Buy from Bayint Naung traders in Yangon. Transport and sell on	Urban centres	n/a	n/a	20 viss (32Kg) / week	20,000[10] - 60,000 / viss (9.26-27.78 USD/Kg)
Wet markets, Mini marts, home shops	Provide purchase point for consumers. Sell in small quantities.	Urban centres	n/a	n/a	n/a	35,000 -70,000 / viss depending on quality and pack size (16.2-32.4 USD/Kg)

[10] Note that from this point on, the dried shrimp are not only from Myeik, but all parts of the country.

Fisher/processors

In the townships studied, the majority of households involved in the processing of dried shrimp also carry out the capture of shrimp. With this in mind, the following section covers both capture and processing. It should also be noted that these SMEs were found to operate only in coastal villages and on the islands, with no dried shrimp fisher/processor SMEs operating in Myeik city.

Fisher/processor households catch the shrimp using either stow nets, push nets or tidal trap gears. Ice is not used by prior to processing to to keep shrimp cool. After landing, the shrimp are boiled/cooked for 30 mins to 1 hour in seawater, then pressed to remove excess water before being sun dried for 1 to 3 days. During the drying process the shrimp are sorted out from small fish which are mixed in with the shrimp. To remove the shell from the dried shrimp, they are put into a rice sack and beaten on the ground to loosen the shell.

The method described above for shell removal is a major cause of breakage, resulting in reductions in quality and income received. The fishing method as well as the quality of water used for washing/cooking the shrimp is also said to affect the quality of the end product. In addition, the characteristics of the fishing ground also have an effect. For example, shrimp caught in areas with brackish water have a good flavour/taste. They are said to be “sweeter”.

Figure 14: Dried shrimp of differing quality

Rain affects the ability to sun dry, so firewood driers are used during the rainy season. Firewood, usually mangrove wood, is used for the cooking process as well as powering the dryers used in the rainy season. Firewood is usually collected from nearby areas. There are two types of drier used: cement platform and iron sheet. The latter is associated with poor quality end products, such as black or burnt shrimp. Large catches are also associated with lower quality products and shrimp are sometimes inadequately dried before being sold to collectors. The small size of some shrimp make it difficult to remove all the shell after the drying process.

Figure 15: Breakage caused by the current processing methods

The majority of fisher/processor households are found on islands. They are relatively poor with low levels of capital and business skills. They are often indebted to collectors, who advance money to secure supplies of shrimp. Men are engaged in shrimp harvesting and may own several nets/gears. Women are involved in drying and processing. However, the work for both women and men is seasonal, with most, activities being carried out during the dry season. Processors on the island reported that it is difficult to find reliable hired labour.

Fishers complain that shrimp catches are generally on the decline due to fishing pressure. Whilst catches are declining, selling price has increased. Processors are also often indebted to collectors who advance funds in order to secure supplies of dried shrimp.

Most processors households produce between 10-30 viss (16-48Kg) of dried shrimp per month, though some produce up to 300 viss (480Kg) per month. Processors sell ungraded shrimp in bulk to collectors or Myeik-based 'souvenir shops'. The reason stated by processors for selling ungraded is that they are not sure whether collectors would purchase the smaller size shrimp. Weights are apparently estimated by processors and different sizes and quality of shrimp are mixed together. Weighing, grading and sorting before selling may help processors achieve a better price for their products.

Although it was not possible to observe dried shrimp harvesting and processing activities first hand, key issues reported were: the lack of adequate access to potable water; the likely use of nearshore polluted seawater for any washing of shrimp or facilities; drying the shrimp on the ground which is open access for people and animals; and the lack of personal hygiene standards. In addition, the shell removal process is fairly ineffective, because it causes the dried shrimp to be broken into small pieces and often leaves bits of shell on the shrimp. Together these issues reduce the prices received.

Collectors

Collectors accumulate quantities of dried shrimp from processors. They are akin to wholesale traders and almost all are based in Myeik city, with only 1 identified on an island. The collectors based in Myeik city purchase from a large number of processors, that are based on many different islands. As such, they don't have close relationships with many of their suppliers. The processors normally deliver directly to the collectors in Myeik.

Figure 16: Collectors sieve shrimp after purchase to grade the product before sale

Collectors check the current price of dried shrimp in Yangon before agreeing a buying price with processors. In order to set the price, they also check the size, moisture content, breakage, amount of shell left on the shrimp and shrimp colour. Collectors receive the shrimp in sacks, then use woven basket sieves of different sizes to sort and grade it into 3 different sizes (large, medium, small) and to separate out a fine shrimp powder, which is sold for poultry feed. Grading also removes impurities such as broken shells. If the moisture content is deemed high, then the shrimp are also dried again using electric fans. Up to 40 % of shrimp arriving in Myeik can be broken.

Collectors in Myeik City deal with between 500 and 4,000 viss (800-6,400Kg) of dried shrimp per month. Some product is sold locally in Myeik to souvenir shops and wet markets, but the bulk of graded shrimp is sent by road to Bayint Naung market in Yangon. There is also some cross-border trade from Myeik to Thailand. Collectors tend not to store dried shrimp for more than a few days, preferring to sell as soon as possible. This is due to the short storage life of the product, even though it is dried.

Collectors have sufficient capital to advance finance to processors and accumulate product at good price. One of the challenges facing collectors is quality control as they receive product from a variety of different processors, over whom they have little influence in terms of handling and hygiene practices. To upgrade, they would need better coordination with processors regarding quality requirements and the use of simple equipment for grading and shelling to improve quality and reduce losses.

At present, they are selling the vast majority of their dried shrimp to Bayint Naung wholesale traders. The reliance on this market has developed because Bayint Naung traders can purchase large volumes. A general feeling amongst collectors is that the Bayint Naung traders cheat them on weights and prices as well as take

overly long to pay the money from sales. Some collectors also sell to local souvenir shops in Myeik in limited volumes. Collectors have limited knowledge of other markets that they could sell dried shrimp to and limited capacity to carry out market research.

Souvenir shops

A number of souvenir shops in Myeik town cater to the needs of tourists for seafood products from the area. These shops tend to stock a variety of dried fish and shrimp products which are packed and labelled. Dried shrimp is one of the two most popular products sold.

Figure 17: Dried shrimp on display in a souvenir shop in Myeik

The shops mainly source dried shrimp from Myeik-based collectors, though some is also sourced from processors in particular communities. If the product is sourced from processors then the souvenir shop will carry out sorting and grading using the process outlined in the above section about collectors. The dried shrimp are weighed and then packed in plastic trays and labelled. They are then sold direct to consumers in the shop.

Some souvenir shop owners are aware that their products could be sold in other outlets, such as supermarkets in Yangon and Mandalay. However, they are constrained by either the incentive to try to access this market, a limited understanding of such new markets and the ability to carry out market research.

Some have capital to invest, a mind-set geared to accessing new markets and new ideas and have social/business network and links to Yangon which may assist in getting a foothold into the high value urban market. Furthermore, souvenir shop owners tend to have some understanding of GHP as well as the use of packaging and labelling.

On the other hand some are fearful of the demands that retailers can impose related to product requirements and volumes. In which case, the likely demand from a growth in tourism industry in the future may prove more attractive for some, particularly if large quantities of shrimp cannot be guaranteed.

Wholesale traders, Yangon

A large proportion of dried shrimp from Myeik goes from collectors to wholesale traders in Bayint Naung market in Yangon. This market is a major conduit for dried and cured fish from all over the country. The traders receive the product, store it and sell on to wholesalers from different parts of the country as well as to value-added processors in Yangon and exporters. As with shrimp paste, the majority of wholesale traders in Bayint Naung act as brokers, arranging sales between buyers and sellers, and taking 5% commission for each sale. The income from the sales is passed onto the collector. The traders in Bayint Naung collude to set the selling prices for products. The traders have access to many buyers and sellers and run what appears to be a relatively low risk business based on commission.

Large volumes of product from many different suppliers make it difficult to guarantee consistent quality and the market environment is also not conducive to good handling and storage practices. Feedback from a number of suppliers suggest that the traders here are not trusted over transactions and delay in sending money back to collectors after sales. The Bayint Naung traders supply dried shrimp to domestic as well as export buyers.

Value-added processors, Yangon

Some larger, value-added processors purchase dried shrimp from Bayint Naung market in Yangon. They grade the shrimp, and then package and label it. It is mainly sold to mini marts and supermarkets in urban centres within Myanmar. Though some high quality shrimp is exported to other countries in Asia.

Intermediate wholesalers

Intermediate wholesalers/retailers in Yangon buy small volumes of dried product every week from the Bayint Naung wholesale market. They then sell it by weight to buyers from wet markets and home shops, hotels and restaurants. Traders have sealing machines and plastic bags, which enable them to pack products for customers at the time of purchase. Some product is ready packed in plain plastic bags with or without labels no label but have been weighed.

Retailers

Dried shrimp is retailed to the final consumer through wet markets, home shops, mini-marts, supermarkets, hotels and restaurants. Please refer to the above section on 'analysis of domestic markets' for a description of these actors.

Figure 18: Dried shrimp for sale in supermarket in Yangon

Supporting functions

The performance of SMEs in this value chain is influenced by a number of supporting functions. These are outlined below.

Infrastructure

Both boat and road transport function adequately, given that the product is robust and has a relatively long storage life. Road infrastructure has improved over the last decade and this has helped the distribution of fish from production areas to markets.

For processors on the islands, various types of infrastructure required to support GHP are lacking. In particular, there is limited access to potable water and fish landing infrastructure is inadequate.

Electricity would be required for packaging and labelling, and the use of some improved technologies such as mechanical driers. At present electricity for island processors is expensive[11] and only available to purchase from generators that operate at night.

[11] The cost of mains power in Yangon is said to be between USD 0.038 – 0.083 per kWh, whereas generator electricity costs in Myeik are between USD 0.20 and 0.30 per kWh

Telecommunications infrastructure has improved greatly in recent years. Myeik city has strong mobile phone and 3G network coverage. Coverage on the islands is more variable.

Packaging, graphic design and printing services

Some packaging materials are available in Myeik, sold through a limited number of retailers. In general, the variety and quality of packaging materials available in Myeik is lower than Yangon and the prices are more expensive. In response, some food processors in Myeik purchase their packaging materials directly from suppliers in Yangon.

Graphic design services in Myeik are not well developed. Local food processors normally ask local printing/IT shops to produce designs, which are very basic. Some of the souvenir shops contact graphic designers in Yangon who are able to produce better designs, though these are still not as attractive and professional as those used by larger Yangon food processors. There are also several printing shops in Myeik, which are able to print a fairly wide variety of labels. However, they are not as advanced as competitors in Yangon.

Competing with processors in Yangon for a share of the value-added retail market will require access to improved packaging and labelling services. This could be achieved either by accessing improved services in Yangon or developing the services in Myeik.

Processing equipment suppliers

The machines that larger processing companies use for dried shrimp processing are grading machines; drying machines; and de-shelling machines. These items are available for purchase in Thailand, but are not available in Myeik or Yangon. However, there are local engineering firms in Myeik which design and build similar machines for larger seafood processing companies and for processors in agricultural sectors, such as rice millers. Potentially, the engineering firms could design equipment that is relevant for dried shrimp processors in this area.

Financial services

Very limited formal microfinance is available to SMEs in Tanintharyi Region. Myeik Public Corporation is providing 100,000 Kyat (74 USD) loans to retailers, with 2.5% interest charged per month on the loans. Pact is creating Village Development Committees, which will administer Village Development Funds. These could provide finance to processed seafood SMEs in the villages where the project operates.

Informal finance for processors is widespread. In particular, collectors and wholesale traders provide loans to processors. However, some processors reported that they are permanently indebted to local moneylenders and find it difficult to repay loans.

Skills, information and learning

Marketing skills, information and learning

One of the barriers to improved market access for collectors, souvenir shops and value-added processors in Myeik is the fact that they lack information on new markets, the preferences of consumers and food safety requirements. A major cause of this lack of information is the fact that most dried shrimp is being sold to Bayint Naung wholesale market, which will purchase a wide variety of types and quality of dried shrimp and has no incentive to communicate the preferences of other markets. It is also caused by the fact that SMEs in Myeik lack key marketing skills, particularly the capacity to carry out market research independently. In

addition, the flow of market information from collectors to processors is fairly weak and there is limited trust between these actors.

Production skills, information and learning

Processors already have the skills to process dried shrimp to a basic standard. However, targeting new markets will require improved quality and food safety, which involves upgrading production practices. Larger processing companies in Myeik are able to identify and recruit consultants to upgrade their production practices to meet market requirements. However, the financial limitations of dried shrimp SMEs mean that this is not feasible for these actors. There are no local training providers delivering training on either dried shrimp production or food safety, though 10 companies were identified in Yangon that provide training in generic food safety standards Upcoming projects in the fishery sector in Tanintharyi region could potentially provide relevant training, though as yet there are no plans to provide training on these specific topics.

Given that the 3G network is relatively widespread, there is theoretical potential for websites and apps in Myanmar language that provide basic information on these topics. However, at present there is very limited information available through these channels.

Other business management skills, information and learning

In addition to marketing and production skills, dried shrimp SMEs will need to improve a variety of other business management skills to meet the requirements of new markets and to expand their businesses. These include financial management, HR and stock control skills. One provider of business management training was identified in Myeik. However, the training is rather infrequent and given limited efforts to promote the training, it is very unlikely that island based processors would be aware of the course.

Coordination

The Myeik Fisheries Federation (MFF) is the umbrella organization for all private sector stakeholders in the seafood sector in Myanmar. MFF has 10 member associations for different sectors within the industry. These include the Myanmar Shrimp Association and the Myanmar Fish Paste, Dried Fish, Fish Sauce Entrepreneurs Association. However, neither of these corresponds directly to the interests of dried shrimp processors.

The Myeik District Fisheries Federation (MDFF) provides local representation of MFF. Large scale processor-exporters are well-represented in MDFF, but SMEs engaged in the dried shrimp value chain are not currently well-represented.

At village level, various projects are initiating committees and associations, which could provide forums for coordination. Tanintharyi Regional Fisheries Partnership is forming associations in coastal villages across Tanintharyi Region. A PACT project is forming Village Development Committees in selected project villages. Fisheries management projects by Flora and Fauna International, as well as World Conservation Society and DANIDA/Department of Fisheries will also form groups for fisheries management, which are likely to include large numbers of individuals engaged in seafood processing. But above village level, there is very limited coordination between dried shrimp processors.

It is also worth noting that souvenir shops in Myeik have recently formed an association.

Research and development

The Marine Science Department of the University of Myeik carries out research on biological and socio-economic issues related to fisheries, though in the last eight years there have been no studies on dried shrimp processing. Companies can also commission research on topics which are of use to their work, though this is beyond the financial capacity of SMEs that produce dried shrimp.

In terms of market research and the development of new products, large processing firms in Myeik can identify and recruit national or international consultants that can carry out these processes. However, the financial limitations of SMEs producing dried shrimp mean that this is not feasible for these actors.

Rules

Fisheries management

The Myanmar Marine Fisheries Law (1990), which is currently being revised, provides the overarching legal framework for the management of the fisheries sector. The Department of Fisheries produces more specific regulations for each state or region, which are revised regularly; issues licenses to fishers; and monitors fishing activity. The navy is responsible for the enforcement of laws relating to fishing operations. At community level, there may also be informal rules related to fisheries management which are agreed between fishers.

Although it was beyond the scope of this study to explore this topic in detail, discussions during this study and as part of the previous process of drafting the 'Guidelines on sustainable practices for Myeik District Fisheries Federation' suggest that enforcement related to fisheries operations is fairly weak. Infringements of rules related to fishing grounds and closed seasons were reported to be common, and fishing without licenses was also reported to occur.

Food safety

Government

The Department of Fisheries has issued a number of directives related to food safety and quality within the framework of the Marine Fisheries Law No 9/1990, which are detailed in Annexe 2. Collectively, these directives seek to minimize health risks associated with fish and crustacean production and guarantee an acceptable quality of production.

The Department of Food and Drug Administration is responsible for over-seeing and ensuring food safety and the safe production of foods for sale to consumers. According to the National Food Law (1997), food businesses should be registered and certified by the FDA. To gain certification, the FDA must inspect the business. In practice, the exact criteria against which the inspection is carried out are slightly unclear, however, with some processors reporting that they were given a specific 'checklist' and some not. In addition, the FDA is hampered by a lack of resources, which makes it difficult to monitor food safety across such a large sector.

Other organizations involved in ensuring product quality are the Ministry of Health, whose laboratory is capable of biological and chemical analysis, and the Ministry of Industry, whose food control laboratory aids it in its function of licensing food manufacturing establishments. Lastly, the Food Industries Development Supporting Laboratory of the Myanmar Food Processors and Exporters Association conducts quality and safety analyses on food and water.

The Department of Fisheries is the EU appointed competent authority responsible for issuing catch and health certificates, inspection of factories, landing sides and farms and the implementation of the Residue Monitoring Plan.

There is a fisheries inspection and quality control unit - The Yangon Division of the Department of Fisheries Research and Development Unit- within the Institute of Fisheries Technology and Marine Fisheries Research. In some parts of the country, it has organised capacity building on topics such as fisheries inspection and quality control. However, no capacity building activities were identified in Myeik.

Private standards and certification

Globally a variety of private standards exist in relation to food safety, such as ISO 22000 Food Safety Training and Assessment; FSSC Food Safety System Certification; Hazard Analysis Critical Control Points (HACCP); and Good Hygeine Practices (GHP). Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research also identified 10 companies in Yangon which are able to provide training in one or more of these standards.

Crosscutting considerations

Labour

At the fishing and processing level, a mixture of household and hired labour is used to carry out the main tasks. This work is predominantly part-time or seasonal. The use of household labour in fishing and processing introduces a risk that child labour may occur, though further research is required to confirm the exact extent. There may also be occupational health and safety issues related to fishing and processing operations, though further study is required to confirm this.

Gender

Men are engaged in fishing and more physically demanding labouring work. They also dominate the collection activities and are involved in trading. Women undertake processing at the household level, collection of dried shrimp, manage or are employees in souvenir shops, work in and manage value-added processing SMEs and are engaged in trading activities particularly at the retail level. The development and growth of SMEs is therefore likely to benefit both men and women, particularly through employment creation, albeit seasonal, at the fisher/processor level.

Environmental

From an environmental perspective there are two major issues. The fishery is relatively open access which means there is little control over fishing effort. Consequently overfishing and reducing catch per unit effort are noted. Secondly, both the shrimp boiling/cooking and rainy season drying process relies on firewood, much of which appears to be harvested from mangrove areas adjacent to communities. Further information is required on the environmental impact of this practice.

Conflict and security

Anecdotal evidence suggests there is some conflict between the small-scale shrimp fishers and inshore fishing vessels which encroach into the nearshore shrimp fishing grounds.

Figure 19: Dried shrimp boiler and firewood used

SWOT analysis

The following table presents the results of a SWOT analysis of the dried shrimp value chain, drawing on the information collected about markets, value chain actors, supporting functions and rules.

Figure 20: SWOT analysis of the dried shrimp value chain

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Dried shrimp processor	Quality of Myeik shrimp and brand well known as good/sweet Provides employment opportunities for women and men Knowledge of how to process shrimp Market in Myeik well known also in Yangon	Process small-quantities of shrimp Impact of rainy season on drying and processing Use of unclean water in processing leading to low quality products Lack of awareness and application of GHP Use of iron plates for drying in rainy season producing low quality products Inadequate drying of shrimp Prawns from Myeik bend when cooked so look smaller than those from other areas Estimate weights of production so do not know real weight in	Storage life of the product Robust product can withstand transport and distribution Scope to improve quality of dried shrimp and reduce losses before sent to collector Well established traditional product consumed by a high % of population Popular export product Initiatives related to co-management, environmental protection and	Decline in catches of shrimp Use of non-approved food colourings Incursion of off-shore vessels into inshore areas Net fence fishing leading to overfishing of shrimp Use of mangrove wood for boiling and drying in rainy season Collectors cheat on weights when buying from processors

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
		order to negotiate with collector Indebtedness to collectors limiting options for price negotiation and accessing new markets Removal of shell difficult and leads to breakage of dried product Lack of record keeping/financial management Seasonal production – mainly for 3 to 6 months of year Living conditions and access to services not conducive to improving processing practices	micro-finance	Fishing method affects quality of dried shrimp
Dried shrimp collector - island	Have sufficient capital to advance to processors and accumulate product at good price Provide a quality control role Market linkages with Myeik and Yangon	Limited understanding of markets and capacity to collect information Limited access to capital for expansion Communications with mainland e.g. boats, mobile phone Need for GHP Energy costs on islands limiting use of equipment and value-addition Limited access to packaging and labelling services/supplies Mind-set of some limits interest in new ideas Lack of business skills	Potential to deal direct with retailers in Yangon Value-added products – retail packaging & labelling, alternative packaging for small-scale wholesalers and home-shops Prawn sauce as a niche product Growing population and increasing demand for fish	Competition for shrimp from other collectors and increasing number of souvenir shops Sustainability of supply
Dried shrimp collector Myeik	Have capital to invest Ability to collect large quantities of dried shrimp from a diversity of suppliers Provide a quality control role	Limited understanding of markets and capacity to collect information Receive product from different processors and cannot control quality Need to grade shrimp before	Potential to deal direct with retailers in Yangon Value-added products: retail packaging & labelling, alternative packaging for small-	Competition for dried shrimp from other collectors, buyers in Yangon who grade and pack for supermarkets and increasing number of souvenir shops

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	Market linkages with Myeik and Yangon Communicate with Bayint Naung over price before buying from processors Access to packaging and labelling services/supplies Some have mind set geared to accessing new markets and new ideas Social/business network and links to Yangon	selling on Need for GHP/GMP and other quality requirements of major retailers Low quality dried shrimp in rainy season Need to re-dry some shrimp from processors as to high moisture content Energy costs limiting use of equipment and value-addition Costs of packaging and labelling locally more expensive Mind-set of some limits interest in new ideas Lack of marketing skills	scale wholesalers and home-shops Growing population and increasing demand for fish Transport improvement – road development provides more market opportunities Lowering of future energy costs with installation of new gas power plant in 5 years time Equipment for grading, drying, shelling	Lower production in Myeik area now and sustainability of supply Competition from shrimp from other regions Dependent on Bayint Naung wholesalers and weak bargaining power leading to lower prices and cash flow problem
Souvenir shops	One of the top 3 most popular products sold Packaging and labelling used for value-added products Can source product direct from processors Customer services skills Strong awareness of the tourist market in Myeik Some have capital to invest Ability to collect shrimp from a diversity of suppliers Provide a quality control role Access to packaging and labelling services/supplies/equi	Limited understanding of new markets and capacity to collect information Need to grade before selling Need for GHP and understanding of standards Energy costs limiting use of equipment and value-addition Perception that supermarkets require quality standards that are difficult to meet e.g. colour change in product so it must be returned Costs of packaging and labelling locally more expensive Mind-set of some limits interest in new ideas Lack of marketing skills	Likely growth of tourism industry in future Dried shrimp has a wide consumer base – local and foreign Potential to deal direct with retailers in Yangon New port development in Dawai offers an important future market Potential to improve packaging and labelling Growing population and increasing demand for fish Transport improvement – road development provides more	Growth in new souvenir shops leading to stiff competition for paste Decline in production, causing issues with sustainability of supply Increasing costs of renting retail space

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	pment Some have mind set geared to accessing new markets and new ideas Social/business network and links to Yangon		market opportunities Lowering of future energy costs with installation of new gas power plant in 5 years time Scope for distributor in Yangon to distribute products in Yangon	
Dried shrimp wholesaler, Bayint Naung	Control of main market channel Set selling price of dried fish collectively Focal point for export buyers from China, Singapore, Malaysia Element of collectivism amongst traders Possess capital Access to many buyers and sellers Relatively low risk business, based on commission	Poor handling and storage practices & food safety standards Cannot guarantee quality	Continuing demand for dried shrimp and growth in number of buyers Export and domestic market opportunities Capacity to diversify business interests	Reputation as untrustworthy Ability to meet health and safety standards

Upgrading strategy

Based on the understanding generated from the research and analysis, the following upgrading strategy is proposed.

Capitalise on the reputation of Myeik seafood

Myeik seafood has a strong reputation in Myanmar for high quality. But at present most dried shrimp coming from Myeik does not specify its origin. Labelling dried shrimp as originating from Myeik would help make this clear to the consumer and would promote Myeik as a distinct brand.

New market channels

Apart from a small amount of product which is sold through souvenir shops, most dried shrimp from Myeik leaves the area in sacks for sale at a relatively low price via traders in Bayint Naung market in Yangon. It is

proposed that Myeik actors target two new markets. Firstly, sell dried shrimp to Yangon value-added processors. Secondly sell dried shrimp as packaged and labelled products to high-end retailers, such as supermarkets and chain-minimarts, in cities such as Yangon, Mandalay, Sagaing and Dawei (particularly once the Special Economic Zone has been completed).

Packaging and labelling: retail, small-scale wholesalers and home-shops

It is proposed that more processors in Myeik start to package and label their dried shrimp. Retail packaging and labelling of dried shrimp for retailers is a simple and relatively straightforward means to add value and increase profits for SMEs, while at the same time making a high quality product more convenient for urban consumers. Producing labels which meet FDA labelling requirements would also help consumers to be aware of relevant food safety issues, such as expiry dates.

Although processors can purchase packaging and labelling materials from suppliers in Yangon, it would be advantageous if local suppliers were able to provide services that are competitive with those in Yangon. As such, a related objective is the improvement of packaging and labelling service providers in Myeik.

New products

It is also recommended that SMEs diversify into producing new products. One example is shrimp powder, which can be marketed as a healthy substitute to MSG, though it also recommended that the potential of other new products is explored.

Improve quality and food safety standards of dried shrimp at processing and collection

SMEs will need to respond to new market requirements and standards if higher value markets are to be accessed and developed. This will entail the application of GHP, improved handling and processing to reduce breakage, dry properly, improve removal of shell and eliminate the contamination of dried shrimp at processing and during distribution as well as pack and label properly. The Thai dried shrimp standard[12] provides some quality parameters that could be adopted, particularly if the Thai market is being targeted:

Improved processing equipment options should also be explored. Ideas can be gleaned from larger processing companies, which employ drying machines, grading machines and de-shelling machines, which can improve quality and reduce losses.

Sustainable management of fisheries and mangroves

To ensure the sustainability of dried shrimp production and hence supply, will require careful attention to resource management. Fishers reported that catch per unit effort has been declining over the last five years. The government has the mandate to ensure sustainable management of fishery resources and there are planned co-management initiatives, implemented with development partners, to try to improve the management of shrimp and other fishery resources in Myeik.

In addition, improved practices are required to prevent unsustainable use of mangroves. This could either involve the use of alternative energy sources to power the drying process during rainy season, or management practices to ensure the sustainable use of mangroves. Development partners with a mandate for environmental conservation programmes should be made aware of the need for activities in this area.

[12] http://www.acfs.go.th/standard/download/eng/Dried_shrimp.pdf

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new markets.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce value-added products and access new markets. Finance would be required for working capital, upgrading facilities and procuring equipment, as well as packaging materials and perhaps training and advisory services.

Dried fish

Product description

A large number of different dried fish products are produced in and around Myeik. Numerous species, both demersal and pelagic, are sundried. Some species such as Indian thread fin bream and croaker are salted and sundried. Squid are boiled and then sundried.

Market analysis

Dried fish is used extensively in Myanmar, Bangladeshi, Chinese, Hong Kong, Indonesian, Cambodian, Thai, Philippino, Malaysian and Vietnamese cuisine. In Myanmar, dried fish is popular with both low and high income consumers in all states and regions.

Bearing in mind the current low capacity of dried fish processors in Tanintharyi Region, the value chain analysis team recommend that accessing higher value markets within Myanmar would be a logical first step, rather than attempting to access export markets first. A detailed analysis of export markets is required if producers wished to access this market in future. As such, the remainder of this section focuses on analysing the domestic market.

Analysis of overall domestic demand and supply

Demand

Dried fish is a popular product in Myanmar, and the different products and species cater for different tastes and purchasing powers. The demand for dried fish tends to be strongest in the inland and highland areas (Upper Myanmar) where it is an important source of low cost animal protein. It is less popular in Yangon due to the availability of fresh fish.

To give some examples of national demand for species which are caught in Tanintharyi region, average consumption per capita per year is 0.15Kg of dried Indian threadfin and 0.1Kg of Spanish mackerel (Needham and Funge-Smith, 2015). Given a population of 54,000,000, estimated total consumption in Myanmar is approximately 8,100 tonnes per year of dried Indian threadfin and 5,400 tonnes per year of dried Spanish mackerel.

Given the fact that fish catches have reduced dramatically in the last 5 years, that dried fish is a well established traditional component of the Myanmar diet and the population is increasing (0.87% per annum), the likely future trend is one of strengthening demand and increasing prices. On the other hand, improvements in cold chain infrastructure and practices in future may result in an increasing proportion of catch being distributed fresh/frozen and less being dried.

Supply and competition

Dried fish is produced in several coastal areas of Myanmar, including Ayeyarwaddy Region, Rakhine State and Tanintharyi Region. Some freshwater fish, such as snakehead, are also caught and dried in inland areas. Although dried fish is produced in many countries in Asia, no evidence was found during the mission of imports of dried fish into Myanmar.

Species commonly dried in Myeik include Spanish mackerel, catfish, rays, sharks and small fish species such as sardine, Indian mackerel and anchovy. Some producers specialise in high value products made from Indian threadfin bream and croaker.

Analysis of domestic markets

This research identified three major existing and potential domestic markets for dried fish: Yangon value added processors; wet markets/home shops; and supermarkets and minimarts. In addition, hotels, restaurants and souvenir shops provide further niche end markets. Each have different consumers, requirements and likely trends for the future. These are presented below.

Across all of these markets there are several characteristics that determine the price of dried fish. Different species command very different prices. Within species, price is also influenced by quality, which is determined mainly by colour and fat content. For example, white or light coloured salted and dried threadfin bream (a high value product) command a higher price than brown coloured products.

Yangon value-added processors

In Yangon there are a number of value-added processors which operate in different ways. Some are currently purchasing dried fish from Bayint Naung market in Yangon, re-drying it, then packaging and labelling it. These processors then sell the majority of their products to minimarts and supermarkets in urban centres within Myanmar.

They have relatively high standards in terms of quality and food safety, due to the fact that their products are sold in higher-end retail outlets, which are fairly demanding. More information about the requirements of specific retailers is provided below.

Typically, Yangon value-added processors purchase from wholesale markets in Yangon. Purchasing through wholesalers has its weaknesses, because it is harder to develop relationships with individual suppliers and to guarantee the quality of their products. As such, there is an opportunity for Myeik actors to develop more direct relationships with these companies. Individual processors would probably not be able to supply the volumes required by these actors, so it is likely that a collector, or other actor who could source dried fish from various sources, would be best positioned to develop relationships with these companies.

Wet market retailers/home shops

Traditional wet markets and home shops offer a wide variety of fresh foods and are conveniently located. Most retailers of this type keep the dried fish out on stalls or hanging, then weigh it and put it into bags when making a sale. They are frequented by all classes of consumer. Consumers at the wet markets are fairly sensitive to price and most are also concerned with quality. Some consumers will accept lower quality dried fish than those shopping at supermarkets, provided the price is also appropriately reduced. The majority of consumers shopping at the wet markets do not require that dried fish is packaged and labelled.

Supermarkets and minimarts

As mentioned in the shrimp paste and dried shrimp analysis, supermarkets and minimarts are present in most large urban centres and the consumers that shop in them are less-price sensitive than those shopping at the wet markets. They are also more interested in quality of product, more concerned with food safety and require products with attractive packaging and labelling. These retailers usually sell dried fish packaged and labelled in a variety of pack sizes.

The product requirements and procurement practices of supermarkets differ from those of minimarts. Supermarkets are constantly looking for new suppliers and are open to trialling products that meet their

requirements. Some have started requesting suppliers to produce dried fish in accordance with Good Hygienic Practices (GHP). In addition, most have requested that suppliers have gained FDA registration and approval, and that products are labelled in way that conforms to labelling legislation. One major retailer reported that products that meet the basic requirements for food safety and labelling must then meet further consumer preferences. In particular, they need to have attractive labelling and to meet customer packaging preferences. The products are also sensory evaluated by the supermarket. If products meet these requirements, they will trial the product. Sales will then be assessed and, if they decide to stock the product on an ongoing basis, they will require suppliers to supply large volumes throughout the year. One large supermarket interviewed reported that suppliers sometimes cannot meet the volumes requirements required, especially during the rainy season. In addition, they indicated that they would like to see more vacuum packed products in future. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores.

Mini-marts are small shops, which have a limited range of products on sale. There are two main types. First are chain-minimarts, which are chain stores operating as part of larger companies. Examples are Grab and Go, Union Mart, City Mart and ABC. These may have over 50 branches per city. The product requirements and procurement practices of these chains are broadly similar to those of the supermarkets. Suppliers can send their products to a central distribution centre and the supermarket can handle the distribution to individual stores. Second are family minimarts, which are not affiliated to large chains, but operate as independent, family-run stores. In these cases, procurement practices may differ from those of supermarkets. Most notably, the quality, food safety, packaging and labelling requirements are often lower than those required by supermarkets. In addition, lower volumes are required than for supermarkets.

Given the increase in the 'consuming class', which was highlighted in the demand section above, it is probable that supermarkets and mini-marts will expand rapidly in the near future, making them an increasingly important market.

Hotels and restaurants

Hotels and restaurants that sell Myanmar cuisine are another market for dried fish. With the growth of the 'consuming class' and tourism, the number of these establishments is likely to increase dramatically in the near future. However, at present most of these outlets buy directly from wet markets or supermarkets. However, there may be niche opportunities to develop relationships with individual hotels and restaurants, as well as chains that want a consistent supply of premium quality dried fish, which meets food safety requirements.

Souvenir shops

In Myeik and other coastal towns with large numbers of tourists, souvenir shops exist which sell a variety of traditional processed seafood products to tourists, including business tourists. At present, there are eight souvenir shops in Myeik city. These retailers sell dried fish either loose, to be weighed and packed for the consumer, or already packed in plastic bags and labelled in a variety of pack sizes. This is a niche retailer, but the number of tourists and business travellers in Myeik is likely to increase in the near future.

Souvenir shops in Myeik look for the same quality characteristics which were outlined in the introduction to the domestic market analysis and they do not purchase dried fish of low quality. In general, they are not interested in purchasing packaged and labelled dried fish, because they prefer to carry out the packaging and labelling themselves.

Recommendations for markets to target

Based on the market analysis conducted so far, Yangon value-added processors, as well as supermarkets and chain-minimarts offer the best markets to target. Yangon value-added processors are attractive because they can buy large volumes and some are willing to pay higher prices for dried fish which meets quality and food safety standards. If Myeik collectors sell to this channel, this would shorten the chain between processor and buyer, which would also increase the flow of information between these actors, making it easier for processors to understand the needs of the end-market and deliver dried fish which meets their requirements.

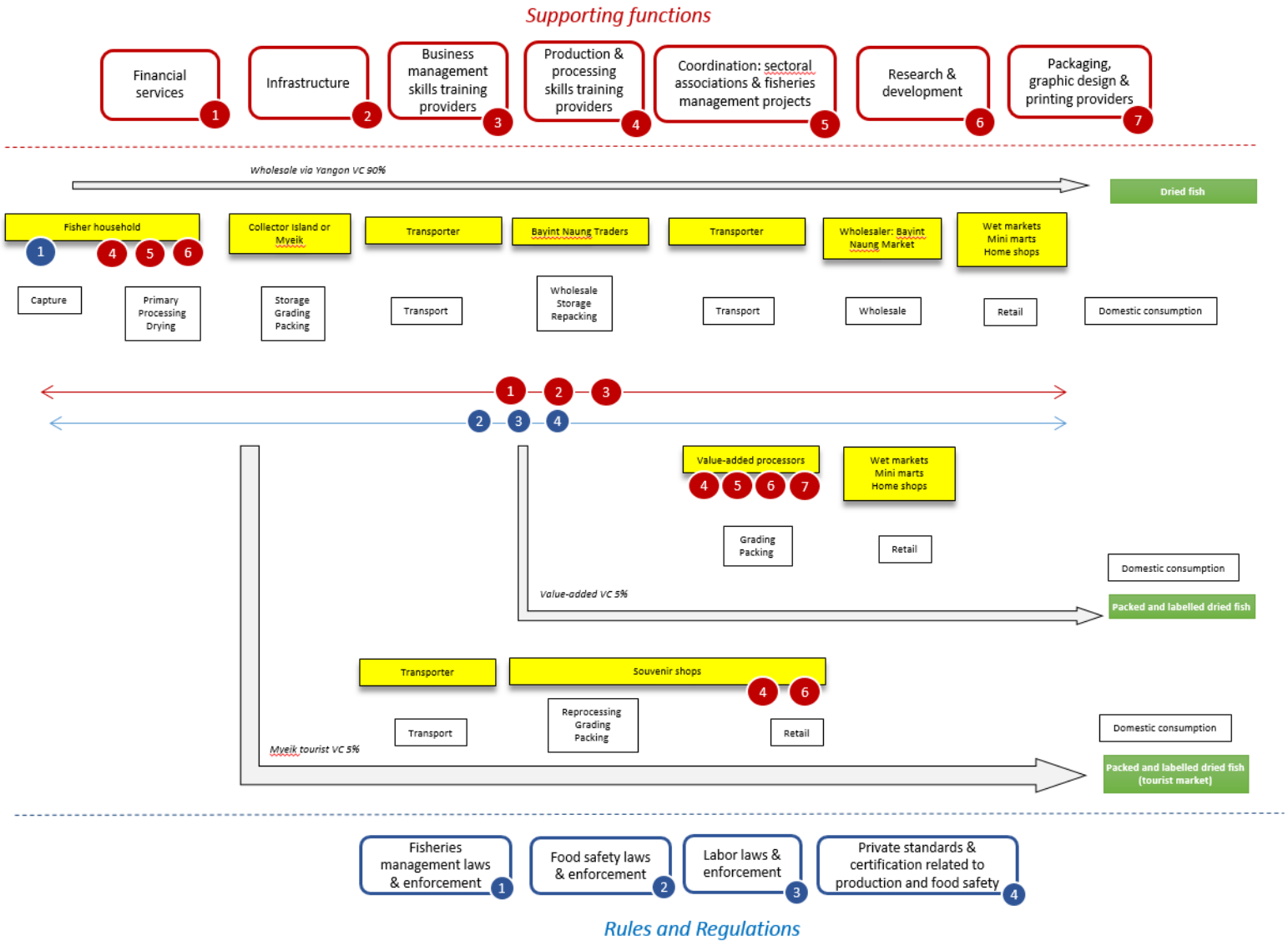
Supermarkets and chain-minimarts are recommended because they want to buy high quality, packaged and labelled products, which attract higher prices than those for bulk products sold on the wet markets. In addition, they are willing to purchase large volumes of these products and the rapid expansion of these retail outlets means that they are likely to increase the volumes which they purchase in the future. They also offer a distribution service if products are delivered to a central location.

The fact that they demand that quality and food safety requirements are met, and that FDA approval has been granted, reduces competition for these markets. It also provides an incentive which can help drive improvements in quality and food safety at the fisher and processor level. If these actors can meet the necessary standards, they will be able to command a better price for their products.

Finally, selling to these buyers will also help form relationships where feedback is provided about the preferences of high end consumers want. This can create a flow of market information which makes it possible to continually improve and react to changing requirements in the future. Selling in bulk to wholesalers does not provide this feedback.

Value chain map

Figure 21: Dried fish value chain map



Value chain actors

The table below summarises the key actors in the dried fish value chain and the available data on their location, population and volumes of product traded as well as average price received. Price data is complicated by the fact that there is a large range of different products along species and size lines which have different prices and markets.

Table 3: Key actors in the dried fish value chain

	Function	Location	Number	Employees	Volumes	Selling price
Fishers/processors: islands	Fishing. Drying. Sell to Bayint Naung traders	Islands & coastal villages	100-200	2- 30 Men Women	300 to 15,000 viss (480-24,000Kg) per month	6000 - 25,000 / viss depending on species (2.78-11.57 USD/Kg)
Processors: Myeik city	Dry fish. Sell to Bayint Naung traders	Myeik	15-20	5-15	n/a	n/a
Souvenir shops	Further drying. Package and label. Sell to consumers	Myeik	8	2 -6 Men Women	n/a	Up to 30,000/ viss (13.89USD/Kg) depending on product
Bayint Naung Traders	Receive in sacks. Store. Sell	Yangon	60	5 - 10	n/a	n/a
Intermediate wholesalers	Buy from Bayint Naung traders in Yangon. Transport to selling area. Sell	Urban centres	n/a	n/a	20 kg / week	10,000 to 30,000 / viss depending on species (4.63-13.89 USD/Kg)
Wet markets, Mini marts, home shops	Retail to consumers	Urban centres	n/a	n/a	n/a	Up to 50,000 / viss depending on product (23.15 USD/Kg)

Fishers

Given the large variety of fish species which are dried in the study area, the fishers and fishing practices engaged in capture are extremely diverse and include artisan, inshore and offshore fishing practices. As such, it is beyond the scope of this study to outline them here. For an overview of fishing practices in this area, please refer to the ILO's[13] (2015) Value chain analysis and competitiveness strategy: marine capture fisheries. If future interventions are carried out to promote drying of selected species, then further research into fishing practices for these species would also be advisable.

Dried fish processors

Dried fish processors operate both in Myeik city, in coastal villages and on the islands, and their operations are broadly similar in these different locations. Dried fish processors normally purchase fresh fish from fishermen. Some processors advance fishermen funds in order to secure supplies of raw material. Processors

[13] ILO (2015). Value chain analysis and competitiveness strategy: marine capture fisheries. Myeik and Yangon, Myanmar. International Labour Organisation, Yangon

will often specialise in drying particular species of fish which is often influenced by the type of fishing gear used and fish landed. It is typically fish which cannot be sold fresh that are dried. These include fish that are of low quality, are less desirable or difficult to market because of location or quantity. The reliance on spoilt fish may be a weakness in the long term for dried fish processors if quality improvement occurs on-board and more high quality fish are landed which could be marketed fresh. Though it should be noted that some higher value fish such as Indian threadfin bream are also salted and dried.

Figure 22: Fish being prepared for drying

SMEs vary in scale from small enterprises employing only household labour to managed business employing up to 15 part-time / casual labourers. Processors operate on some islands, in Myeik City and in other mainland locations. Casual labour (men and women) are employed to clean and oversee the drying process, which can take several days to complete depending on the size of fish and weather conditions. A number of children were observed working on the cleaning process at one dried fish processor. However, further research is required to confirm the exact extent of this issue.

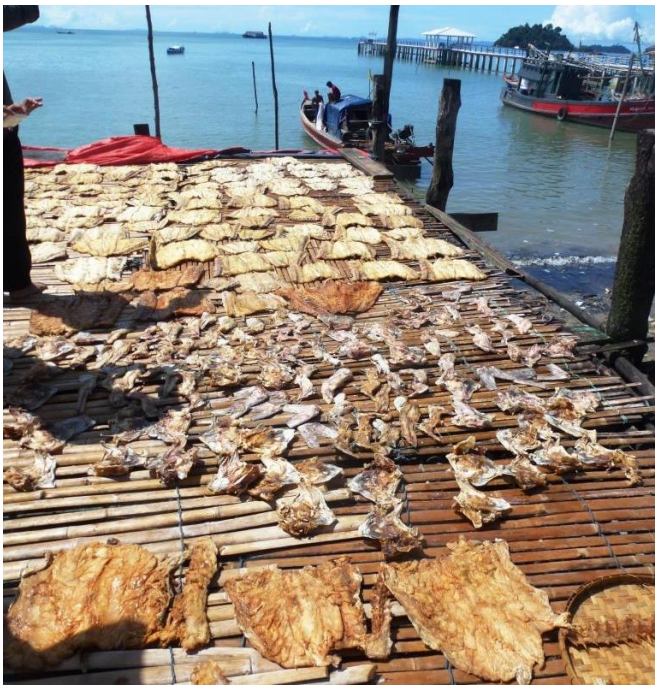
Fresh fish are prepared (split, eviscerated) on the ground and then salted for approximately 24 hours before being sundried on mats on the ground or raised racks. Some dried fish are dyed yellow, and it is not clear whether an approved dye is used. Some processors have access to a water supply used for washing down. Observations of dried fish processing activities at 3 locations identified a lack of adequate access to potable water; the likely use of nearshore polluted seawater for any washing of fish or facilities; preparing and drying the fish on the ground, which is open access for people and animals; and the lack of personal hygiene standards. Some SMEs expressed an interest in upgrading their practices to improve GHP and food safety. However, they mentioned that they lack access to affordable finance.

After processing, the product is stored for 1 or 2 days. The majority is then transported to Yangon, where it is sold through Bayint Naung market. The research found no collectors of dried fish. In contrast to the shrimp paste and dried shrimp value chains, it is the processors who sell to Bayint Naung market in the dried fish value chain. In addition, they also sell smaller amounts to local retailers in Myeik, including wet markets and Souvenir Shops. Some processors expressed an interest in pursuing value addition and accessing new markets.

The scale of dried fish processing SME varies and production can be between 300 to 15,000 viss (480-24,000Kg) of dried product per month. Approximately 2,000 viss (3,200Kg) of fresh fish produces 800 viss (1,280Kg) of dried product. The cost of the fresh fish is seen as the largest cost at an average of 2000 kyat/viss (0.92 USD/Kg) (equivalent to 5000 / viss (8000Kg) of from fish per 1 viss dried product). As an example, a medium scale processor in Myeik spends approximately 3.5 to 4 million kyat (2593-2963 USD) on fresh fish in a week. The costs of processing are increased in the rainy season, yet the selling price of products is lower. Dried fish production tends to be less during this period.

A lucrative by-product from some species such as Indian threadfin bream and croaker is the swim bladder (fish maw) of the fish which is also sundried and sold via Yangon to mainly Chinese buyers who use it in traditional medicine or cuisine. In Hong Kong, fish maw retails for between 500 and 1000 US$ / kg, depending on the species of fish from which it was taken and its quality.

Figure 23: Salted Indian threadfin bream drying



Souvenir shops

A number of souvenir shops in Myeik town cater to the needs of tourists for seafood products from the area. These shops tend to stock a wide variety of dried fish products, with dried and salted Indian threadfin bream ('Ngapoke chauk') one of the two most popular products sold. These shops will often source dried fish from particular processors, with whom they have an ongoing relationship. The dried fish are weighed and then packed and labelled in plastic trays or bags, which are sold direct to consumers in the shop.

Some souvenir shop owners are aware that their products could be sold in other outlets such as supermarkets in Yangon and Mandalay. However, they are constrained by either the incentive to try to access this market, a limited understanding of such new markets and the ability to carry out market research. Some have capital to invest, a mind-set geared to accessing new markets and new ideas and have social/business network and links to Yangon which may assist in getting a foothold into the high value urban market. Furthermore, souvenir shop owners tend to have some understanding of GHP as well as the use of packaging

and labelling. However, some are fearful of the demands that retailers can impose related to product requirements and volumes. In which case, the likely demand from a growth in tourism industry in the future may prove more attractive for some, particularly if large quantities of fish cannot be guaranteed.

Wholesale traders - Yangon

A large proportion of dried fish from Myeik goes from collectors to wholesale traders in Baiynt Naung market in Yangon. This market is a major conduit for dried and cured fish from all over the country. The traders receive the product, store it and sell on to wholesalers from different parts of the country as well as to value-added processors in Yangon and exporters. Orders are placed by phone and the dried fish are sold on a 5% commission basis on behalf of the collectors. The proceeds from the sales are passed onto the collector. The traders in Bayint Naung collude to set the selling prices for products. The traders have access to many buyers and sellers and run what appears to be a relatively low risk business based on commission. Many appear wealthy and may well have access to capital to invest in new business ventures. Large volumes of product from many different suppliers make it difficult to guarantee consistent quality and the market environment is also not conducive to good handling and storage practices. Feedback from a number of producers suggest that the traders here are not trusted over transactions and delay in sending money back to collectors after sales.

Dried fish processors rely on Bayint Naung traders to sell large volumes of product on a commission basis. Processors met mentioned that the Bayint Naung traders are not transparent on prices and it takes an overly long time for revenue from sales to be passed back to processors.

Value-added processors, Yangon

Some larger, value-added processors purchase dried fish from Bayint Naung market in Yangon. They may re-dry it, and then package and label it. It is mainly sold to mini marts and supermarkets in urban centres within Myanmar.

Intermediate wholesalers

Intermediate wholesalers/retailers in Yangon buy small volumes of dried product every week from the Bayint Naung wholesale market. They then sell it by weight to buyers from wet markets and home shops, hotels and restaurants. Traders have sealing machines and plastic bags, which enable them to pack products for customers at the time of purchase. Some product is ready packed in plain plastic bags with or without labels but have been weighed.

Retailers

Dried fish is retailed to the final consumer through wet markets, home shops, mini-marts, supermarkets, hotels and restaurants. Please refer to the above section on ‘analysis of domestic markets’ for a description of these actors.

Figure 24: Salted dried fish on display in a supermarket

Supporting functions

The performance of SMEs in this value chain is influenced by a number of supporting functions. These are outlined below.

Infrastructure

Both boat and road transport function adequately, given that the product is robust and has a relatively long storage life. Road infrastructure has improved over the last decade and this has helped the distribution of fish from production areas to markets.

For processors on the islands, various types of infrastructure required to support GHP are lacking. In particular, there is limited access to potable water and fish landing infrastructure is inadequate.

Electricity would be required for packaging and labelling, and the use of some improved technologies such as mechanical driers. At present electricity for island processors is expensive[14] and only available to purchase from generators that operate at night.

Telecommunications infrastructure has improved greatly in recent years. Myeik city has strong mobile phone and 3G network coverage. Coverage on the islands is more variable.

Packaging, graphic design and printing services

Some packaging materials are available in Myeik, sold through a limited number of retailers. In general, the variety and quality of packaging materials available in Myeik is lower than Yangon and the prices are more expensive. In response, some food processors in Myeik purchase their packaging materials directly from suppliers in Yangon.

[14] The cost of mains power in Yangon is said to be between USD 0.038 – 0.083 per kWh, whereas generator electricity costs in Myeik are between USD 0.20 and 0.30 per kWh

Graphic design services in Myeik are not well developed. Local food processors normally ask local printing/IT shops to produce designs, which are very basic. Some of the souvenir shops contact graphic designers in Yangon who are able to produce better designs, though these are still not as attractive and professional as those used by larger Yangon food processors. There are also several printing shops in Myeik, which are able to print a fairly wide variety of labels. However, they are not as advanced as competitors in Yangon.

Competing with processors in Yangon for a share of the value-added retail market will require access to improved packaging and labelling services. This could be achieved either by accessing improved services in Yangon or developing the services in Myeik.

Financial services

Very limited formal microfinance is available to SMEs in Tanintharyi Region. Myeik Public Corporation is providing 100,000 Kyat (74 USD) loans to retailers, with 2.5% interest charged per month on the loans. Pact is creating Village Development Committees, which will administer Village Development Funds. These could provide finance to processed seafood SMEs in the villages where the project operates.

Informal finance for processors is widespread. In particular, collectors and wholesale traders provide loans to processors. However, some processors reported that they are permanently indebted to local moneylenders and find it difficult to repay loans.

Skills, information and learning

Marketing skills, information and learning

One of the barriers to improved market access for collectors, souvenir shops and value-added processors in Myeik is the fact that they lack information on new markets, the preferences of consumers and food safety requirements. A major cause of this lack of information is the fact that most dried fish is being sold to Bayint Naung wholesale market, which will purchase a wide variety of types and quality of dried fish and has no incentive to communicate the preferences of other markets. It is also caused by the fact that SMEs in Myeik lack key marketing skills, particularly the capacity to carry out market research independently. In addition, the flow of market information from collectors to processors is fairly weak and there is limited trust between these actors.

Production skills, information and learning

Processors already have the skills to process dried fish to a basic standard. However, targeting new markets will require improved quality and food safety, which involves upgrading production practices. Larger processing companies in Myeik are able to identify and recruit consultants to upgrade their production practices to meet market requirements. However, the financial limitations of dried fish SMEs mean that this is not feasible for these actors. There are no local training providers delivering training on either dried fish production or food safety, though 10 companies were identified in Yangon that provide training in generic food safety standards. Upcoming projects in the fishery sector in Tanintharyi region could potentially provide relevant training, though as yet there are no plans to provide training on these specific topics.

Given that the 3G network is relatively widespread, there is theoretical potential for websites and apps in Myanmar language that provide basic information on these topics. However, at present there is very limited information available through these channels.

Other business management skills, information and learning

In addition to marketing and production skills, dried fish SMEs will need to improve a variety of other business management skills to meet the requirements of new markets and to expand their businesses. These include financial management, HR and stock control skills. One provider of business management training was identified in Myeik. However, the training is rather infrequent and given limited efforts to promote the training, it is very unlikely that island based processors would be aware of the course.

Coordination

The Myeik Fisheries Federation (MFF) is the umbrella organization for all private sector stakeholders in the seafood sector in Myanmar. MFF has 10 member associations for different sectors within the industry. These include the Myanmar Fish Paste, Dried Fish, Fish Sauce Entrepreneurs Association. However, dried fish processor SMEs on the islands around Myeik are not engaged in this association at present.

The Myeik District Fisheries Federation (MDFF) provides local representation of MFF. Large scale processor-exporters are well-represented in MDFF, but SMEs engaged in the dried fish value chain are not currently well-represented.

At village level, various projects are initiating committees and associations, which could provide forums for coordination. Tanintharyi Regional Fisheries Partnership is forming associations in coastal villages across Tanintharyi Region. A PACT project is forming Village Development Committees in selected project villages. Fisheries management projects by Flora and Fauna International, as well as World Conservation Society and DANIDA/Department of Fisheries will also form groups for fisheries management, which are likely to include large numbers of individuals engaged in seafood processing. But above village level, there is very limited coordination between dried fish processors.

It is also worth noting that souvenir shops in Myeik have recently formed an association.

Research and development

The Marine Science Department of the University of Myeik carries out research on biological and socio-economic issues related to fisheries, though in the last eight years there have been no studies on dried fish processing. Companies can also commission research on topics which are of use to their work, though this is beyond the financial capacity of SMEs that produce dried fish.

In terms of market research and the development of new products, large processing firms in Myeik can identify and recruit national or international consultants that can carry out these processes. However, the financial limitations of SMEs producing dried fish mean that this is not feasible for these actors.

Rules

Fisheries management

The Myanmar Marine Fisheries Law (1990), which is currently being revised, provides the overarching legal framework for the management of the fisheries sector. The Department of Fisheries produces more specific regulations for each state or region, which are revised regularly; issues licenses to fishers; and monitors fishing activity. The navy is responsible for the enforcement of laws relating to fishing operations. At community level, there may also be informal rules related to fisheries management which are agreed between fishers.

Although it was beyond the scope of this study to explore this topic in detail, discussions during this study and as part of the previous process of drafting the 'Guidelines on sustainable practices for Myeik District Fisheries Federation' suggest that enforcement related to fisheries operations is fairly weak. Infringements of rules related to fishing grounds and closed seasons were reported to be common, and fishing without licenses were also reported to occur.

Food safety

Government

The Department of Fisheries has issued a number of directives related to food safety and quality within the framework of the Marine Fisheries Law No 9/1990, which are detailed in Annexe 2. Collectively, these directives seek to minimize health risks associated with fish and crustacean production and guarantee an acceptable quality of production.

The Department of Food and Drug Administration is responsible for over-seeing and ensuring food safety and the safe production of foods for sale to consumers. According to the National Food Law (1997), food businesses should be registered and certified by the FDA. To gain certification, the FDA must inspect the business. In practice, the exact criteria against which the inspection is carried out are slightly unclear, however, with some processors reporting that they were given a specific 'checklist' and some not. In addition, the FDA is hampered by a lack of resources, which makes it difficult to monitor food safety across such a large sector.

Other organizations involved in ensuring product quality are the Ministry of Health, whose laboratory is capable of biological and chemical analysis, and the Ministry of Industry, whose food control laboratory aids it in its function of licensing food manufacturing establishments. Lastly, the Food Industries Development Supporting Laboratory of the Myanmar Food Processors and Exporters Association conducts quality and safety analyses on food and water.

The Department of Fisheries is the EU appointed competent authority responsible for issuing catch and health certificates, inspection of factories, landing sides and farms and the implementation of the Residue Monitoring Plan.

There is a fisheries inspection and quality control unit - The Yangon Division of the Department of Fisheries Research and Development unit- within the Institute of Fisheries Technology and Marine Fisheries Research. In some parts of the country, it has organised capacity building on topics such as fisheries inspection and quality control. However, no capacity building activities were identified in Myeik.

Private standards and certification

Globally a variety of private standards exist in relation to food safety, such as ISO 22000 Food Safety Training and Assessment; FSSC Food Safety System Certification; Hazard Analysis Critical Control Points (HACCP); and Good Hygeine Practices (GHP). Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research also identified 10 companies in Yangon which are able to provide training in one or more of these standards.

Cross-cutting considerations

Labour

At the fishing and processing level, a mixture of household and hired labour is used to carry out the main tasks. This work is predominantly part-time or seasonal. The use of household labour in fishing and processing introduces a risk that child labour may occur and in some of the dried fish processing SMEs child labour was observed. However, further research is required to confirm the exact extent. There may also be occupational health and safety issues related to fishing and processing operations. It should be noted that the fishing vessels for these products generally travel further from the shore and stay at sea for longer periods than those engaged in capture for shrimp paste and dried shrimp. This introduces greater occupational health and safety risks. In addition, the processing practices require the use of sharp knives, which also introduces an increased risk of injury. However, further study is required to identify all risks.

Gender

Men are engaged in fishing and more physically demanding labouring work. They also dominate the collection activities and are involved in trading. Women undertake processing at the household level, manage or are employees in souvenir shops and are engaged in trading activities, particularly at the retail level. The development and growth of SMEs is therefore likely to benefit both men and women, particularly through employment creation, albeit seasonal, at the fisher/processor level.

Environmental

One major issue is the purchase, processing and sale of certain endangered species, including sharks and rays. Another issue is the fact that the fisheries are relatively open access, which means there is little control over fishing effort. Another environmental issue is the odour produced by processing establishments, which can be offensive, particularly in built-up areas.

Conflict and security

Anecdotal evidence suggests there is some conflict between fishing vessels infringing on each others' fishing grounds.

SWOT analysis

The following table presents the results of a SWOT analysis of the dried fish value chain, drawing on the information collected about markets, value chain actors, supporting functions and rules.

Figure 25: SWOT analysis of the dried fish value chain

ACTOR	STRENGHS	WEAKNESSES	OPPORTUNITIES	THREATS
Dried fish processor	Salted Indian thread fin/croaker (Ngapoke chauk) is a popular / high value product Swim bladder is valuable by-product from some species Provides employment	Limited by working capital/investment Reliance on low-quality/spoilt fish that cannot be sold fresh Impact of rainy season on drying and	Storage life of the product Robust product can withstand transport and distribution Well established traditional product	Decline in catches Incursion of off-shore vessels into near shore areas Increasing fishing effort

ACTOR	STRENGHS	WEAKNESSES	OPPORTUNITIES	THREATS
	opportunities for women and men Different processors specialise in different species Knowledge of how to process Simple low cost processing practices No need for prolonged storage as product sold on soon after processing Good links with market in Myeik and Yangon	processing Now more competitive so profits less Operating in woeful environmental conditions with risks of cross contamination from animals, humans Lack of awareness and application of GHP Lack of record keeping/financial management Reliance of weather conditions for effective drying Living conditions and access to services not conducive to improving processing practices	consumed by a high % of population Improvement in working conditions Potential to export	Use of dyes on some fish
Souvenir shops	Packaging and labelling used for value-added products Customer services skills Strong awareness of the tourist market in Myeik Some have capital to invest Variety of dried fish products produced locally Dried fish has a long shelf life and does not require refrigerated storage / display Provide a quality control role Access to packaging and labelling services/supplies/equipment Some have mind set geared to accessing new markets and	Limited understanding of new markets and capacity to collect information Need for GHP and understanding of standards e.g. City Mart Energy costs limiting use of equipment and value-addition Perception that supermarkets require quality standards that are difficult to meet e.g. colour change in product so it must be returned Costs of packaging and labelling locally more expensive	Likely growth of tourism industry in future Potential to deal direct with retailers in Yangon New port development in Dawei offers an important future market Potential to improve packaging and labelling Growing population and increasing demand for fish Transport improvement – road development-	Growth in new souvenir shops leading to stiff competition for paste Sustainability of supply Increasing costs of renting retail space

ACTOR	STRENGHS	WEAKNESSES	OPPORTUNITIES	THREATS
	new ideas Social/business network and links to Yangon	 Mind-set of some limits interest in new ideas Lack of marketing skills	provides more market opportunities Lowering of future energy costs with installation of new gas power plant in 5 years time Scope for distributor in Yangon to distribute products in Yangon	

Upgrading strategy

Based on the understanding generated from the research and analysis, the following upgrading strategy is proposed.

Capitalise on the reputation of Myeik seafood

Myeik seafood has a strong reputation in Myanmar for high quality. But at present most dried fish coming from Myeik does not specify its origin. Labelling dried fish as originating from Myeik would help make this clear to the consumer and would promote Myeik as a distinct brand.

Access new market channels

Apart from a small amount of product which is sold through souvenir shops, most dried fish from Myeik leaves the area in sacks for sale at a relatively low price via traders in Bayint Naung market in Yangon. It is proposed that Myeik actors target two new markets. Firstly, sell dried fish to Yangon value-added processors. Secondly sell dried fish as packaged and labelled products to high-end retailers, such as supermarkets and chain-minimarts, in cities such as Yangon, Mandalay, Sagaing and Dawei (particularly once the Special Economic Zone has been completed).

Packaging and labelling: retail, small-scale wholesalers and home-shops

It is proposed that more processors in Myeik start to package and label their dried fish. Retail packaging and labelling of dried fish for retailers is a simple and relatively straightforward means to add value and increase profits for SMEs, while at the same time making a high quality product more convenient for urban consumers. Producing labels which meet FDA labelling requirements would also help consumers to be aware of relevant food safety issues, such as expiry dates.

Although processors can purchase packaging and labelling materials from suppliers in Yangon, it would be advantageous if local suppliers were able to provide services that are competitive with those in Yangon. As such, a related objective is the improvement of packaging and labelling service providers in Myeik.

Improve quality and food safety standards of dried fish at processing and collection

SMEs will need to respond to new market requirements and standards if higher value markets are to be accessed and developed. This will entail the application of GHP, improved handling and processing to reduce damage, ensuring products are dried properly, eliminate the contamination risks to dried fish at processing

and during distribution as well as pack and label properly. As part of this, alternative drying equipment options should be explored, including the use of improved drying racks.

Sustainable management of fisheries

To ensure the sustainability of dried fish production will require careful attention to resource management. Fishers reported that catch per unit effort has been declining over the last five years. The government has the mandate to ensure sustainable management of fishery resources and there are planned co-management initiatives, implemented with development partners, to try to improve the management of these resources in Myeik.

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new markets.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce value-added products and access new markets. Finance would be required for working capital, upgrading facilities and procuring equipment, as well as packaging materials and perhaps training and advisory services.

Barramundi

Product description

Barramundi or Asian sea bass (*Lates calcarifer*) is a species of catadromous fish widely distributed in the Indo-West Pacific region from Southeast Asia to Papua New Guinea and Northern Australia. In Myanmar they are known as “ka ka tit”. They are caught from the wild or cultured. Under culture they normally grow to 400-600g within 12 months and to 3 kg within 18–24 months. In Asia, most barramundi are marketed at 500–900g, although small numbers of larger fish (1–3 kg) are also sold. Barramundi have a mild flavour and a white, flaky flesh, with varying amounts of body fat. In fresh form, they can be sold whole, gutted or un-gutted; or in fillets or portions, with skin on or skinless.

Figure 26: Barramundi

Market analysis

Analysis of demand and supply

Demand

In Myanmar the main market is Yangon, where the fish is sold by farmers to wholesalers for 7000 to 9000 Kyat/viss (USD 6/kg). The retail price of barramundi fillets in supermarkets in Yangon is 30,000 kyat per viss (USD 21/Kg).

Barramundi is consumed in many countries in Asia, including Thailand, Indonesia, Bangladesh and China. It is also widely consumed in Australia. Demand volumes for key consuming countries are detailed in the table below.

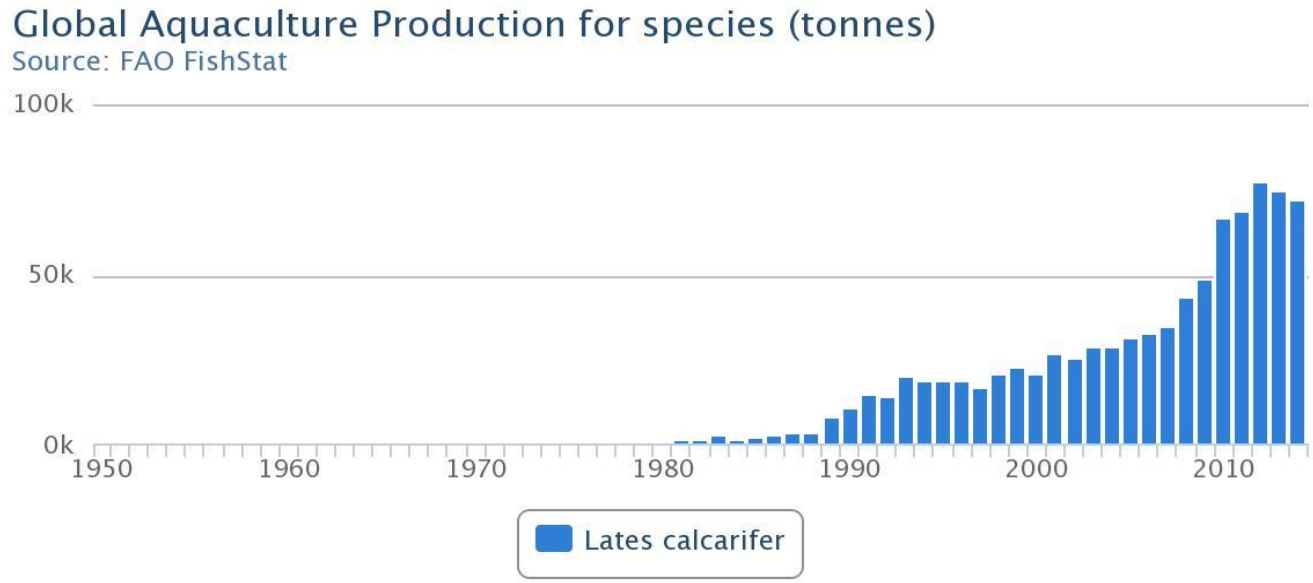
Figure 27: Demand volumes for key consuming countries

Country	Total consumption
Australia[15]	17,000 tonnes per year (including 10,000 tonnes imported fillets from SE Asia)
Indonesia[16]	27,500 tonnes per year (0.11 kg per capita x 250,000,000 population)
Thailand[10]	22,000 tonnes per year (0.33 kg/per capita x 67,000,000 population)
Myanmar[10]	8,000 tonnes per year (0.15 kg/per capita x 53,000,000 population)

Meetings with seafood buyers who sell to both the domestic and regional markets confirmed that buyers perceive there to be a strong and consistent demand for barramundi both in Myanmar and in the region.

Supply

Barramundi is fished and farmed through aquaculture in many countries across Asia, Australasia, the Americas and Europe. Southeast Asia is the biggest production zone, with the majority of production taking place in small coastal cage farms. Thailand is the biggest producer in Asia. Indonesia, Malaysia and Taiwan Province of China are also major producers. The graph below provides the global trend in production of barramundi through aquaculture[17].



In the broader Southeast Asian region, production is estimated to exceed 30,000 tons, with Thailand producing the bulk of supply at an estimated 20,000 tonnes in 2012[18].

[15] http://www.news.com.au/national/more-than-half-of-australians-most-popular-fish-barramundi-is-from-asia/news-story/d22b49cc980da78448e287bc0b490d44

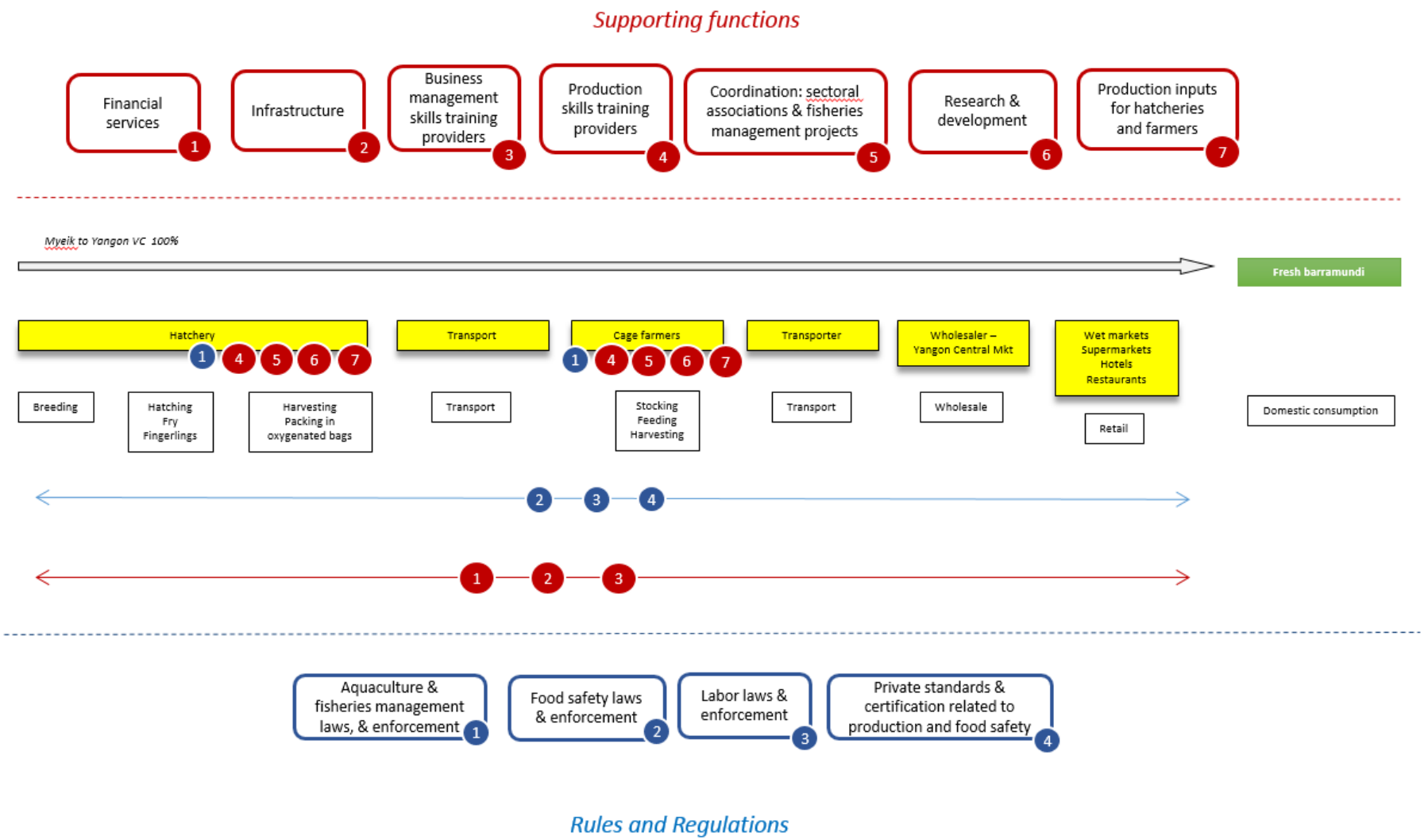
[16] Needham, S. & Funge-Smith, S. J. (2014) "The consumption of fish and fish products in the Asia-Pacific region based on household surveys". FAO Regional Office for Asia and the Pacific, Bangkok, Thailand . RAP Publication 2015/12. 87pp

[17] http://www.fao.org/fishery/culturedspecies/Lates_calcarifer/en

[18] http://www.thaiunionfeedmill.com/aquar.pdf

Value chain map

Figure 28: Barramundi value chain map



Value chain actors

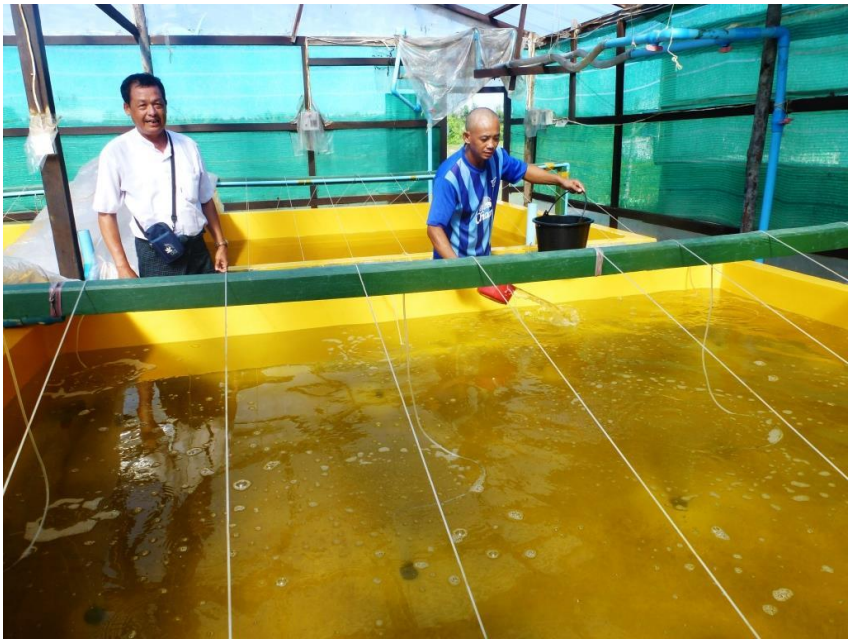
Hatcheries

There are three hatcheries producing fingerlings for cage farmers in the Myeik area. One is operated by the Department of Fisheries; one is operated by United KMK, a large processor-exporter company; and one by an SME. Only the last of these is currently retailing fingerlings to farmers, which limits the options for farmers that want to purchase fingerlings.

Hatcheries hold brood stock, which are caught through wild capture. At present, wild broodstock is still widely available, which is useful for ensuring genetic diversity. The brood stock are artificially induced to spawn in tanks, through hormone injections. The eggs are hatched and the fry are fed on plankton, including Artemia. After approximately three months the fingerlings are ready for sale to farmers and they are typically 75mm long at this stage. Most of the hatchery process takes place in a temperature controlled semi-indoor environment.

The SME hatchery which is retailing fingerlings does not carry out any proactive promotion and sales activities. Interest in buying fingerlings has spread through word of mouth and through people observing other fish farmers. Farmers must come to the hatchery to purchase the fingerlings. These are then transported in oxygenated plastic bags to the islands. This hatchery carries out three growing cycles per year and each cycle produces 150,000-200,000 fingerlings, giving approximately 450,000-600,000 fingerlings per year. The KMK hatchery has a capacity to produce 1.2 million fingerlings per year. The DoF hatchery can produce 500,000 at 1cm size, but these are not suitable for grow-out, which requires fingerlings of at least 5 cm . It was reported that the low capacity of the hatcheries is a major limitation to the expansion of production to new areas.

Figure 29: Barramundi hatchery, Myeik



The investments required to construct a hatchery, as well as the running costs of the business, particularly electricity are relatively high for SMEs. The management and care of the brood stock is also a significant cost for the business. Poor access to finance was reported to be a constraint to expansion for the SME hatchery.

Farmers

At present, barramundi cage farming was reported to be taking place on a limited number of islands in the Myeik archipelago. The extent of production was reported to be approximately 20 farmers and 300 cages. The main islands where the farming is taking place were reported to be Ye Kan Thaung, Ko Meh, Moe Ma Lin Cho, We Kyun, Ma Swe Oo and Ma Gyi. One hatchery owner reported that many other sites on the archipelago would be suitable for production and that many villagers had expressed an interest.

Some islands provide natural protection for cages, which is required to avoid storm damage. Farmers use simple wooden framed cages which are 3m x 3m. The cages are joined together to produce rafts. The fingerlings are purchased from the hatchery on the mainland, transported in oxygenated plastic bags of water to the cage site and then grown on for 5-6 months until harvestable size. Trash fish is the main feed ingredient used by the farmers. Please refer to the environmental heading under cross-cutting considerations for an account of some of the issues related to this. Cage farmers can purchase formulated feed produced in Thailand, but this is regarded as expensive[19].

One major threat to production is disease. High stocking densities can increase disease risks. Barramundi is particularly susceptible to a wide variety of Gram-negative bacteria that cause serious diseases. Feeding antibiotic-medicated aqua feeds is still common practice in some countries to treat or prevent these bacterial infections. In some countries, the prophylactic use of antibiotics in aquaculture production has been widespread. Trash fish, which is the main feed used by barramundi farmers in Myeik, does not facilitate the administration of treatments for disease and may therefore compound any disease outbreaks in Myeik.

The current cage technology is seen as less efficient due to the small cage size, the small mesh size of nets used in the cage, the ease at which the cages can be damaged which is partly due to the square shape. Land farming of barramundi is also possible , but access to the land to do this is seen as a constraint.

Theft of fish is a common problem with cage culture, though was not reported as being an issue in the study area at present. To engage in cage farming requires significant investment and the ability to tie-up capital for six months before receiving income. This makes it less suitable for the poorest households in this area.

Barramundi cage culture could be an important source of employment and income generation for islanders who are faced with declining natural fishery resources. The cage culture approach is now a relatively well-established process in the area and lessons have been learnt about effective production over the last 3-4 years since it started in this area.

Cage farmers in the study area are currently selling the barramundi to wholesale traders in Yangon or to collectors in Myeik. They are typically put on ice and transported to Yangon by truck.

Wholesalers (Yangon)

During this value chain analysis, no research was carried out on fish wholesalers in Yangon. However, as with all fresh fish, it is likely that barramundi would be traded through the main wholesale markets for fresh fish, at San Pya and Shwe Pa Dauk. Please refer to the ILO (2015)[20] or Belton *et al*. (2015)[21] for a description of the structure and function of these markets.

[19] The cost of formulated feed was reported to be 2,000 Kyat (1.48 USD) per Kg, whereas the cost of trash fish was reported to be 250 Kyat (0.18 USD) per Kg. Though there are major differences in nutritional values of these two feeds.

[20] ILO (2015). Value chain analysis and competitiveness strategy: marine capture fisheries. Myeik and Yangon, Myanmar. International Labour Organisation, Yangon

Processors (Myeik and Yangon)

There are 5 large, export-oriented processors in Myeik. One of these companies, United KMK, previously processed barramundi into fillets and exported these. Given the right conditions, there is theoretical potential for these companies to initiate processing and exporting of barramundi again. They have the capacity to carry out processing to meet standards of a variety of regional markets and have the links necessary to access these markets. Although, none of these factories are currently approved to export to the EU. In Yangon, there are 69 export-oriented processors, 13 of which are EU approved. Again, given the right conditions these companies could export to regional markets and, for those with approval, to the EU.

Supporting functions

The performance of SMEs in this value chain is influenced by a number of supporting functions. These are outlined below.

Infrastructure

Transport links to Yangon by boat are readily available and access to ice suppliers is strong enough to ensure a basic cold chain. Transport links to Ranong (Thailand) by boat or road are strong and many islands have access to vessels that can transport goods directly to Ranong. Shipping to more distant locations was reported to be costly and a barrier to profitable exports. One buyer reported that shipping costs to other ASEAN countries were three times higher from Myeik than they are from Yangon.

Electricity is particularly important at the hatchery stage where it is used to power the pumps required for tank aeration and water circulation. Hatcheries in Myeik are reliant on diesel generators for power and the cost of diesel is the most significant hatchery cost. On the islands, electricity is even more expensive [22] and is only available to purchase from generators that operate at night.

Telecommunications infrastructure has improved greatly in recent years. Myeik city has strong mobile phone and 3G network coverage. Coverage on the islands is more variable.

Financial services

Very limited formal microfinance is available to SMEs in Tanintharyi Region. Myeik Public Corporation is providing 100,000 Kyat (74 USD) loans to retailers, with 2.5% interest charged per month on the loans. Pact is creating Village Development Committees, which will administer Village Development Funds. These could provide finance to barramundi farming SMEs in the villages where the project operates. Informal finance is widespread and could be accessed by barramundi farmers. There may be potential for hatchery owners to provide finance or inputs on credit to fish farmers, though this was not reported as happening at present.

[21] Belton B, Hein A, Htoo K, Seng Kham L, Nischan U, Reardon T, Boughton D (2015) aquaculture in transition: value chain transformation, fish and food security in Myanmar. International Development Working Paper 139. Feed the Future. USAID

[22] The cost of mains power in Yangon is said to be between USD 0.038 – 0.083 per kWh, whereas generator electricity costs in Myeik are between USD 0.20 and 0.30 per kWh

Skills, information and learning

Marketing skills, information and learning

At present, Barramundi farmers sell to buyers in Yangon and to Thailand. Although access to markets is not a primary constraint for these farmers, there may be potential to get higher prices by finding new buyers and this may require improvements in marketing skills. Although the value chain analysis did not research why more island communities are not currently farming barramundi, it may be that a lack of relationships with buyers is one factor that prevents people from starting. If this is found to be the case, then market research skills would need improving.

Production skills, information and learning

At present, the hatcheries are the major source of production knowledge and they provide free advice to new farmers about how to farm barramundi. The current level of knowledge among these actors is reasonably good, though there are still ways in which this could be improved. In particular, Good Aquaculture Practices (GAP), disease identification and treatment, fish nutrition, food safety and post-harvest handling appear are key areas where training and advisory for farmers could be improved. In addition, there are clear limits to the extent of training and advice that are provided through hatcheries at present. Only clients can receive this advice and it is provided in an ad-hoc way, rather than in any structured form of training or consulting.

Given that the 3G network is relatively widespread, there is theoretical potential for websites and apps in Myanmar language that provide basic information on these topics. However, at present there is very limited information available through these channels.

Other business management skills, information and learning

In addition to marketing and production skills, SMEs will need to improve a variety of other business management skills to meet the requirements of new markets and to expand their businesses. These include financial management, HR and stock control skills. One provider of business management training was identified in Myeik. However, the training is rather infrequent and given limited efforts to promote the training, it is very unlikely that island based processors would be aware of the course.

Coordination

The Myeik Fisheries Federation (MFF) is the umbrella organization for all private sector stakeholders in the seafood sector in Myanmar. MFF has 10 member associations for different sectors within the industry. One of these is the Myanmar Fish Farmers Association. However, the small-scale barramundi farmers in the study areas are not linked to this organisation.

At village level, various projects are initiating committees and associations, which could provide forums for coordination. Tanintharyi Regional Fisheries Partnership is forming associations in coastal villages across Tanintharyi Region. A PACT project is forming Village Development Committees in selected project villages. Fisheries management projects by Flora and Fauna International, as well as World Conservation Society and DANIDA/Department of Fisheries will also form groups for fisheries management. At present, none of these projects are engaged in promoting mariculture, but some of the village-level structures created could be useful entry points for introducing the idea to communities and facilitating discussion about the pros and cons.

Research and development

The Marine Science Department of the University of Myeik carries out research on biological and socio-economic issues related to fisheries, though in the last eight years there have been no studies on barramundi farming. Companies can also commission research on topics which are of use to their work. This is feasible for large companies engaged in barramundi farming, but beyond the financial capacity of SMEs that farm barramundi.

In terms of market research and the development of new products, particularly value added products, large processing firms in Myeik can identify and recruit national or international consultants that carry out these processes. However, the financial limitations of SMEs farming barramundi mean that this is not feasible for these actors.

Globally, considerable efforts have been made to research barramundi aquaculture since the 1970s and this has produced a significant knowledge base which has contributed to the reliability and cost-efficiency of production of this species globally. Because of the mature nature of the barramundi aquaculture industry, there is comparatively little on-going research. One major area where there is a recognized need, but to date little effort, is in genetic selection programmes targeting faster growth and disease resistance. Another major area of research, that incorporates the overall marine finfish aquaculture industry in Asia, is the assessment of the environmental impacts of cage aquaculture. Although there is some research into the reduction of these impacts and improved planning for coastal aquaculture development, the development of planning and implementation frameworks to ensure the sustainability of coastal cage aquaculture remains a challenge for many countries.

Production inputs

Hatchery inputs

The materials and equipment for construction of hatcheries are not all available in Myeik, but can be purchased in either Yangon or Thailand. Lack of locally available materials and equipment is not seen as a key constraint, given that these materials are purchased infrequently. However, among the items that are purchased frequently, the high price of Artemia[23] was mentioned as a key constraint. At present, hatcheries are purchasing Artemia from input dealers in Thailand and the costs are high. There are no Artemia producers or input dealers in Tanintharyi Region. Trials of Artemia production began in Ayeyarwaddy Region, though the scale of production is still small.

Cage farming inputs

There are no service providers in Myeik that are specialised in cage construction and installation. Cage farmers currently purchase the floats in Thailand, and other materials locally, then construct the cages themselves.

There are a number of large feed mills in Ayeyarwaddy Region and one can produce a specialist seabass feed to order. However, the price of commercially manufactured floating feeds with comparable characteristics are between 10% and 30% higher in Myanmar than in other countries in the region[24]. There are also no input dealers selling relevant formulated feed products in Myeik.

[23] Artemia (brine shrimp) is required as feed for barramundi fry at a certain stage of development.

[24] Belton, B., Hein, A., Htoo, K., Kham, L. S., Nischan, U., Reardon, T., Boughton, D. (2015). Aquaculture in Transition. Value chain transformation, fish and food security in Myanmar. Michigan State University: Michigan

At present, there are also no input dealers selling disease management products in Myeik. Farmers currently purchase these products in Thailand. The result is that the instructions are in Thai, which may mean that they are not understood. Likewise, water testing equipment is not available in Myeik.

Rules

Production practices

The Law relating to Aquaculture No. 24/89 regulates the application for aquaculture leases and licences. In addition, the Marine Fisheries Law No 9/1990 and the Freshwater Fisheries Law No 1/1991 also contain some licensing requirements for aquaculture activities. According to the Marine Fisheries Law, any person that wishes to carry out inshore fishery should apply for a license to the Officer-in-charge of the Department of Fisheries of the respective Township. According to the Law, "fishery" includes the hatching and breeding of fish, while "inshore fishery" means any fishery carried out in the inshore area along the Myanmar coast as determined by the Director General.

The district Department of Fisheries office reported that individuals who want to begin farming barramundi must submit an application to their office. Staff from the Department of Fisheries then carry out an assessment of the potential impact on other fishery and mariculture activities in the area. If the impacts are deemed acceptable, the Department of Fisheries then notify members of communities in the area and request community members to contact them if they have any objections to the proposed activities. If no objections are received, a license is granted.

Several other laws and directives apply to aquaculture. Under the Law relating to Aquaculture, no person may import or export live fish without the prior permission of the Department. Water pollution is controlled through guidelines issued in June 1994 by the Myanmar Investment Commission. Reportedly, the guidelines require that new projects, from both foreign and private investments, have waste water treatment plants or systems in place. The Pesticides Law No 10/90 regulates the registration, use, storage, sale and labelling of pesticides. Directive No 8/98, issued under the Marine Fisheries Law No 9/1990, addresses the application of aquaculture medical drugs in fish and fish products and requires monitoring of the production process. In addition, the Drug Law No 7/92, which regulates the registration, use, storage, sale, labelling and advertising of drugs, may be applicable, too. Drugs are defined as "any substance for use, whether internal or external in the diagnosis, prevention and treatment of disease, birth control and any beneficial effect in human beings and animals". There are no specific provisions in any law on the use of fish feed.

Private standards and certification

Globally a variety of private standards exist in relation to aquaculture. These include Global GAP Aquaculture, Aquaculture Stewardship Council and Best Aquaculture Practices. Research identified companies in Yangon which are able to provide certification in these standards.

Food safety

Government

The Department of Fisheries has issued a number of directives related to food safety and quality within the framework of the Marine Fisheries Law No 9/1990, which are detailed in Annexe 2. Collectively, these directives seek to minimize health risks associated with fish and crustacean production and guarantee an acceptable quality of production.

The Department of Food and Drug Administration is responsible for overseeing and ensuring food safety and the safe production of foods for sale to consumers. According to the National Food Law (1997), food businesses should be registered and certified by the FDA. To gain certification, the FDA must inspect the business. In practice, the exact criteria against which the inspection is carried out are slightly unclear, however, with some processors reporting that they were given a specific 'checklist' and some not. In addition, the FDA is hampered by a lack of resources, which makes it difficult to monitor food safety across such a large sector.

Other organizations involved in ensuring product quality are the Ministry of Health, whose laboratory is capable of biological and chemical analysis, and the Ministry of Industry, whose food control laboratory aids it in its function of licensing food manufacturing establishments. Lastly, the Food Industries Development Supporting Laboratory of the Myanmar Food Processors and Exporters Association conducts quality and safety analyses on food and water.

The Department of Fisheries is the EU appointed competent authority responsible for issuing health certificates, inspection of factories, landing sites and farms, and the implementation of a Residue Monitoring Plan.

There is a fisheries inspection and quality control unit - The Yangon Division of the Department of Fisheries Research and Development unit- within the Institute of Fisheries Technology and Marine Fisheries Research. In some parts of the country, it has organised capacity building on topics such as fisheries inspection and quality control. However, no capacity building activities were identified in Myeik.

Private standards and certification

Globally a variety of private standards exist in relation to food safety, such as ISO 22000 Food Safety Training and Assessment; FSSC Food Safety System Certification; Hazard Analysis Critical Control Points (HACCP); and Good Hygeine Practices (GHP). Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research identified 9 companies in Yangon which are able to provide certification to one or more of these standards. Research also identified 10 companies in Yangon which are able to provide training in one or more of these standards.

Cross-cutting considerations

Labour

Barramundi culture provides opportunities for skilled and unskilled labour at hatchery and farm level as well as creating employment associated with fish distribution. Broadly speaking, barramundi farming is significantly less dangerous for labourers than fishing activities. As such, if fishers shift from wild capture to barramundi farming it is likely to mean less accidents and injuries for labourers.

Gender

Further research is required to establish the exact involvement of women in barramundi farming.

Environmental

Because it provides an alternative source of production, barramundi farming has the potential to reduce the wild capture fishing efforts made by fishers in the Myeik Archipelago, particularly if it proves to be more profitable than wild capture.

However, there are a number of potential environmental risks which could occur with the expansion of barramundi cage culture. Firstly, nitrogen inputs (from 'trash' fish) to marine finfish cages may be lost through uneaten food, faecal and urinary wastes and these nutrient inputs, although small in comparison with other coastal discharges, may lead to localised water quality degradation and sediment accumulation. In severe cases, this 'self pollution' can lead to cage farms exceeding the capacity of the local environment to provide inputs (such as dissolved oxygen) and assimilate wastes, contributing to fish disease outbreaks and undermining sustainability. If pesticides and antibiotics are used, these may also pass into areas around fish farms.

Barramundi cage culture in Myeik is heavily reliant on trash fish as feed. Unfortunately trash fish often includes juvenile fish including those of commercial species, which has likely implications for stocks of wild fish. In addition, formulated feed can also include trash fish as a major ingredient, leading to similar implications.

In addition, Barramundi is particularly susceptible to a wide variety of Gram-negative bacteria that cause major, serious diseases. Feeding antibiotic-medicated aqua feeds is still common practice in some countries to treat these bacterial infections. In some areas, the prophylactic use of antibiotics in aquaculture production has also been widespread. Most barramundi aquaculture is now carried out with formulated diets, although trash fish is mainly used in Myeik. Trash fish as feed does not facilitate the administration of treatments for disease and may therefore compound any disease outbreaks in Myeik.

However, the extent of these risks for current and future operations in Myeik has not yet been analysed and there are management solutions which can limit many of the negative impacts. Clearly further research is needed to identify exact risks and what management solutions should be put in place to mitigate them.

Conflict and security

Theft was not reported to be an issue at present. However, if expansion occurred, the risk of theft must be taken seriously. If placed in fishing grounds where wild capture fishers operate, there is also a potential risk of conflict with fishers. The waste management issues mentioned below

SWOT analysis

The following table presents the results of a SWOT analysis of the Barramundi value chain, drawing on the information collected about markets, value chain actors, supporting functions and rules.

Figure 30: SWOT analysis of the Barramundi value chain

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Hatchery	Natural production of rotifers in earthen ponds	High cost of electricity	Island archipelago providing numerous potential sites for cage	Reliance on diesel generator as energy source

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	Technology well established and proven	High cost of artemia Brood stock require expensive management Limited production capacity and lack of finance for expansion	farmers Potential to sell fingerlings to farmers in other areas of Myanmar Growing demand for fish in Myanmar	Pollution Reliance on other people's investment in cage farming
Cage farmers	Employment and income generation for islanders Islands provide natural shelter Access to hatcheries is fairly good	Lack of access to affordable formulated feed Initial investment is large for poorer farmers and money is tied up for 6 months, which may cause cash flow problems Cage design not efficient: too small, small mesh size, weak, square Access to land for pond culture is limited Risk of theft If many more people want to begin fish-farming, the capacity of hatcheries needs to increase.	Relatively well established process in the area and lessons learnt over last 3-4 years Development of indigenous feed industry for formulated feed Presence of existing animal feed industry Market for barramundi in Yangon Land based farming in ponds Improved cage design	Reliance on trash fish as feed. If more people farm fish, there may be insufficient trash fish at village level. This may increase demand for purchased trash fish, promoting unsustainable fishing practices Weather e.g. storms, cyclones

Upgrading strategy

Based on the understanding generated from the research and analysis, the following upgrading strategy is proposed.

Sustainable expansion of the production of barramundi, including adequate hatchery capacity

Barramundi culture has the potential to create employment, contribute to food security as well as generate foreign exchange earnings. In the face of declining catches per unit effort from wild capture, it could offer an alternative source of supply to wild capture and could help reduce overall fishing effort in Tanintharyi region. Broadly speaking, barramundi farming is also significantly less dangerous for labourers than fishing activities. There is also a strong export market for barramundi, yet production is limited at present.

With this in mind, there appears to be a strong rationale for increasing production of barramundi through cage culture. This would involve an increase in the capacity of hatcheries and an increasing number of farmers engaging in barramundi farming. However, there are risks involved in increasing production, which are outlined in the cross-cutting consideration section above. It is important that potential negative impacts are assessed and that management strategies are put in place to reduce these impacts.

Research about production practices and mitigation of negative impacts of production

To optimise the efficiency of production, it is critical that a rigorous and locally-relevant knowledge-base is developed. This should include research on relevant aspects of production at both the hatchery and farm level. In addition, to minimise the risks involved in the expansion of production, which are outlined in the cross-cutting considerations section, research should be carried out to assess potential and actual negative impacts of barramundi production. Increasing the capacity of local researchers to carry out this research would be highly advisable, in order to ensure its sustainability.

Development of production input markets and advisory service providers

Various types of input are essential for effective and efficient production at both hatchery and farm level. These include Artemia, formulated feed, disease management products, and cages, among others. Currently, these inputs are expensive and need to be purchased in Thailand. Developing low cost and local distribution of these inputs would make production more efficient. In addition, there may be some scope for local production or manufacturing of some relevant inputs, which could further reduce their costs. Likewise, advisory services need to be improved, to enable potential farmers to learn the production practices required to start cage culture and to ensure that best practice is adopted by new and existing farmers.

When developing both input markets and advisory services, various business models should be considered, such as embedding input supply and advisory service provision within contract-farming models. Equally, a broad range of actors should be considered as potential input suppliers and advisory service providers. This could include actors such as existing hatcheries, as well as the many existing suppliers of fishing gear and processor-exporter companies wishing to expand their supply.

Cost-saving opportunities for hatcheries

Energy costs at hatchery level are significant and there is a reliance on diesel generators. Identifying appropriate solar technologies and other ways of reducing diesel costs will increase the profitability of these operations and may help increase the rate of their expansion.

Access new markets and consider certification options

There are many export markets into which barramundi from Myeik could be sold. Further research is necessary to identify specific buyers and their requirements. Some of the requirements may necessitate improvements in production and post-harvest handling, to ensure quality, including food safety. Certification to standards such as Global GAP Aquaculture should also be considered, especially if markets can be identified that pay higher prices for such standards.

Develop processing

There are 5 large processor-exporter companies in Myeik. If appropriate markets exist, there could be opportunities for processing into other product formats, such as gutted, filleted and skinless. Opportunities for processing SMEs in Myeik to produce these formats should also be explored. To meet market requirements, this may also necessitate improvements in post-harvest handling and food safety.

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new markets.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce new products and access new markets.

Blood cockle

Product description

Tegillarca granosa, also known as Anadara granosa, is a species of ark clam known as the blood cockle or blood clam due to the red haemoglobin liquid inside the soft tissues. It is found throughout the Indo-Pacific region from the eastern coast of South Africa northwards and eastwards to Southeast Asia, Australia, Polynesia, and up to northern Japan. It lives mainly in the intertidal zone at one to two metres water depth, burrowed down into sand or mud. Adults can grow to be 5 to 6 cm long and 4 to 5 cm wide.

Blood cockle meat is served steamed, boiled, roasted, or raw. The cockles are generally marketed fresh, though the meat is also available in frozen form. The marketable size of live clam is 24-30 mm. The blood cockle lives in low-oxygen environments, and thus ingests many viruses and bacteria, including hepatitis A, hepatitis E, typhoid, and dysentery, to get the nutrients it needs. The method of quick-boiling for consumption can leave viruses and bacteria present. There are therefore food safety risks associated with this product.

Figure 31: Blood cockle

Figure 32: Blood cockle after harvesting

Market analysis

Analysis of demand and supply

Demand

Blood cockles are popular with consumers in Southern China and throughout Southeast Asia, particularly in Thailand. At present, the blood cockle produced in Myeik is only marketed in Thailand. The market for blood cockle in Myanmar was reported to be small, though there is a lack of information on the current situation and there could be demand from Chinese and Thai restaurants in urban centres such as Yangon and Mandalay. The available data on annual blood cockle consumption in Asia is summarised below.

Figure 33: Available data on blood cockle consumption

Country	Consumption data
Indonesia[25]	20,000 tonnes (0.08 kg/per capita/year x 250,000,000 population)
Thailand[14]	30,000 tonnes (0.44 kg/per capita/year x 67,000,000 population)
Singapore[26]	1000 tonnes

In Singapore in mid 2016, the wholesale price had risen from USD 1 / kg to USD 1.8 / kg primarily due to a shortage of supply from Malaysia. The buying price for cockles from Myeik in Thailand in November 2016 was USD 1.7 / kg, the same as the price in Singapore.

[25] Needham, S. & Funge-Smith, S. J. (2014) "The consumption of fish and fish products in the Asia-Pacific region based on household surveys". FAO Regional Office for Asia and the Pacific, Bangkok, Thailand . RAP Publication 2015/12. 87pp

[26] http://www.tnp.sg/news/singapore/clammy-situation-cockle-importers

Supply

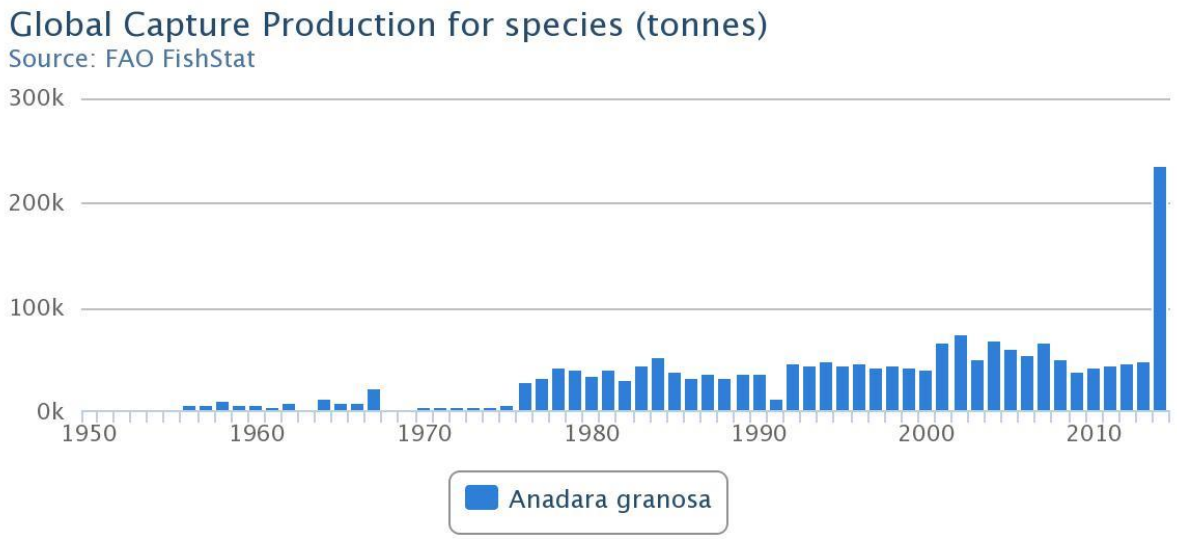
Blood cockle is captured or cultivated in China and across South East Asia. The table below provides available data on the supply of blood cockle and a list of the major producing countries in the South East Asia Region.

Figure 34: Blood cockle production in South East Asian countries[27]

Country	Year	Production (tonnes)
Thailand	2014	64270
Cambodia	2014	1300
Malaysia	2015	16000
Indonesia	2012	43177

At its peak in 2005, Malaysia produced 100,000 tonnes of cockles for both local consumption and export. In 2015 production had dropped to 16,000 tonnes primarily due to poor water quality in the main breeding areas. One of the reasons that Myeik is now supplying Thailand is because production in Thailand was negatively affected by the 2004 tsunami. China is also a major producing country. On the coast of Zhejiang Province in China alone, blood cockle plantations occupy about 100 km^2 of mudflats and blood cockle is also farmed in the river estuaries of neighbouring Fujian Province.

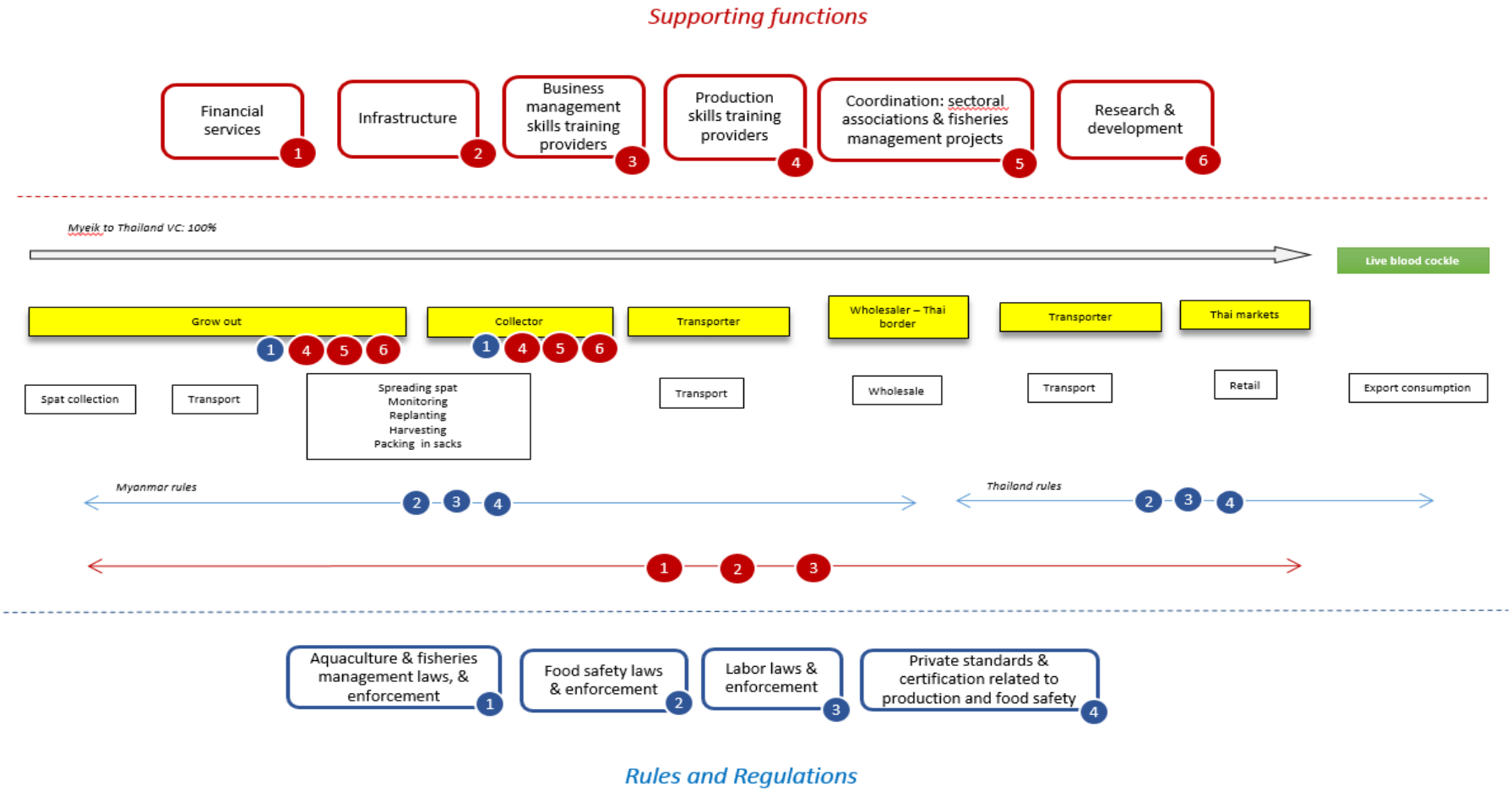
The graphs below detail total annual global production from capture and aquaculture. Although capture has remained relatively stable, production through aquaculture has shown steady increases over the last 25 years.



[27] https://knoema.com/FAOGPS2016/global-production-statistics-2014?tsId=1077940

Value chain map

Figure 35: blood cockle value chain map



Value chain actors

Farmers

Blood cockles are reared in suitable muddy areas adjacent to some islands around Myeik. There is a lack of commercial hatchery technology for artificial breeding of spat. In other countries, blood cockles have been successfully bred under laboratory conditions, but this has not been developed into commercially viable hatchery operations. As such, farming relies on the collection of spat from the wild. Spat was reported to be collected only from Ye Kan Taung and Kya Kyaung islands. Farming was reported to take place on Ye Kan Taung, Ye Aye and Lin Ma Lo islands.

Spat is collected from sites where it is known to be abundant, and then planted in grow-out areas at a density of 20 baskets for 1 acre. The marketable sized adults are then harvested after 1 year of growth. Between depositing the spat in the grow-out area and harvesting, the area is monitored at least once per month. After 6 months, the cockles can be replanted to give them more space to grow. Excessive exposure to heat at low tide can lead to mortality. Once harvested, the cockles are packed into sacks for sale to a collector, who transports them to market. There are 120 cockles per kg at harvestable size.

The division of labour in the above tasks typically involves one wealthier actor managing the farming process and hiring labourers to carry out the collection of spat, planting, monitoring and harvesting. Normally the labourers that collect spat are paid for the quantity they collect, rather than a daily wage. In some cases, the collector who trades the adult blood cockles (see below), also plays the role of farm manager, hiring the labourers to carry out farming tasks. Those that manage the farming process can employ up to 50 workers on a part-time/casual basis to carry out the harvesting.

1 kg of spat consists of approximately 300 cockles and 500 kg of spat is said to produce 2000 kg of final product. 25 kg of spat costs 10,000 kyat (7.41 USD) or 400 Kyat (0.3 USD) per Kg. The investments made in spat and grow-out are tied up for a relatively long period (1 year) before income is received. This makes it less suitable for the poorer households in the area.

Cockle farming is a low input form of mariculture as no artificial feeding is used and the cockle spat is collected by farmers/labourers locally from nursery grounds (mud flats near mangroves) at low tide. In Myanmar only manual labour is used for spat collection, as opposed to machines which can cause significant disruption to the sea bed. Initial observations suggest that cultivation may be feasible in many more areas on the Myeik archipelago, though this would be dependent on the availability of spat. If spat is over-harvested from a limited number of sites, then the supply is likely to diminish rapidly.

Collectors: Myeik

Collectors pick up large volumes of harvested cockles from the farmers and transport them to buyers in Ranong, Thailand. In some cases, collectors fund the farming operations detailed above. The key costs to the collector are the cost of spat, boat transport and labour. Delays and heat can cause mortality during distribution. The sacks are kept wet with seawater to reduce mortality. In addition, from time of harvesting, the live cockles must reach the market within 16-24 hours, otherwise mortality will occur.

At the moment, the harvested blood cockle are destined for only one market, Thailand. The Thai buyers make orders for specific volumes to be delivered at a specific point and were reported to pay quickly after receiving their consignment. One cockle collector reported that it is difficult to supply the quantity of cockle demanded by the Thai market.

Trader: Thailand

During the timeframe of the value chain analysis mission, it was not possible to visit Ranong to meet Thai traders. Further research would be beneficial to understand these actors and the additional actors between them and the end-markets.

Supporting functions

The performance of SMEs in this value chain is influenced by a number of supporting functions. These are outlined below.

Infrastructure

Boat transport is required to transport harvested spat to market. Harvested cockles must reach their end destination within 24 hours, otherwise mortality will occur. In the absence of a system to keep the cockles alive for prolonged periods after harvesting, and the reliance on the Thai market, the transport time currently determines where cockles can be farmed. Any farming area that is more than 24 hours from the Thai or other market would not be suitable for farming. Aeration tanks could be an option in the future, though they are not currently used by blood cockle collectors.

Electricity would be required if aeration tanks were to be used for transportation. These would need to run off either diesel generators or solar power.

Telecommunications infrastructure has improved greatly in recent years. Myeik city has strong mobile phone and 3G network coverage. Coverage on the islands is more variable.

Financial services

Cash flow is a concern for farmers or collectors funding the farming operations, due to the fact that the investment in spat and grow-out is tied up for 12 months. Very limited formal microfinance is available to SMEs in Tanintharyi Region. Myeik Public Corporation is providing 100,000 Kyat (74 USD) loans to retailers, with 2.5% interest charged per month on the loans. Pact is creating Village Development Committees, which will administer Village Development Funds. These could provide finance to SMEs in the villages where the project operates. Informal finance is already present in the value chain. Most notably, some collectors are financing farming operations.

Skills, information and learning

Marketing skills, information and learning

At present, blood cockle farmers sell to buyers in Thailand. Although access to markets is not a primary constraint for these farmers, there may be potential to get higher prices by finding new buyers and this may require improvements in marketing skills.

Production skills, information and learning

At present, knowledge about production practices has spread informally, by Myeik actors (particularly collectors) visiting Thai blood cockle farms and sharing this information with other Myeik actors. There are no formal providers of training or information about blood cockle production in and around Myeik. Although informal learning has enabled farmers to learn to produce in a way that is commercially viable, further improvements could be made which would increase production, post-harvest handling and food safety. Improved access to formal training and advisory services would be necessary to achieve these improvements.

In addition, the current lack of training and advisory services makes it difficult for people who are interested in starting blood cockle farming to find out key information about production, unless they can establish relationships with existing farmers.

Other specific information gaps include information on areas where spat can be found and harvested as well as suitable grow out areas.

Given that the 3G network is relatively widespread, there is theoretical potential for websites and apps in Myanmar language that provide basic information on all the topics listed above. However, at present there is very limited information available through these channels.

Other business management skills, information and learning

In addition to marketing and production skills, SMEs will need to improve a variety of other business management skills to meet the requirements of new markets and to expand their businesses. These include financial management, HR and stock control skills. One provider of business management training was identified in Myeik. However, the training is rather infrequent and given limited efforts to promote the training, it is very unlikely that island based processors would be aware of the course.

Coordination

Blood cockle farming is in its infancy and there appears to be no obvious coordinating mechanisms or forums, specifically focused on blood cockle farming or marketing.

The Myeik Fisheries Federation (MFF) is the umbrella organization for all private sector stakeholders in the seafood sector in Myanmar. MFF has 10 member associations for different sectors within the industry. However, none of these is focused on blood cockle farming. The Myeik District Fisheries Federation (MDFF) provides local representation of MFF. Large scale processor-exporters are well-represented in MDFF, but SMEs engaged in the blood cockle value chain are not currently well-represented.

At village level, various projects are initiating committees and associations, which could provide forums for coordination. Tanintharyi Regional Fisheries Partnership is forming associations in coastal villages across Tanintharyi Region. A PACT project is forming Village Development Committees in selected project villages. Fisheries management projects by Flora and Fauna International, as well as World Conservation Society and DANIDA/Department of Fisheries will also form groups for fisheries management, which are likely to include some individuals engaged in blood cockle farming.

Research and development

The Marine Science Department of the University of Myeik carries out research on biological and socio-economic issues related to fisheries, though in the last eight years there have been no studies on blood cockle farming. However, a recently initiated JICA bivalve research project with the University of Myeik may provide relevant research on this topic. Companies can also commission research on topics which are of use to their work. This is feasible for large companies, but beyond the financial capacity of SMEs involved in blood cockle farming.

One key research need at present is how to avoid the over-exploitation of juvenile cockles, which has been a major issue in Indonesia, and how to reduce the effects of pollution on spat production, which has affected production in Malaysia. Additional research needs are: systems for artificial rearing of cockles; the identification of suitable growing areas and live-cockle transportation technology; and a bivalve monitoring system to reduce the food safety risk of blood cockles.

Rules

Production practices

Government

The Law relating to Aquaculture No. 24/89 regulates the application for aquaculture leases and licences. In addition, the Marine Fisheries Law No 9/1990 and the Freshwater Fisheries Law No 1/1991 also contain some licensing requirements for aquaculture activities. According to the Marine Fisheries Law, any person that wishes to carry out inshore fishery should apply for a license to the Officer-in-charge of the Department of Fisheries of the respective Township. According to the Law, "fishery" includes the hatching and breeding of fish, while "inshore fishery" means any fishery carried out in the inshore area along the Myanmar coast as determined by the Director General.

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Informal rules on production

Farmers reported that village-level community leaders are also involved in decision making regarding who does what within their jurisdiction. In particular, it was reported that people must seek consent from community leaders to gain access to certain areas for blood cockle farming.

Private standards and certification

Globally a variety of private standards exist in relation to aquaculture. These include Global GAP Aquaculture, Aquaculture Stewardship Council and Best Aquaculture Practices. Research identified companies in Yangon which are able to provide certification in these standards.

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Cross-cutting considerations

Labour

Blood cockle production provides employment for low skilled labourers who carry out collection of spat, planting in grow-out areas and harvesting marketable sized adults. Further research is needed to understand the extent of child labour engaged in these activities, as well as the occupational safety and health risks.

Gender

Both men and women are engaged in the collection of spat, growing and harvesting of blood cockle. As such, expansion of blood cockle production is likely to benefit both men and women.

Conflict and security

There is no evidence so far of conflict related to blood cockle production. However, given the fact that areas of sea bed are required and that these may be areas where fishermen might operate, there appears to be potential for both land and land vs fisher conflict. In other countries, such as Malaysia, harvesting of mangroves has had a negative impact on cockle culture, so this is another potential cause of conflicts to consider going forward. There is also a potential risk of theft of cockles during the farming stage. At present, this was reported to occur, but only to be a minor issue.

Environmental impact

Because it provides an alternative source of production, blood cockle farming has the potential to reduce the wild capture fishing efforts made by fishers in the Myeik Archipelago, particularly if it proves to be more profitable than wild capture. Broadly speaking, blood cockle farming also has less potential environmental issues associated with it than fish farming, because it is a much lower intensity production system.

However, one environmental issues which should be considered is the potential negative impact on the seabed from mass harvesting of spat, particularly in terms of the ecology and invertebrate makeup of the mudflats. At present, mechanised extraction of spat is not permitted or practiced in Myanmar, which will provide some protection for the inter-tidal zone environment.

SWOT analysis

The following table presents the results of a SWOT analysis of the blood cockle value chain, drawing on the information collected about markets, value chain actors, supporting functions and rules.

Figure 36: SWOT analysis of the blood cockle value chain

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
Blood cockle farmers: islands	Low input farming (e.g. no artificial feeding) Spat is already available locally in wild Knowledge of farming techniques Strong market demand Have sufficient capital to invest in farming Manual labour available for spat collection (not allowed to use a machine) Provides employment and income for low skilled labourer in collection of spat as well as grow-out. These are opportunities for	Needs specific areas with right muddy conditions Theft of cockles Heat kills cockles if grown too high up shore When temperature is high, growth is slow High investment and cash tied up for 1 year Access to land from local communities can be an issue: permission required from community leaders	Cultivation possible in more areas, depending on availability of spat JICA bivalve research project in near future Alternative production source. Could reduce fishing effort if more profitable Other markets could be accessed Growing conditions in Myanmar known to be good compared to Thailand Use of aeration tanks to extend storage life after harvesting	Impact of spat collection on life-cycle of other organisms e.g. fish, crab Limited availability of spat for grow-out and lack of technology for artificial breeding/ hatchery

ACTOR	STRENGTHS	WEAKNESSES	OPPORTUNITIES	THREATS
	both men and women			
Blood cockle collectors	Knowledge of farming process and post-harvest handling techniques Have sufficient capital to invest in farming and trading Access to Thai market	Land tenure system may limit investment When financing farming: high investment and cash tied up for 1 year Need to sell harvested product within 16 - 24 hours Transport time limits expansion of production northwards away from Thailand Sometimes cannot supply demand from Thailand	Scope to explore feasibility of farming in other areas of islands Problems with supplies in other countries e.g. Malaysia Canning/other methods of preservation Development of domestic market – restaurants in Yangon Air transport of live cockle from Yangon to export markets Use of aeration to extend storage time New markets with high demand: Malaysia, China, Singapore, Hong Kong	High risk food as eaten partially cooked and can harbour food poisoning viruses Lack of bivalve monitoring system to avoid food safety concerns Reliance on Thai market

Upgrading strategy

Based on the understanding generated from the research and analysis, the following upgrading strategy is proposed.

Sustainable expansion of the production of live blood cockle

Blood cockle farming has the potential to create employment, contribute to food security as well as generate foreign exchange earnings. In the face of declining catches per unit effort from wild capture, it could offer an alternative source of supply of seafood products and could help reduce overall fishing effort in Tanintharyi region.
There is also a strong export market for blood cockle in Asia and production in Thailand and Malaysia has reduced in recent years. Production in Tanintharyi Region is limited at present, but there is a real opportunity to capitalise on the shortfall in regional supply by increasing production.

Identifying potential areas for spat collection and grow out will be important in order to gauge the potential for increasing production. Consideration should also be given to the environmental implications of expanded production and to the development of guidance regarding long term sustainable management of the blood cockle culture sector.

Research about production practices and mitigation of negative impacts of production

To optimise the efficiency of production, it is critical that a rigorous and locally-relevant knowledge-base is developed. This should include research on relevant aspects of production at farm level, as well as post-harvest handling. In addition, to minimise the risks involved in the expansion of production, which are outlined in the cross-cutting considerations section, research should be carried out to assess potential and actual negative impacts of production. Increasing the capacity of local researchers to carry out this research would be highly advisable, in order to ensure its sustainability.

Access new markets and consider certification options

There are many export markets that are interested in purchasing blood cockle and there may also be demand among niche domestic buyers, such as Chinese and Thai restaurants in Yangon and Mandalay. Further research is necessary to identify specific buyers and their requirements. Some of the requirements may necessitate improvements in production and post-harvest handling, to ensure quality, including food safety.

Assessment of the logistics, costs and food safety systems for transporting live cockles to other markets in Asia will also be essential to establish the markets with highest potential and feasibility. A key component of supplying any new market will be introduction of technology that aids live cockle distribution. Such technology may also enable traders to have more control of the supply to the existing Thai market.

Certification to standards such as Global GAP Aquaculture should also be considered, especially if markets can be identified that pay higher prices for this.

Business management

Improvements in generic business management skills will underpin growth and development of all actors in the chain that wish to improve existing businesses, expand or target new markets.

Access to finance

Some SMEs will require access to affordable finance for investment and working capital in order to expand, produce new products and access new markets.

Annexe 1: Further reading

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Annexe 2: Directives issued under the Marine Fisheries Law No 9/1990 which relate to food safety

Under the Marine Fisheries Law No 9/1990, the Director General has issued a large number of directives that have a bearing on food safety:

1. Directive No. 7/96 provides for structural requirements for fisheries manufacturing facilities in order to ensure safety, hygiene and quality of production. The Directive addresses buildings, food handling areas and services such as waste disposal and water supply.
2. Directive No. 8/96 provides for operational requirements for fisheries manufacturing facilities in order to ensure safety, hygiene and quality of production. The Directive addresses hygienic requirements for premises, personal hygiene and health requirements, hygiene requirements for processing, and hygienic requirements in production/harvest areas. Fish products for export may not be grown in or harvested from areas where substances are present that are potentially harmful to human health.
3. Directive No. 8/98 addresses the application of aquaculture medical drugs in fish and fish products and requires monitoring of the production process. The presence of certain residues and substances must be detected in fish, their excrement and body fluids, fish products, aquaculture feed and drinking water. Products that have been illegally treated with aquaculture medical drugs must be rejected for human consumption and for export
4. Directive No. 9/96 provides rules on additives that can be used in fisheries products. It lists the maximum residue limit (MRL) for pesticides, antibiotics and other residues in fisheries products. It also lists the limits for metal contaminants. Reference is made to international standards of international organizations such as the Codex Alimentarius Commission.
5. Directive No 10/96 provides rules on the sampling of processed fish products.
6. Directive No 11/96 provides rules on the packaging (and labelling) of processed fish products. Any contamination must be avoided.
7. Directive No 3/98 provides rules on the microbiological criteria for the production of cooked crustaceans and shellfish.
8. Directive No 4/98 contains an extensive and detailed list of food additives that may be used in fish and fishery products.
9. Directive No 5/98 contains the water standard to be applied by the fish processing industry.
10. Directive No 6/98 provides rules for the inspection