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Assessing mariculture market constraints and potential in South-East Sulawesi: stakeholder engagement and situation analysis

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prepared by

Geoff Gooley, Department of Primary Industries (Fisheries Victoria)

*co-authors/
contributors/
collaborators*

Prof. La Ode M. Aslan, Haluoleo University

Mr Hotman Hutauruk, Dinas Kelautan Dan Perikanan

Mr Armen Zulham, Indonesian Centre for Marine and Fisheries Socio-Economic Research

Prof. Sena De Silva, Network of Aquaculture Centres in Asia-Pacific

approved by

David Shearer

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Contents

| | | |
|-----------|--|-------------------------------------|
| 1 | Acknowledgments | 4 |
| 2 | Executive summary | 5 |
| 3 | Introduction..... | 8 |
| 4 | Enter Heading 1 | 11 |
| 5 | Enter Heading 1 | 12 |
| 6 | Enter Heading 1 | 12 |
| 7 | Enter Heading 1 | Error! Bookmark not defined. |
| 8 | Enter Heading 1 | 16 |
| 9 | Enter Heading 1 | 24 |
| 10 | Enter Heading 1 | Error! Bookmark not defined. |
| 11 | Conclusions and recommendations | 28 |
| 11.1 | Conclusions | 28 |
| 11.2 | Recommendations | 28 |
| 12 | References | 28 |
| 12.1 | References cited in report | 30 |
| 12.2 | List of publications produced by project | 30 |
| 13 | Appendixes | 31 |
| 13.1 | Appendix 1:..... | Error! Bookmark not defined. |
| 13.2 | Appendix 2:..... | Error! Bookmark not defined. |
| 13.3 | Appendix 3:..... | Error! Bookmark not defined. |

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> the SMAR (ACIAR) team in Makassar, including Ms Suli Hakim and Mr Luthfi Fatah

2 Executive summary

2.1 Background

The island of Sulawesi (38,139 km²) with a coastal area of 114,879 km² and a coast line of 1,740 km is recognised by the government of Indonesia as a major area for development of mariculture. Within Sulawesi, one of the least developed areas is South East Sulawesi Province.

SE Sulawesi and the associated islands have many accessible and well sheltered bays and inlets with abundant natural resources, which provide suitable sites and good water quality for mariculture. Resident coastal communities are eager to increase their quality of life through adoption and development of commercial production systems for various products, including grouper, seaweed, lobster, abalone, pearl oyster and sea cucumber.

Fishery related activities are of considerable importance to this region and are currently estimated to account for about 12 % of the annual GDP, to which mariculture contributes approximately 3-4 %. In 2007, aquaculture production in the Province reached 153,160 t, valued at approximately 1000 billion IndRp, with a total of 115,483 households and 160,140 persons involved in the sector. Most production activity is centred around the islands of Buton and Muna, and in the outer Kendari Bay area, near Kendari, the major population and commercial centre of the Province.

Major production to date (> 85%) has been primarily centred around farming of red seaweed, largely in response to increasing global market demand for raw materials, but a variety of other higher value products are presently being produced for local and export seafood markets in Sulawesi, Indonesia and the broader Asian region.

Although the legislative and regulatory framework, designed in part to facilitate development of mariculture in Indonesia, has been in place since the mid 1980s-early 1990s, it is apparent that most development has taken place within the last 5-7 years. For the most part, development to date appears to have been mostly opportunistic, somewhat ad hoc and fragmented, with little strategic industry or market focus. The consequence is that much latent potential remains untapped, with limited opportunity being realised for expansion, diversification and increased profitability; this at a time when the mariculture sector throughout the region faces major challenges from, among other things, climate change, market globalisation, the global economic crisis and rapidly changing consumer preferences for higher value, quality assured seafood products for human consumption.

2.2 Present Study

Mariculture and fisheries development is often seen as an important strategy to contribute to poverty alleviation of rural coastal communities. The Government of Indonesia, having recognised this fact, is in the process of initiating development activities in partnership with the Australian Government through the 'Smallholder Agribusiness Development Initiative' (SADI). The purpose of this initiative is to reduce poverty and improve livelihoods for smallholders in eastern Indonesia.

The Australian Centre for International Agricultural Research (ACIAR) coordinates the 'Support for Market Driven Adaptive Research' (SMAR) sub-program of SADI. A major priority identified as part of the initial SMAR planning and prioritisation process was the development of the mariculture industry, particularly for various high value species in SE Sulawesi. It was further recognised that 'through chain' constraints were limiting commercial growth of the industry sector and economic development opportunities for the region. Adopting a more market-driven approach was therefore seen as a pre-requisite to

realising untapped potential of the mariculture industry in SE Sulawesi, with the ultimate flow of benefits directed towards local, smallholder producers (fishers and fish farmers).

The purpose of this project therefore is to develop an effective stakeholder group that is able to support the development of a more agribusiness, market driven approach to industry development of the smallholder mariculture sector in SE Sulawesi. Such an approach to market chain development is expected to benefit smallholders in the context of increased opportunity for more equitable, 'through chain' sharing of the economic value (i.e. 'value chain' agribusiness approach) of mariculture production in SE Sulawesi. The specific project objectives were:

1. To facilitate local leadership and support for mariculture industry development through establishment of a functional stakeholder network and strategic implementation framework.
2. To identify opportunities to adopt a more agribusiness, market driven approach to industry development of the smallholder mariculture market sector in SE Sulawesi.
3. In close consultation with the stakeholder network, prepare an industry development strategy.

The strategy used to deliver project outcomes against the stated objectives was to focus on establishing an initial framework for market-driven development, with an emphasis on characterisation of all components of the supply chain, from production through to post-harvest stages and associated distribution networks and market destinations. This involved initial stakeholder engagement, situation/needs analysis, knowledge management, strategic planning and capacity building, and addressing associated technical, market, communication and logistical constraints.

2.3 Conclusions and Recommendations

Given the latent potential of the industry in SE Sulawesi, it is clear that the province in general, and smallholders in particular, would gain considerable benefit to social and economic wellbeing through promoting selected market development opportunities and addressing associated key risks. Under the circumstances, the preferred approach is to 'bundle' the development and risk response into a pilot project designed to undertake a package of related activities on a pilot, commercial scale. Such a pilot project would develop, evaluate and demonstrate several village-based case studies designed to facilitate through chain practice change. According to the proposed industry development strategy, this would progress selected industry sectors in the first instance from the present Stage 1, semi-functional supply chain, to Stage II, functional market chain over a 3-5 year period. Features of the case studies would be 1) the identification of designated chain champions and formation of village-based farmer association networks, 2) formal engagement of new entrants to partner and coinvest with existing chain participants to offset and underwrite costs going forward, and 3) development and implementation of Better Management Practices (BMPs) by industry as a means to facilitate improved productivity and market access.

To facilitate implementation of the draft industry development strategy and associated conceptual framework outlined in this report, the following key recommendations are made:

Primary:

- > Undertake a regional scale, 3-5 year pilot project in SE Sulawesi to trial the development, evaluation and demonstration of selected mariculture market chain strategies and associated actions as a portfolio of specific case studies.

> The pilot project to be coordinated and implemented under the direction of a new high level mariculture task force to be established in SE Sulawesi with joint representation by key industry and government stakeholders.

Secondary:

> The case studies to be undertaken concurrently in selected regions of Kendari Bay and Buton and Muna Islands with focus on selected supply chains for key 'marquise' products including seaweed, grouper, lobster, sea cucumber, abalone and pearl oyster.

> The case studies to include:

>> Formation and implementation of village-based associations ('aquaclubs') of farmers, fishers and local traders, to be recognised by the Dinas as key industry forums for communication, training and general support.

>> Identification of chain champions within such associations and elsewhere within chains, including inter-island traders and other industry stakeholders as appropriate (e.g. NGOs, investors, consultants etc).

>> Development of a regional marketing strategy and industry investment strategy to be undertaken by appropriately qualified consultant(s) under direction of key industry and government stakeholder working group including aquaclubs, chain champions, Dinas, Haluoleo University (Unhalu) and relevant NGOs and development agencies elsewhere within the provincial government of SE Sulawesi.

>> Joint establishment by the Dinas and Unhalu. of a functional and cost-effective communications system to facilitate capacity building within aquaclubs and market intelligence for real time delivery of critical price, quantity, quality and logistical data.

>> Joint establishment of a technical advisory group within the Unhalu and the Dinas for coordination and delivery of the proposed R, D & E strategy.

>> Drafting of a management plan for mariculture in SE Sulawesi which provides an aquatic ecosystem-based IMTA framework for development; to be developed by appropriately qualified consultants under direction of and in collaboration with a key industry and government stakeholder working group including Dinas, Univ. Halu., relevant NGOs and environmental management agencies elsewhere within the provincial government of SE Sulawesi, and aquaclubs and chain champions.

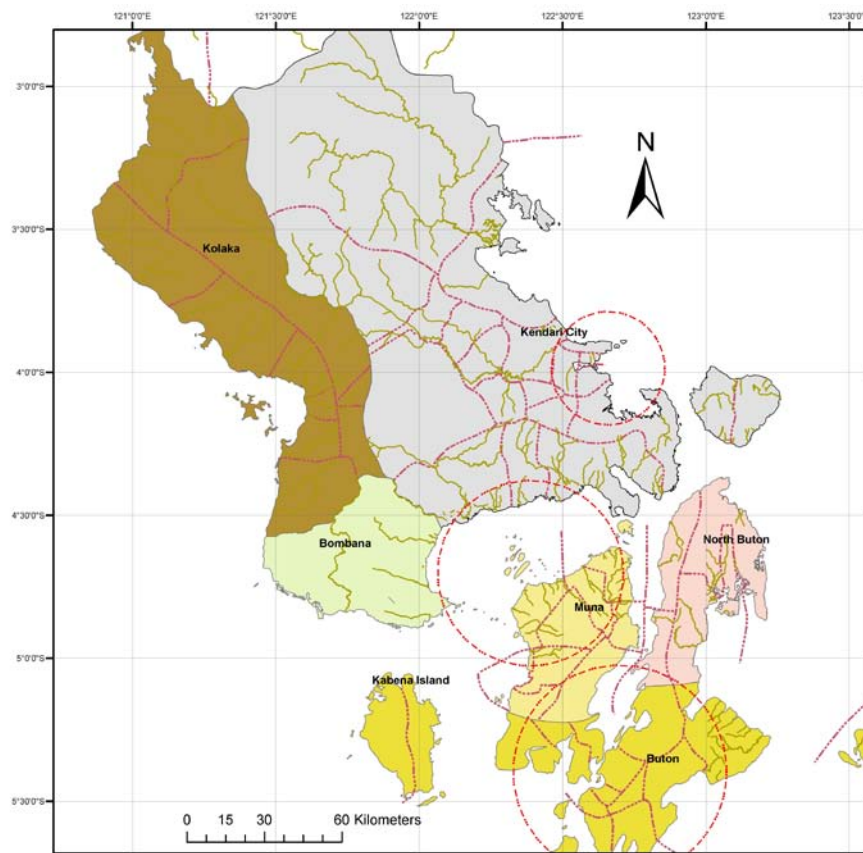
>> Development and trial demonstration of BMPs for selected industry sectors via newly established aquaclubs.

3 Introduction

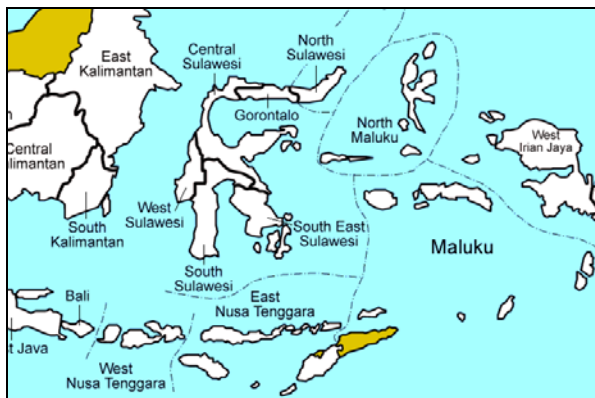
The island of Sulawesi (38,139 km²) with a coastal area of 114,879 km² and a coast line of 1,740 km is recognised by the government of Indonesia as a major area for development of mariculture. Within Sulawesi, one of the least developed areas is SE Sulawesi Province, which consists of 12 Districts, comprising ten regencies and two towns, including Kendari which is the major population and commercial centre.

SE Sulawesi and the associated islands have many accessible and well sheltered bays and inlets with abundant natural resources, including good water quality, for mariculture. Resident coastal communities are eager to increase their quality of life through adoption and development of commercial production systems for various local products including grouper, seaweed, lobster, abalone, pearl oyster and sea cucumber.

Fishery related activities are of considerable importance to this Province, and are currently estimated to account for about 12 % of the annual GDP, to which mariculture contributes approximately 3-4 % (Aslan et al. 2008). In 2007 aquaculture production in the Province reached 153,160 t, valued at approximately 1000 billion IndRp, with a total of 115,483 households and 160,140 persons involved. Most production activity in the Province is centred around the islands of Buton and Muna, and in the outer Kendari Bay area, near Kendari. Major production to date (> 85%) has been primarily centred around farming of red seaweed, largely in response to increasing global market demand for raw materials, but a variety of other higher value products are presently being produced for local and export seafood markets in Sulawesi, Indonesia and the broader Asian region.



SE Sulawesi, showing project study areas



Location of SE Sulawesi within the Indonesian archipelago

Although the legislative and regulatory framework designed in part to facilitate development of mariculture in Indonesia has been in place since the mid 1980s-early 1990s (ICMFSE 2009), it is apparent that most development has taken place within the last 5-7 years (Dinas Perikanan 2009). In order to encourage mariculture, for export as well as for increasing domestic consumption of seafood, the 'Aquaculture and Fisheries Vitalisation Initiative for East Indonesia' of the Government of Indonesia (GOI) is being implemented at the provincial level through the Dinas. Under this initiative, aquaculture products including shrimp, lobster, groupers, seaweed and sea cucumber have been targeted. The revitalisation initiative essentially consists of providing soft loans to small-scale farmers formed into groups of 5-10 individuals and provision of training, and aims to bring about institutional (farmer groups) empowerment. The average loan provided is in the order of Rp 5-6 million, and the farmers are expected to invest these funds in seed, netting and feed procurement, and improving cage infrastructure. For SE Sulawesi, Rp 1 billion has been made available by the GOI in 2008 for investment in 12 districts/towns throughout the province.

Apart from the GOI initiative, for the most part development to date appears to have been mostly opportunistic, somewhat ad hoc and fragmented, with little strategic industry or market focus. The consequence is that much latent potential remains untapped, with limited opportunity being realised for expansion, diversification and increased profitability; this at a time when the mariculture sector throughout the region faces major challenges from among other things, climate change, market globalisation, the global economic crisis and rapidly changing consumer preferences for higher value, quality assured seafood products for human consumption.

3.1 Support for Market Driven Adaptive Research (SMAR)

Mariculture and fisheries development is often seen as an important strategy to contribute to poverty alleviation of rural coastal communities. The Government of Indonesia, having recognised this fact, is in the process of initiating development activities in partnership with the Australian Government through the 'Smallholder Agribusiness Development Initiative' (SADI). The purpose of this initiative is to reduce poverty and improve livelihoods for smallholders in eastern Indonesia.

The Australian Centre for International Agricultural Research (ACIAR) coordinates the 'Support for Market Driven Adaptive Research' (SMAR¹) sub-program of SADI. A major priority identified as part of the initial SMAR planning and prioritisation process was the

¹ The purpose of SMAR is to develop strengthened, province-based agricultural R&D capacity that is market and client-driven and effectively transferring knowledge between stakeholders.

development of the mariculture industry, particularly for various high value species in SE Sulawesi. It was further recognised that ‘through chain’ constraints were limiting commercial growth of the industry sector and economic development opportunities for the region. Adopting a more market-driven approach was therefore seen as a pre-requisite to realising untapped potential of the mariculture industry in SE Sulawesi, with the ultimate flow of benefits directed towards local, smallholder producers (fishers and fish farmers).

For these constraints to be addressed, the functionality of existing mariculture supply chains must be enhanced to establish a more efficient and effective market chain, complete with streamlined and fully integrated production, post-harvest and market components. To achieve a functional market chain in turn requires investment in technical and marketing capacity, cost-effective networks and communication systems, infrastructure and a supportive institutional framework. Further, the natural resource base upon which mariculture industry production relies, needs to be sustainably managed to optimise long-term benefits.

Critically, for the success of the development of this industry, there is a need for:

- 1) a better understanding of the supply/market chain for selected mariculture products from South East Sulawesi;
- 2) an understanding of what constraints will need to be overcome within the supply chain to successfully link the market with smallholder producers, and
- 3) consideration of the different supply/market chain strategies that could be implemented to gain increased competitiveness in the market place, with particular reference to post-harvest/post-farm gate options.

This rationale is based upon the understanding that it is not production systems that will be competitive in the global marketplace, rather, competitive industries will be based on the establishment of efficient and effective ‘market chains’ that will be able to penetrate and maintain domestic and export market access.

3.2 The present study

The purpose of this project therefore is to develop an effective stakeholder group that is able to support the development of a more agribusiness, market driven approach to industry development of the smallholder mariculture sector in SE Sulawesi. Such an approach to market chain development is expected to benefit smallholders in the context of increased opportunity for more equitable, ‘through chain’ sharing of the economic value (i.e. ‘value chain’ agribusiness approach) of mariculture production in SE Sulawesi.

The project was commissioned in January, 2008 for a 14 month period. The project team is lead by Fisheries Victoria, Department of Primary Industries Victoria (DPIV), Australia, and involves collaboration with:

- the Faculty of Fisheries and Marine Science, Haluoleo University (Unhalu.)
- Dinas Kelautan dan Perikanan (Fisheries Department), Kendari, SE Sulawesi Province, Indonesia
- the Network of Aquaculture Centres in Asia-Pacific (NACA), Bangkok, Thailand
- the Indonesian Centre for Marine & Fisheries Socio-Economic Research (ICMFSE), Jakarta, Indonesia.

4 Objectives

1. To facilitate local leadership and support for mariculture industry development through establishment of a functional stakeholder network and strategic implementation framework.
2. To identify opportunities to adopt a more agribusiness, market driven approach to industry development of the smallholder mariculture market sector in SE Sulawesi.
3. In close consultation with the stakeholder network, prepare an industry development strategy.

5 Methodology

The key methods utilised to deliver this project were:

- a) Identification, establishment and formal engagement of key stakeholder network, including smallholder producers, other market chain participants (collectors/ middlemen/ traders/ processors/ exporters), investors/entrepreneurs, relevant government and tertiary institutions in SE Sulawesi and other provinces/regions (Sulawesi/Eastern Indonesia/SE Asia/Asia-Pacific);
- b) Development and commissioning of a communication plan to facilitate stakeholder engagement with emphasis on routine collation and delivery of market chain information in user-friendly format by local project partners; to include development of reliable, robust and cost-effective methods of data collection and dissemination to build market chain knowledge base;
- c) Characterisation and assessment of smallholder mariculture sector structure/ status (situation analysis) and associated market chain issues, opportunities and constraints (needs analysis) in SE Sulawesi, with emphasis on both post-harvest capability (e.g. market strategies, value-adding) and production input issues (incl. availability of seedstock and feeds where appropriate);
- d) Undertaking strategic planning analysis to develop and identify market chain models and options for industry development designed to build 'through chain' capacity, facilitate practice change consistent with delivery of SMAR initiative outcomes across Eastern Indonesia, achieve increased competitiveness within domestic and export markets and overall sustainable mariculture industry development in SE Sulawesi.

The strategy used to deliver project outcomes against the stated objectives was to focus on establishing an initial framework for market-driven development, with an emphasis on the post-harvest/post-farmgate component of the supply chain. This involved initial stakeholder engagement, situation/needs analysis, knowledge management, strategic planning and capacity building, and addressing associated technical, market, communication and logistical constraints.

This project is the first step in a possible multi-staged process, and was specifically designed to enable a logical and measured analysis of the situation, and preparation of an action agenda designed to underpin strategic and prioritised planning for future development by key stakeholders.

Achievements against activities and outputs/milestones Enter text

6 Achievements against activities and outputs/milestones

Objective 1: To facilitate local leadership and support for mariculture industry development through establishment of a functional stakeholder network and strategic implementation framework

| no. | activity | outputs/ milestones | completion date | comments |
|-----|---|---|--------------------|--|
| 1.1 | Project visit to Kendari (Jan. '08), incl. project inception workshop, site inspections, stakeholder consultation and preliminary mapping of market chain | Draft project work plan for local partners | Jan '08 | Local partners: University of Haluoleo, Kendari (Unhalu.), Dinas Perikanan, Kendari (Dinas) and Indonesian Centre for Marine and Fisheries Socio-Economic Research, Jakarta (ICMFSE) |
| | | Prelim. Market Chain (post-harvest) report | June '08 | Market chain report ('Seafood Market Supply Chain, SE Sulawesi') prepared by Morelink Consultants (emphasis on post-harvest sector) |
| 1.2 | Establish local project team and TOR for project, incl. development of work plans and consultative network | Amended project work plan, incl. design and drafting of task specific briefs for proposed market chain survey | Feb - July '08 | Back-office activities incl. consultation between DPI, ACIAR SMAR (Makassar) and local project partners, and exchange of draft briefs/agreements for agreed activities as per draft work plan |
| 1.3 | Project visit to Kendari (Aug. '08), workshop and finalisation of project steering committee and work plans | Final project work plan for local partners | Aug. '08 | Project visit by Australian (NACA) team members on behalf of DPI, incl. further field visits and stakeholder consultation |
| | | Project 'Technote' | Oct. '08 | The project 'Technote' ('Mariculture Development Opportunities in SE Sulawesi, Indonesia') published in the NACA magazine (Asian Aquaculture Asia, Vol. 13, No. 4, Oct-Dec 2008) |
| 1.4 | Project visits to Kendari and Makassar, project planning with local project partners, and training needs analysis and implementation | Training of local project team for market chain survey, and commission of survey | July '08 | Activity undertaken in Kendari by local project team members incl. Unhalu and ICMFSE; survey commissioned July/Aug '08 |
| | | Progress reporting and review of prelim. survey results | Nov. '08 | Project visit by PL, incl. activities in Makassar (industry consultation) and Kendari (industry consultation and review of survey results); survey reporting provided by Unhalu and reviewed by PL |
| | | | | |

PC = partner country, A = Australia

Objective 2: To identify opportunities to adopt a more agribusiness, market driven approach to industry development of the smallholder mariculture sector in SE Sulawesi

| no. | activity | outputs/ milestones | completion date | comments |
|-----|--|--|---------------------|---|
| 2.1 | Undertake market chain analysis, stakeholder needs and industry network feasibility analysis, and institutional framework analysis | Mariculture market chain survey report | June '09 | Survey report ('Mapping Survey, Situation Analysis and Characterisation of Mariculture Supply Chain in SE Sulawesi') completed by Univ. Halu, ICMFER, NACA and DPI. |
| | | Farmer network feasibility analysis report | June '09 | Report ('Analysis of Mariculture Producer Networks in SE Sulawesi, Indonesia') completed by Dinas Perikanan. |
| | | Report on institutional framework | June '09 | Report ('Institutional Framework for Fisheries and Aquaculture Development in SE Sulawesi, Indonesia') completed by ICMFER |
| 2.2 | Review of progress/draft reports and undertake additional stakeholder consultation, market chain mapping and capability analysis | Amended draft reports as per activity 2.1 | Nov. '08 - Apr. '09 | Combination of project visits to Kendari (Nov. '08 and April '09) and back-office activities by PL, in consultation with local project team members in Indonesia and NACA |
| | | | | |

PC = partner country, A = Australia

Objective 3: Prepare an industry development strategy that will benefit smallholders in the context of increased opportunity for more equitable, 'through chain' sharing of the economic value of mariculture production in SE Sulawesi

| no. | activity | outputs/ milestones | completion date | comments |
|-----|---|--|--|--|
| 3.1 | Prepare discussion paper summarising project findings | Collective outputs from reports listed under Activity No. 1.1, 1.3 and 2.1 | As per Activity No. 1.1, 1.3 and 2.1 | Stand-alone Discussion Paper was not produced, rather a portfolio of reports/publications was produced to collectively address Milestone #2 |
| 3.2 | Undertake project visit and convene strategic planning workshop for stakeholder engagement and input to Industry Development Strategy | Draft Conceptual Framework and Strategic Industry Development Plan for Mariculture in SE Sulawesi | April '09 | Project visit completed by PL and convened strategic planning workshop with local project team and stakeholders on formulation of conceptual framework and draft industry development plan. |
| 3.3 | Prepare draft Industry Development plan incl. R, D & E action plan | Draft Conceptual Framework and Strategic Industry Development Plan for Mariculture in SE Sulawesi | April-June '09 | Back-office activity by PL in consultation with project team |
| 3.4 | Finalise Industry Development Plan and meet and consult with/seek feedback from local key stakeholders | Final draft Conceptual Framework and Strategic Industry Development Plan for Mariculture in SE Sulawesi Roadshow presentation/workshop of project (Final Report) findings | July '09 Nov-Dec '09 (pending) | Back-office activity by PL in consultation with project team Presentation of Final Report findings to local stakeholders in SE Sulawesi to be undertaken (expected in Nov-Dec '10) once Final Report finalised |
| 3.5 | Prepare reports for web publication | Collective outputs from reports listed under Activity No. 1.1, 1.3, 2.1 and 3.4 GIS mapping of the study area | As per Activity No. 1.1, 1.3, 2.1 and 3.4 (and pending re translations) Sept. '09 (pending) | Back-office activity by local project team. Once Final Report is accepted by ACIAR, pdf versions of relevant reports will be made available for download via project link on NACA web page (incl. Bahasa translation). Report entitled 'Mapping of Existing Mariculture Activities in South East Sulawesi' completed by Univ. Halu. |
| 3.6 | Prepare Final Report | Final Report to ACIAR incl. all supplementary reports | August '09 | Back-office activity by PL in consultation with project team |
| | | | | |

PC = partner country, A = Australia

7 Key results and discussion

The key results for this project are collectively described in the key supplementary reports prepared during the project, and are summarised below.

1) **Seafood Market Supply Chain - SE Sulawesi (Morelink 2008) -**

The study has identified a range of opportunities and constraints affecting the growth of the SE Sulawesi seafood industry. These are summarized below.

a) Export demand for seafood is strong. Indonesia is a major producer of a wide range of seafood for export to markets in Asia, USA and EU. Seafood (live fish, lobsters, dried abalone, dried sea cucumber and seaweed) is an important part of the economy of SE Sulawesi as the waters of SE Sulawesi provide fertile ground and a large supply base for wild catch seafood and further potential for farmed seafood.

There are good opportunities to expand the practice of 'farmed' seafood as supply of 'wild catch' seafood diminishes. There is also an opportunity to introduce regional branding (based on QA standards) to promote the Kendari seafood industry. This could be done through the establishment of a local trading cooperative.

b) Fishermen are not market focused. Fishermen supply to a collector what they catch or produce rather than what the buyer wants. This leads to lower or discounted returns to the fishermen if the seafood doesn't meet specifications on size, freshness or water content.

There is a need for training of fishermen to reduce the mortality of live fish through improved husbandry practices.

c) Traders have the market power. City based traders (from Jakarta, Surabaya or Makassar) control the buying and selling (for export or domestic markets) of seafood from Kendari seafood suppliers. Fishermen from Kendari are then price takers and lack the knowledge of market requirements. In Makassar there is a major fishing cooperative (PUSKOPIN) which provides a vehicle for exchange of information and trade.

There is a need for better communication between traders and fishermen on market requirements.

d) Limited infrastructure. The Kendari port does not have reefer containers or cold storage facilities unlike the port of Makassar. There is ice making facilities in Kendari for fishermen. Also, traders in Kendari of live fish have holding tanks and packing facilities.

There is an opportunity to introduce packing facilities in fishing communities so that they can hold and pack fish for the market. This will bring the fishermen closer to the market and improve market signals which could lead to an increase in profit per kg of seafood.

e) Involve all Strategic Allies. There are a few local Government departments that provide a service role in the seafood industry in SE Sulawesi.

There is a need to involve all allies in training and market development programs, including Quarantine, the Department of Fisheries and the University.

2) **Mapping Survey, Situation Analysis and Characterisation of Mariculture Supply Chain in SE Sulawesi (Unhalu et. al. 2009):**

The mariculture industry in SE Sulawesi plays an important role in providing existing source of income, jobs and potential employment opportunities for rural, coastal communities, and export earnings for the local economy. SE Sulawesi has expansive areas for potential mariculture development, but also faces various constraints, such as low productivity due to use of traditional technologies, weak bargaining position for local stakeholders in terms of accessing finance and increased share of product value. In

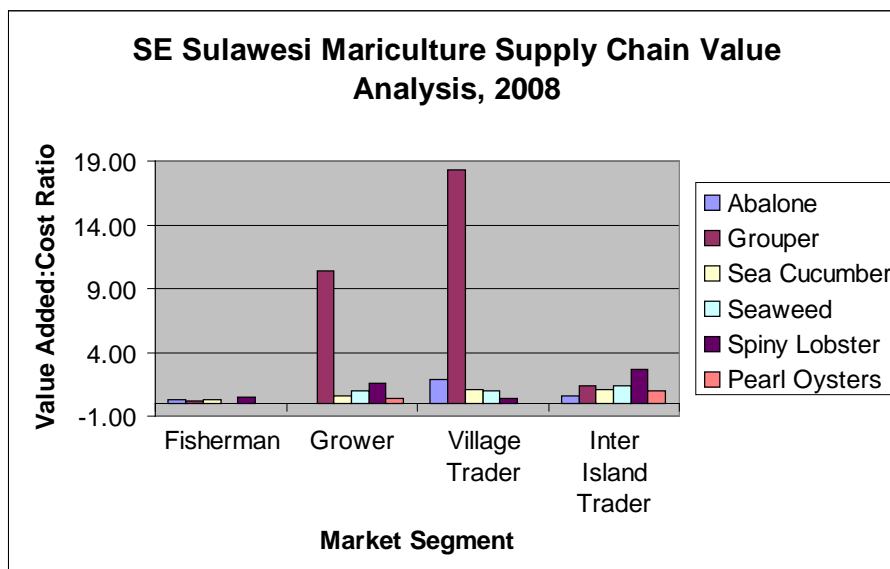
Kendari Bay in particular, the mariculture industry faces a potential environment problem due to the expansion of urban and coastal development.

In summary, the SE Sulawesi supply chain characteristics vary considerably across locations and products. Some chains are reasonably well established, relatively short and simple. Other chains are quite complex and long, and only recently established or still emerging. All supply chain stages currently play an important role. Fishers and growers are at the very start of the chain and are therefore critical to all latter stages. Village fish traders play a prominent role to collect the mariculture products in various remote locations. A relatively small number of inter-island traders strictly control the distribution and marketing of products to various local and export destinations, as well as providing financial support through loans to village fish traders. In this context, financial hardship and constraints on expansion remain a serious problem for village fish traders and by association therefore fishers and growers in all areas and for all products. Access to other, more equitable, 'external' sources of income through governmental/inter-governmental agencies and/or private, joint venture capital investment is required to alleviate this problem for producers and local village collectors

Overall, the flow of benefits in terms of share of through chain value is disproportionate, with fishers and growers typically disadvantaged by comparison to traders. In turn, local village traders typically receive proportionately less of the overall through chain value compared with inter-island traders; the latter having the only direct link into the final consumer market place. More specifically, the fishers and growers have a relatively weak bargaining position in the transaction of mariculture products in the marketplace. This imbalance needs to be addressed, perhaps through introduction of an auction-type market system and/or negotiation of forward purchase contracts in order to improve the bargaining position of various stakeholders at the production end of the supply chain.

The reliability of existing mariculture production and supply statistics for the industry is relatively low due to inconsistent and incorrect recording and reporting of production and market data, especially for live products. Unreported transshipment occurs in many places because the live fishes are sold for export directly to fishing vessels at sea where production occurs.

A summary of supply chain value analysis for the mariculture sector in SE Sulawesi, as mapped in 2008, is provided below:



Currently, SE Sulawesi is known primarily as one source of 'raw material' for the mariculture industry in Indonesia, with little emphasis on post-harvest added value. Infrastructure at production sites is limited by available technology and finance, which limits potential expansion. Mostly traditional technologies are utilised and available finance

through the existing supply chain is typically controlled by the traders. Post-harvest infrastructure at existing landing sites is limited and suitable processing, warehousing and transportation systems are needed to support the development of mariculture in SE Sulawesi. Capacity building and institutional development at all stages is required and is considered an increasingly important investment priority in order to maintain sustainability and to increase economic viability of the SE Sulawesi mariculture industry.

3) *Analysis of Mariculture Producer Networks in SE Sulawesi, Indonesia (Dinas Perikanan 2009) -*

Due to its geographic location, SE Sulawesi has the advantage of having valuable natural fisheries resources, predicted to be in excess of 1,520 million tonnes sustainable annual yield. Actual fisheries production by the end of year 2007 was estimated at 200,672 tonnes, valued at (Ind.) Rp. 3,310 billion (Annual Report of Fisheries, 2007). Most fishing activities are concentrated in populated coastal areas. More than 60% of fishing gear is still manually operated and traditional, however over exploitation of wild stock and environmental degradation due to pollution are being experienced by traditional fisheries in some areas. This has been the major problem faced by local fisherman. Also, lack of knowledge, high operational cost and low price of fish in local markets are being identified as additional problems.

Based on existing conditions, mariculture is being encouraged by local government to enhance fisheries production and at the same time reduce environmental degradation, particularly in coral reef ecosystems, due to destructive fishing activities. Currently, mariculture is developing in almost all coastal areas of SE-Sulawesi, but medium to large farms are operated mainly in Buton, Muna and Kendari. Potential area that can be developed for mariculture is estimated to be in excess of 230,000 ha, of which an estimated 42,000-52,000 ha only has been exploited for mariculture activities already (see summary data below). Mariculture is dominated by seaweed, a staple commodity of the region, and more recently also higher value species such as groupers, pearl oysters and lobsters. Valuable capture fisheries for sea cucumber and abalone are also considered in the context of mariculture development in the present study, as both have potential to be cultured using both wild caught and hatchery-produced seed and viable, high value export markets exist. Estimated potential and actual production for key fisheries sectors in SE Sulawesi in October, 2008 (Source: Dinas Perikanan Dan Kelautan, SE Sulawesi) is:

| Sector | Potential production | Actual production |
|------------------------------------|----------------------|-------------------|
| Marine capture fishery | 1,520,340 tonnes | 286,289 tonnes |
| Freshwater (lakes) capture fishery | 98,000 tonnes | 497 tonnes |
| Brackishwater aquaculture | 44,699 ha | 14,632 ha |
| Freshwater aquaculture | 20,850 ha | 1,275 ha |
| Mariculture | 230,170 ha | 42,572 ha |

Seaweed is the most cultured product in SE Sulawesi as water quality parameters and ease of culture techniques facilitate culture success of this product. Problems confronting mariculture development in SE Sulawesi include the high initial investment cost and limited availability of capital, high operational costs, limited technical knowledge and market access.

The survey findings highlight the need for and high level of support from farmers for the formation of a network of farmer groups and association. To a large extent, farmers are already organized into logical, geographically-based groupings with specific product and species focus, depending on where they are. Where groups do not already exist could readily form into groups simply on the basis of existing village and district arrangements. This also applies to fishers targeting species with potential for development as mariculture species such as abalone and sea-cucumber, as well as fishers providing trash fish for mariculture feeds and wild-caught juveniles as mariculture seedstock. All such farmers and fishers are either one or the same, where households have already diversified, or are co-located in villages so that horizontal business integration can be easily realized.

All surveyed groups have been recorded with key contacts and direct (100% preferred) contact details. All (100%) of surveyed farmer groups have identified a requirement for skills-based training in production, marketing and other associated agribusiness disciplines. They have also completely agreed with the need for improved and expanded production and post-harvest infrastructure and the willingness to support and participate in a more functional mariculture market chain with an emphasis on both domestic and export trade.

4) Institutional Framework for Fisheries and Aquaculture Development in SE Sulawesi, Indonesia (ICMFSE 2009) -

As the lead agency at the local government level, the capacity of district MFOs to undertake the function of planning and implementation marine and fisheries development programs effectively and efficiently is limited due in part to the following issues:

The MFO, as the lead agency in mariculture development at local government level, has merged with other government institutions which have a different focus.

The capacity and capability of MFO officers to conduct marine and fisheries planning is constrained due limited skills-based training and experience relevant to marine and fisheries resources.

The allocation of budget for fisheries development programs at the provincial level creates difficulties for implementation at the district level, particularly where programs are not targeted at stakeholder needs e.g. budgets targeting infrastructure when the priority should be on technical assistance and supporting funds to offset operational costs.

Regular technical and management assistance is limited for most mariculture programs implemented at the district level, and

Most of the budget focus is on increasing the primary production of mariculture business and limited effort is put into encouraging value-adding to secondary products through quality control grading and processing of the products.

The mariculture industry in SE Sulawesi specifically needs many improvements to achieve and economically viable industrial scale. To facilitate development, priority consideration should be given to:

Pilot support for MFOs at the three main mariculture production locations in SE Sulawesi (Kendari, Buton and Muna) as part of a provincial scale case study, with the emphasis being to encourage community-based economies and demand driven policies.

Increasing the capacity provincial and district MFOs specifically relating to the management and technical support of mariculture businesses as well as for strategic planning of the sector.

At the MoMFA level, there is a need to increase funding support for the development of mariculture and fishery sector as a whole.

5) Mapping of Existing Mariculture Activities in SouthEast Sulawesi (UnHalu 2010)

The objective of this study was to map the existing status and geo-physical attributes of mariculture activities in the Province, including seed source, production and distribution of key species, practiced mariculture techniques, key water quality and other bio-physical parameters, as part of the broader ACIAR project survey designed to characterise the existing mariculture supply chain in SE Sulawesi.

It is expected that this study will provide valuable information to key mariculture sector stakeholders, including business entities and individuals, government agencies, researchers and to the fish farmers themselves in order to develop sustainable yet profitable mariculture in SE Sulawesi. This allows for a better understanding of what industry development strategies are required to enhance functionality of the supply chain and improve overall profitability and sustainability of the sector. In particular, the improvement of livelihoods and overall wellbeing of smallholder producers is an expected medium-longer term outcome of the adoption of a more agribusiness approach to development of mariculture in this Province.

Based on the results of this study, the following conclusions and recommendation are made:

- >> Three big clusters of existing mariculture activities are located in Kendari, Muna and Buton areas, collectively serving as both a source of mariculture products and a market destination or transit location.
- >> Most mariculture production in SE Sulawesi is based on traditional practices.
- >> All surveyed locations of existing mariculture activities in SE Sulawesi show relatively optimal water quality conditions.
- >> A lack of financial support, knowledge, skill, market information and institutional support has prevented farmers from enhancing their livelihoods and wellbeing through mariculture activities alone.
- >> Site capacity and suitability analysis of existing or potential areas of mariculture activities and development have largely not been considered by stakeholders involved in managing coastal areas, resulting in crowded and unmanaged development with multiple overlapping economic activities in some areas.
- >> Sensitive mariculture activities can be forced out from areas due to environmental and amenity impacts from other conflicting activities.
- >> Locations with no land transportation (small islands) or geographically far from capital cities have longer supply chain for products, with reduced profit margins as a result.
- >> Piloting of integrated 'value-adding' mariculture industries (e.g. raw material, processed products and 'ready to eat' industries) might help ease some if not all of the existing economic problems of the mariculture sector.
- >> Twice annual time series of water quality measurements representing wet and dry seasons is required to depict the real condition of water quality in SE Sulawesi, for both existing and proposed areas for development.

6) Conceptual Framework and Strategic Industry Development Plan for Mariculture in SE Sulawesi (DPI et al. 2009):

An industry development strategy for the mariculture sector in SE Sulawesi will assist industry to explore concepts, identify risks and opportunities, prioritise and schedule key needs and associated tasks, set targets and goals and otherwise provide a formal vehicle to engage stakeholders, including industry, government, service providers and investors in relation to such issues as:

- a) Organisation and management: Considers the requirements for key industry networks and linkages between industry participants and attraction of competent leaders ('chain champions'), producers, traders, investors and service providers.
- b) Market planning and development: Refers to such issues as joint marketing and marketing alliances, distribution alliances, better integration of primary producers, processors and exporters and the development of strategic marketing plans.
- c) Primary production supply, growth and profitability: Requirements to determine and implement improved production and post-harvest practices in the form of Better Management Practices.
- d) Quality assurance systems: The development and implementation of appropriate 'through chain' QA/QC systems, food safety and traceability to meet market needs and expectations.
- e) R, D & E and training: Requirements for market chain members to enhance productivity, profitability and sustainability through access to new technologies and to standardised training programs are issues for consideration.
- f) Investment: Framework for lobbying for Government and aid program support and for attracting new capital investment for infrastructure, capacity building, market development etc.

To achieve these outcomes, the industry development strategy should have a clear vision and be based on SMART goals (Strategic Measurable Achievable Realistic Timely) goals owned and supported by key stakeholders, with an agreed work plan incorporating prioritised actions and a timetable for addressing short, medium and long term objectives and outcomes.

The industry development strategy should remain in draft format at least initially until all stakeholders are consulted and feedback provided, after which it can be finalised and implemented as a Stage I/II plan. The strategy needs to be reviewed and revised as appropriate at least every three years thereafter to ensure it remains on track to achieve stated outcomes.

A tentative vision for development of the mariculture industry in SE Sulawesi is:

" To be a significant and sustainable primary industry supporting social, economic and environmental wellbeing of coastal communities throughout the Province...."

To realise this vision, the following key development goals are proposed for initial consideration:

- > High Level (long term)
 - >> The mariculture industry to develop through an agribusiness-based, market-driven approach
 - >> Smallholder, business and institutional capacity enables the realisation of industry potential and flow of through chain benefits
- > Low Level (short-medium term)
 - >> Development is supported by producer networks and associated integrated businesses employing Better Management Practices

>> Development is supported by targeted, industry-based RD&E and skills-based training

>> Development is supported by structured investment, market development and marketing plans

These goals also implicitly identify the broad scale practice changes that are required from industry and key stakeholders, as well as the expected knowledge, attitudes, aspirations and skills that are likely to become apparent.

Key Result Areas and associated performance indicators to determine progress in meeting these goals are yet to be determined, but may include:

- > Validated production, pricing, yield and profitability data for mariculture sectors/products
- > Producer association registrations, start-ups, communications, enquiries and feedback
- > Compliance with and performance of agreed Better Management Practices
- > Market/buyer demand, trends and specifications
- > Through chain infrastructure and investment trends, registered businesses and start-ups
- > Registered training courses, enrolments and qualifications
- > R,D & E outputs, publications, manuals, services and IP commercialisation.

The primary 'end users' and beneficiaries of the proposed mariculture industry development strategy for SE Sulawesi include:

- > Smallholder farmers, fishers and local traders
- > Coastal communities
- > Other chain participants
- > Provincial and regional institutions (tertiary and government)

For the purposes of this study, a three staged industry development strategy is proposed, with a primary 'through chain' focus based on the following timeframes and nominal descriptors:

- > Stage I - Present – Semi-Functional Supply Chain
- > Stage II - next 3-5 yrs – Functional Market Chain
- > Stage III - >5-10 yrs – Value Chain

The present, Stage I 'semi-functional' supply chain (Fig. 1) is so described based on the outcomes of the environmental scanning undertaken as part of this study (see also Unhalu. et. al. (2009)). The existing supply chain is established, operational and economically viable, but profitability is variable and disproportionate across sectors and probably therefore not viable in the longer term. Producers are 'price takers' rather than 'price makers', thereby subject to the vagaries of fluctuating market demand with limited ability to optimise recurrent expenditure, revenue and overall profitability. Producers typically place little premium on product quality beyond the needs of the next step in the chain. In most cases they are unaware of end consumer needs and associated market requirements, other than what is dictated by the traders. This is a disincentive for investment, expansion and diversification by the producers. Although existing practices are largely traditional and consistent throughout the Province, there is also no accepted benchmark for production techniques, product quality or environmental management. In the absence of adopting a more agribusiness approach to development, livelihood of producers remains mostly impoverished and considerable potential remains unrealised.

To break the status quo, industry development requires an investment in capacity building, production, communication/information systems and post-harvest infrastructure, resource management and a strategic market focus.

Stage II is proposed as the first step in progressing from the existing supply chain scenario to a more functional market chain over the next 3-5 years. This is seen as the immediate priority for the industry, but with an aspirational goal of subsequently developing a true 'value chain' in the longer term as Stage III (realistically, given existing circumstances, unlikely within the next 5-10 years).

A Stage II Functional Market Chain is characterised by most sectors being established on agribusiness principles of management and development, typically featuring strong, strategically-based partnerships or networks with more integrated and streamlined planning, production, trading and marketing processes. These partnerships or networks would be led and/or coordinated and managed by designated 'chain champions' and provide a platform for development, demonstration and implementation of standardised Better Management Practices (BMPs). Market information systems would be established and operational for much of the chain, allowing pricing, quality and profitability to be enhanced. This would provide the basis for a more informed, strategic expansion in overall production of existing products and diversification into new products as appropriate, together with necessary market-driven incentive for changing established practices. Higher value and quality products would begin to be differentiated in the market place with the assistance of BMPs to underpin quality control, productivity improvement and environmental management. Enhanced technical capacity and infrastructure at all stages would be under active development and expansion, as evident from combined government and private sector investment.

8 Impacts

8.1 Scientific impacts – now and in 5 years

This project has created a valuable new database which comprehensively describes in quantitative and qualitative form a suite of key parameters which effectively define the scope, scale and present status of the mariculture sector and associated supply chain for selected products within SE Sulawesi. This is the first time such a database has been formulated and effectively characterises and maps the present industry situation. To this end, this database is both valuable and unique; as such data has not previously been available.

Within five years, and assuming the proposed industry development strategy is implemented successfully, the industry should have progressed from the existing semi-functional supply chain (Stage I) to at least a more functional market chain model (Stage II). At this point, and assuming further data collection to enhance the database and to expand the temporal scale of the data (if not the spatial scale) through perhaps repeat, biannual surveys, the database will enable reliable time-series monitoring and analysis of key industry management and development metrics for purposes of facilitating evidential-based, sustainable management and development of mariculture in SE Sulawesi.

8.2 Capacity impacts – now and in 5 years

The major capacity building impacts from the project have been achieved in three key areas:

The Fisheries Faculty at Unhalu has the first cohort of undergraduate students progressing through as 3rd year students at the present time (four year undergraduate course). Eight leading students were selected by the faculty as 2nd year students in 2008 to undertake the field component of the baseline socio-economic and market chain survey of the mariculture sector in SE Sulawesi as part of the project. The students were supervised jointly by the Dean of the Faculty, Dr Aslan Laode, and Mr Armen Zulham, (ICMFSE). Survey design was undertaken by the Project Team, student training by Armen Zulham and day to day support provided by staff of the Faculty. The students undertook initial data collation, summary analysis and reporting, including presentation of preliminary results at the Project's strategic planning international workshop in Kendari on April 25 2009. This seminar presentation involved English language PowerPoint seminar, together with Bahasa translation seminar notes for local workshop participants. This was the first ever English language seminar presentation by students in the 27 year history of Unhalu. This task was undertaken as an additional work load to the normal undergraduate course work, and the students were only paid a relatively small, nominal allowance for time spent, plus travel costs. Basically the students participated as a unique learning experience and a practical means to enhance various skills. The quality of the work was exceptional and the students collectively made a major contribution to the project through delivery of the field component of the survey.

It is expected this cohort of students will provide leadership to other senior undergraduate students in the Faculty as they progress towards conclusion of their graduate degree in 2010. Within the next five year period, these same students are expected to be most likely to undertake post-graduate training at various levels and/or take up science-based positions within government and/or leading industry development positions. The impacts of capacity building of this type are expected to be realised within the next five years coincident with needs and opportunities arising as industry development in the mariculture sector in SE Sulawesi progresses from Stage 1 (present; semi-functional supply chain) to Stage 2 (proposed functional market chain). Demand for science-based skills to underpin

various aspects of environmental monitoring and management planning, as well as agribusiness development and management, will be at a premium at this time.

From a broader science delivery perspective, the enhanced capacity at the Faculty level was achieved through establishment of effective collaborative networks. Specifically, the partnership established between the project team members and associated faculties (e.g. GIS) and other institutions, including Unhalu, the Dinas, ICMFSE, NACA and DPI, has collectively enhanced local capacity for science delivery, strategic project planning, management and reporting, and general communications to facilitate international engagement. Practical experience in delivering a multi-disciplinary, collaborative project such as this has focussed the attention of local stakeholders and set new benchmarks in achieving acceptable standards of project delivery governance and overall performance, including completeness, accuracy and timing of outputs. This enhanced capacity will provide a framework for developing, leading and delivering future programs in SE Sulawesi over the next five years and beyond. It also provides an effective focal point for foreign aid funded project investment and engagement by associated agencies, including national governments such as ACIAR, NGOs and inter-governmental agencies (such as NACA).

From an industry perspective, the major capacity impacts going forward, subject to adoption of relevant recommendations would be enhanced knowledge, skills, business acumen and profitability collectively realised in the formation of proposed farmer associations and development and adoption of BMPs.

8.3 Community impacts – now and in 5 years

Immediate community impacts from the delivery of this project are limited. This project is primarily a scoping study designed to identify needs and opportunities, and to establish enhanced capacity to facilitate future developments. Tangible community impacts are therefore expected to be more apparent within the next 3-5 years, subject to the recommendations for the project being actioned.

More specifically, the project has described the role that commercial mariculture presently plays in delivering significant socio-economic benefits to small-holder fishers, farmers and collectors/trader in mostly impoverished coastal communities in the Kendari, Muna and Buton regions of SE Sulawesi. The project has also clearly identified the role that marine natural resources, both biological and physical, play in supporting mariculture production in SE Sulawesi. The project has characterised the existing semi-functional market chain for mariculture in these regions, which indicates a disproportionate minority flow of benefits to small-holders, an overall lack of an agribusiness approach to farming, a lack of a strategic approach to development, and a lack of an ecosystem framework for marine resource management.

Subject to implementation of recommended actions designed to facilitate industry development and progression to Stage II (Functional Market Chain), broader community benefits are expected to commence being achieved within a five year time frame in Se Sulawesi.

In the absence of any further activity, the collective impacts on the community presently amount to an overall loss of opportunity for growth, and the risk of environmental decline within the coastal zone of SE Sulawesi where the key centres of mariculture production are located.

8.3.1 Economic impacts

Within five years, potential exists to increase overall mariculture production levels within selected key sectors, including seaweed and selected higher value products. Growth rates in production are difficult to project due to the lack of reliable data for existing production, but mean annual growth consistent with recent trends in seaweed farming are considered

reasonable as a benchmark. Overall production level increases are likely to be complemented by increases in unit pricing over time, particularly as quality control/assurance and marketing support take effect.

Production costs are likely to be moderated due to competitive pricing of labour going forward, and the natural productivity of the region. Conversely, cost pressures on inputs from introduction of new production technologies and infrastructure, the cost of certification for market access, and the vagaries of export pricing in otherwise global markets for most mariculture products, are likely to moderate returns periodically, if not progressively. On balance, given the abundance of natural advantages in SE Sulawesi, and global demand far exceeding supply for high quality mariculture produce, significant economic benefits are expected for the region if the constraints can be addressed, and opportunities realised.

8.3.2 Social impacts

Coastal communities in SE Sulawesi are mostly impoverished, with few readily apparent opportunities for sustainable economic growth and enhancement of personal well being. Mariculture is one sector where the flow of economic benefits has potential for broader knock on social impacts throughout the communities. The proposed agribusiness-based industry development strategy has a concerted focus on building cooperative networks within and between these communities in order to facilitate skills-based training, diversified, expanded and integrated farming/fishing and regional-scale marketing and branding to tap into lucrative export markets. If the existing Stage I semi-functional supply chain can be developed to Stage II functional market chain over the next five years and beyond, the knock-on social benefits to coastal communities in terms of creating opportunities for employment of future generations in mariculture may be considerable in SE Sulawesi. These opportunities include directly as fishers and farmers, and indirectly in myriad support services such as logistics, processing, marketing training, administration, management and R, D&E.

8.3.3 Environmental impacts

Maintaining the integrity of the marine environment is central to the existing legislative framework that has been put in place at a national level in Indonesia. In practice, the application of this legislation at the regional level within the mariculture industry in SE Sulawesi is limited, with few apparent planning provisions based on environmental sustainability imperatives. There is little or no environmental monitoring, and exceeding environmental carrying capacity and negatively impacting natural resource assets from excessive and/or otherwise inappropriate industry development are identifiable risks at the present time, particularly in Kendari Bay.

At the present time, the expansive coastline and the low density, traditional approach to farming in most areas, including particularly in Buton and Muna, do not present major environmental threats. There is scope for substantial expansion in production within natural environmental carrying capacity limits in all areas of SE Sulawesi, but it will require adoption of an ecosystem-based management framework, such as Integrated Multi Trophic Aquaculture (IMTA). The concept of trophically balanced production inherent in IMTA is a feature of the proposed mariculture industry development strategy for SE Sulawesi proposed by this project.

8.4 Communication and dissemination activities

1. Major workshops:

> Project Inception and Planning International Workshop, Plaza Inn Hotel, Kendari, SE Sulawesi, January, 2008.

> Strategic Planning International Workshop, Plaza Inn Hotel, Kendari, SE Sulawesi, April 2009.

2. Major surveys:

Direct communications were undertaken with smallholder stakeholders in coastal villages were undertaken as part of delivery of the two key surveys undertake in this project: involving

> Completed Mapping Survey, Situation Analysis and Characterisation of Mariculture Supply Chain in SE Sulawesi during July-Dec 2008; involved completion of 147 direct interviews of individual respondents covering three regions (Kendari Bay, Buton and Muna Islands) and 'grower, fisher, local trader and inter-island trader' sectors in all aspects of the mariculture market chain in SE Sulawesi (see also Unhalu. et al. 2009, this report).

> Completed analysis of mariculture producer networks in SE Sulawesi during July-Dec 2008; involved direct interview of 47 specific/village-based producer (farmer/fisher) groups covering three regions (Kendari Bay, Buton and Muna Islands) of SE Sulawesi (see also Dinas et al. 2009, this report).

> Completed GIS mapping of existing mariculture activities in the three major producer locations of Kendari Bay, Muna and Buton islands during June-July 2009 (see also Unhalu. 2010, this report).

3. The article entitled 'Mariculture Development Opportunities in SE Sulawesi' was published in the official Network of Aquaculture Centres in Asia-Pacific (NACA) Aquaculture Asia Magazine (October-December 2008). This magazine has widespread coverage throughout the Asia-Pacific, including Indonesia and Australia, and is available via a free pdf download from the NACA website.

4. The project fact sheet entitled 'Cultivating Marine products for Market' was published by ACIAR in the ACIAR-SADI Update 2.7 (April 2009), and is available as a free pdf download on the ACIAR website.

5. A poster entitled 'Mariculture Sites and Species Cultured in SouthEast Sulawesi, Indonesia' by Univ. Halu, Dinas, ICMF SER, DPI and NACA accepted for presentation and publication in proceedings of 'Global Aquaculture Conference 2010' in Bangkok, June 2010.

6. The final ACIAR report and all supplementary reports for the project will be posted to the NACA website for further distribution as free pdf version downloads to stakeholders throughout the region. The Final Report will also be available on the ACIAR website as a free pdf version download.

9 Conclusions and recommendations

As previously stated, the major conclusions and recommendations for this project are based collectively on the findings of the various surveys and analyses undertaken and reported separately as part of this project. These conclusions and recommendations also fed into the preparation of the draft conceptual framework and industry development plan reported by DPI et al. (2009), which aimed to draw on all previous project findings for purposes of documenting key conclusions and recommendations designed to address the primary objectives of the project within an overarching and strategic context. These are summarised below.

9.1 Conclusions

Given the latent potential of the industry in SE Sulawesi, it is clear that the province in general, and smallholders in particular, would gain considerable benefit to social and economic wellbeing through promoting selected market development opportunities and addressing associated key risks. Under the circumstances, the preferred approach is to 'bundle' the development and risk response into a pilot project designed to undertake a package of related activities on a pilot, commercial scale. Such a pilot project would develop, evaluate and demonstrate several village-based case studies designed to facilitate through chain practice change. According to the proposed industry development strategy, this would progress selected industry sectors in the first instance from the present Stage 1, semi-functional supply chain, to Stage II, functional market chain over a 3-5 year period. Features of the case studies would be 1) the identification of designated chain champions and formation of village-based farmer association networks, 2) formal engagement of new entrants to partner and coinvest with existing chain participants to offset and underwrite costs going forward, and 3) development and implementation of Better Management Practices (BMPs) by industry as a means to facilitate improved productivity and market access.

An example might include partnering up with one or more existing seafood companies based in Kendari Bay that are presently focused primarily on the wild catch fishery for inputs, particularly deep water pelagic fishes. These companies, operating as chain champions, are likely to have spare storage, processing and transport capacity and access to existing export markets in which demand exceeds supply. These companies may also have more ready access to venture capital for investment in new production infrastructure and capacity building, and may be amenable to entering into forward purchase contracts to offset existing financial risks to smallholders. For smallholders to effectively engage with such partnerships, better organisational arrangements and enhanced capacity is required.

9.2 Recommendations

To facilitate implementation of the draft industry development strategy and associated conceptual framework outlined in this report, the following key recommendations are made:

Primary:

- > Undertake a regional scale, 3-5 year pilot project in SE Sulawesi to trial the development, evaluation and demonstration of selected mariculture market chain strategies and associated actions as a portfolio of specific case studies
- > The pilot project to be coordinated and implemented under the direction of a new high level mariculture task force to be established in SE Sulawesi with joint representation by key industry and government stakeholders.

Secondary:

- > The case studies to be undertaken concurrently in selected regions of Kendari Bay and Buton and Muna Islands with focus on selected supply chains for key 'marquise' products including seaweed, grouper, lobster, sea cucumber, abalone and pearl oyster
- > The case studies to include:
 - >> Formation and implementation of village-based associations ('aquaclubs') of farmers, fishers and local traders, to be recognised by the Dinas as key industry forums for communication, training and general support
 - >> Identification of chain champions within such associations and elsewhere within chains, including inter-island traders and other industry stakeholders as appropriate (e.g. NGOs, investors, consultants etc)
 - >> Development of a regional marketing strategy and industry investment strategy to be undertaken by appropriately qualified consultant(s) under direction of key industry and government stakeholder working group including aquaclubs, chain champions, Dinas, Unhalu and relevant NGOs and development agencies elsewhere within the provincial government of SE Sulawesi
 - >> Joint establishment by the Dinas and Unhalu of a functional and cost-effective communications system to facilitate capacity building within aquaclubs and market intelligence for real time delivery of critical price, quantity, quality and logistical data
 - >> Joint establishment of a technical advisory group within the Unhalu And the Dinas for coordination and delivery of the proposed R,D & E strategy
 - >> Drafting of a management plan for mariculture in SE Sulawesi which provides an aquatic ecosystem-based IMTA framework for development; to be developed by appropriately qualified consultants under direction of and in collaboration with a key industry and government stakeholder working group including Dinas, Univ. Halu., relevant NGOs and environmental management agencies elsewhere within the provincial government of SE Sulawesi, and aquaclubs and chain champions.
 - >> Development and trial demonstration of BMPs for selected industry sectors via newly established aquaclubs.

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Unhalu (2010) Mapping of Existing Mariculture Activities in SouthEast Sulawesi: Potential, Current and Future Status. Internal report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2009, by University of Haluoleo (Faculty of Fisheries and Marine Science and Research Centre for Indonesian Aquaculture, Kendari, SE Sulawesi). 45 pp.

10.2 List of publications produced by project

Aslan, L. M., Hotman, H., Armen, Z., Irwan, E., Mhummaed, A., Phillips, M., Olsen, L., Larkin, B., De Silva, S.S. and Gooley, G. (2008). Mariculture development opportunities in SE Sulawesi, Indonesia. *Aquaculture Asia Magazine*, October-December 2008. pp. 36-41.

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11 Appendixes

11.1 Appendix 1:

Aslan, L. M., Hotman, H., Armen, Z., Irwan, E., Mhummaed, A., Phillips, M., Olsen, L., Larkin, B., De Silva, S.S. and Gooley, G. (2008). Mariculture development opportunities in SE Sulawesi, Indonesia. *Aquaculture Asia Magazine*, October-December 2008. pp. 36-41.

11.2 Appendix 2:

Morelink (2008). *Seafood Market Supply Chain - SE Sulawesi*. Internal Report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2008, by MoreLink Asia Pacific (Jakarta, Indonesia). 36 pp.

11.3 Appendix 3:

Unhalu, ICMFSER, NACA and DPI (2009) *Mapping Survey, Situation Analysis and Characterisation of Mariculture Supply Chain in SE Sulawesi*. Internal report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2009, by University of Haluoleo (Fisheries Faculty, Kendari, SE Sulawesi), Indonesian Centre for Marine and Fisheries Socio-Economic Research (Jakarta, Indonesia), Network of Aquaculture Centres in Asia-Pacific (Thailand) and Department of Primary Industries (Victoria, Australia). 32 pp.

11.4 Appendix 4:

Dinas Perikanan (2009). *Analysis of Mariculture Producer Networks in SE Sulawesi, Indonesia*. Internal report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2009, by Dinas Kelautan dan Perikanan (Kendari, SE Sulawesi). 35 pp.

11.5 Appendix 5:

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11.6 Appendix 6:

Unhalu (2010) Mapping of Existing Mariculture Activities in SouthEast Sulawesi: Potential, Current and Future Status. Internal report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2009, by University of Haluoleo (Faculty of Fisheries and Marine Science and Research Centre for Indonesian Aquaculture, Kendari, SE Sulawesi). 45 pp.

11.7 Appendix 7:

DPI, NACA, Unhalu, Dinas Perikanan and ICMFSE (2009). Conceptual Framework and Strategic Industry Development Plan for Mariculture in SE Sulawesi. Internal report to Australian Centre for International Agricultural Research, Project No. SMAR/2007/225, June 2009, by Department of Primary Industries (Victoria, Australia), Network of Aquaculture Centres in Asia-Pacific (Thailand), University of Haluoleo (Fisheries Faculty, Kendari, SE Sulawesi), Dinas Perikanan (Kendari, SE Sulawesi) and Indonesian Centre for Marine and Fisheries Socio-Economic Research (Jakarta, Indonesia). 23 pp.