The Role of Information Systems and Technology: an Integrative Approach to Managing the Tasmanian Rock Lobster Industry

Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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DECLARATION

This thesis contains no material that has been accepted for the award of any other higher degree or graduate diploma in any tertiary institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

Tristan Jane Richards

Date: 31st October 2005

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ABSTRACT

This thesis is about the role of information systems and technology (IS/IT) in the seafood industry. The topic is part of an ongoing research initiative driven by the Tasmanian Rock Lobster Fishermen's Association (TRLFA) to gain a better understanding of rock lobster supply chains, product and information flows, price formation, market trends and business cultures. Limited understanding of such issues may explain a widely held perception among members of the Association that fishers and processors are 'price takers' for a scarce and valued commodity. In trying to develop their knowledge of supply chains, the TRLFA has sought IS/IT solutions to improve market access, and communication and information flows, and to allow its members more often to be 'price makers'. The overarching aim of this research has been to create strategies to ensure a viable and sustainable future for the industry. Two novel IS/IT models are developed and tested via consultation with key stakeholders, who have provided feedback on the cases and helped to verify assumptions about the supply chain. Using data modelling techniques, current and future industry supply chains are mapped. An industry profile is established using an analysis of strengths, weaknesses, opportunities and threats (SWOT analysis). One particular IS/IT model, including a strategic plan for the Tasmanian rock lobster industry, is then recommended on the basis of Critical Success Factor (CSF) analysis. The work is indebted to numerous theories, methodologies and techniques from qualitative social research and information systems; an understanding of fisheries policy is also important to the project. This multi-disciplinary approach reflects my conviction that an integrative approach to the management of the Tasmanian rock lobster industry is central to sustainable outcomes. In the final analysis, the salience of the research goes beyond making improvements to supply chain management. Hence, attention is also paid to the fact that the Tasmanian rock lobster industry has played a significant part in the social and economic development of the island state. The industry has, in fact, provided a reason for the existence of small rural towns and communities there; however these communities have become increasingly affected by the mixed effects of globalisation and the rationalisation of businesses and technologies, making them sometimes highly dependent upon resource extraction, a situation which underscores the need to create new and appropriate management strategies that reduce dependency on exogenous forces and influences.

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This dissertation has been a significant personal goal. However, I would have not achieved so much, if it were not for the faith, support and assistance I have had from my network of family, friends, supervisors, and work and University colleagues. My thanks and acknowledgement extends to all.

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Last but not least, I also wish to thank my support crew of family and friends. Many thanks to Mum and Dad for all that proof reading, words of encouragement and love. Also many thanks to my partner, Gavin, and my beloved dog, Bella, for their patience, encouragement and love, and putting up with the endless weekends of being quiet around the house. Also many thanks to my friends, particularly Catherine, Sally, Paul, John, Dave and Natasha, for their continuous encouragement and support of my pursuit.

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TABLES

FIGURES

ACRONYMS

ABARE – Australian Bureau of Agricultural Research Economics

ABS – Australian Bureau of Statistics

AFMA – Australian Fisheries Management Authority

APEC - Australian Pacific Economic Commission

AQIS – Australian Quarantine Inspection Service

ASSEG - Australian Seafood Strategy for Export Growth project

ASIC - Australian Seafood Industry Council

BSE – Bovine Spongiform Encephalitis

B2B - Business to Business

B2C - Business to Consumer

CCAMLR – Commission for the Conservation of Antarctic Marine Living Resources

CEN - Comité Européen de Normalisation, the European Committee for Standardization, <http://www.cenorm.org>

CFAC - Crustacean Fisheries Advisory Committee

CSF - Critical Success Factor

C2C - Consumer to Consumer

DED – Department of Economic Development

DFAT – Department of Foreign Affairs and Trade

DIER - Department of Infrastructure, Energy and Resources

DPIWE – Department of Primary Industries, Water and Environment

DPPS - Tasmania Police, Department of Police and Public Safety

EA – Environment Australia (Department of Environment and Heritage (DEH))

EC - Electronic Commerce

ERD - Entity Relationship Diagram

ETHICS - Effective Technical and Human Implementation of Computer-based Systems methodology

FRDC - Fisheries Research and Development Corporation

GPS - Geographic Positioning System

GM - Genetically Modified

GMO - Genetically Modified Organisms

HACCP – Hazard Analysis and Critical Control Points

ICT - Information, Communications, and Technology

IFD - Information Flow Diagram

IS/IT - Information Systems/Information Technology

MPAs - Marine Protected Areas

MSC – Marine Stewardship Council

NFIS – National Food Industry Strategy

NOIE – National Office for the Information Economy

QIM- Quality Index Management (QIM)

QMS - Quota Management System

RFID – Radio Frequency Identification devices/technology

RMPS - Resource Management and Planning System

R-3s – Rural, Remote and Regional

SARS - Severe Acute Respiratory Syndrome

SCM - Supply Chain Management

SIS - Strategic Information Systems

SSA- Seafood Services Australia

SSM - Soft Systems Methodology

STA – Seafood Training Australia

SWOT - Strengths, Weaknesses, Opportunities and Threats

TAFI – Tasmanian Aquaculture and Fisheries Institute

TasFRAB - Tasmanian Fisheries Research Advisory Board

TFIC - Tasmanian Fishing Industry Council

TIAR - Tasmanian Institute of Agricultural Research

TECC - Tasmanian Electronic Commerce Centre

TFLC – Tasmanian Freight Logistics Council

TRLFA - Tasmanian Rock Lobster Fishermen's Association

TRLPA - Tasmanian Rock Lobster Processor's Association

TACC - Total Allowable Commercial Catch

VMS - Vessel Monitoring System

VHF - Very High Frequency

XML – Extensible Markup Language

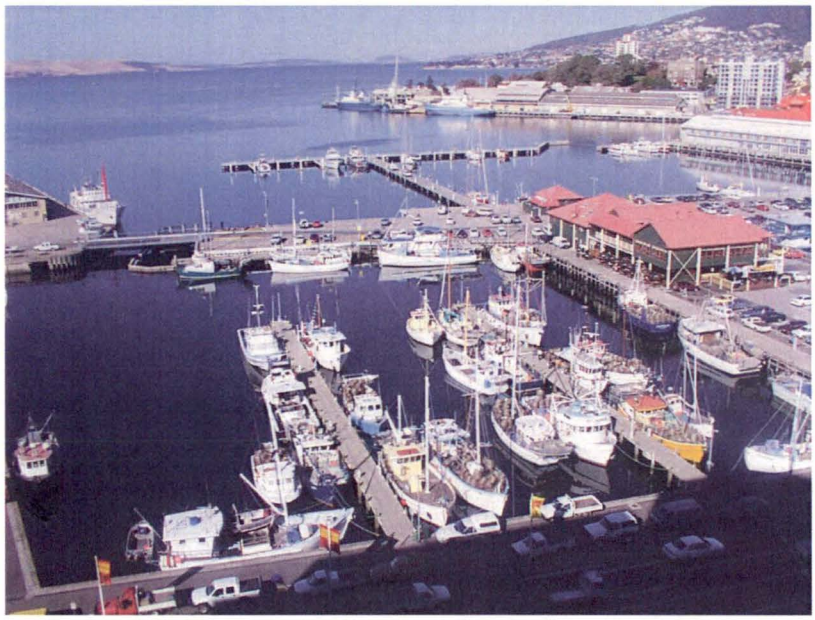
GLOSSARY

EANnet	Data Synchronisation and Product Registry service.
Environment Australia (EA)	Also now known as the Department of Environment and Heritage (DEH)
Fish cauf	Fishing gear used for holding fish
R-3 areas	Rural, remote and regional communities
Supply Chain	Encompasses all activities (a series of interlinking steps) associated with the flow and transformation of the raw materials stage all the way to the end user, and collectively define the nature, character and value of the product at the time of receipt by the end consumer.
Supply Chain Management	A generic term that encompasses the coordination of order generation, order taking, and order fulfilment/distribution of products, services, or information" (Kalakota & Whinston 1997: 287). SCM is also known as 'value chain' or 'demand chain' management, which has the following principles: build value; focus on the customer; and be demand led.
Sustainability	The ability of a human, natural or mixed system to withstand or adapt to endogenous or exogenous change indefinitely. Sustainable development is therefore a pathway of deliberate change and improvement, which maintains or enhances this attribute of the system, while answering the needs of the present population (Dovers & Handmer 1992: 275).
Sustainable Development	[U]sing, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased (Environment Australia 1992: 1)
System	A collection of components that work together to realise some objective.
Systems analysis	A process followed to determine what the system does and what is required of it.
System analyst	A person who analyses the way the system works and identifies its problems.

PART ONE: INTRODUCTION, THEMES AND METHODOLOGY

"Tasmania has a huge diversity of the very best seafoods in the world. Crayfish, abalone, scallops, blue eye, Atlantic salmon, trout, tuna – the list goes on and on. This industry is an integral part of our island state. It makes a massive contribution to our image, to our social system and, of course, to our economy. The participants are often self-employed individuals who are shy of publicity and, like farmers, are the unsung heroes and backbone of the country"

(Mure in Bennett et al. 2002: 6).



Sullivans Cove, Hobart, Tasmania (Courtesy of Rod Berens)

Preface[1]

My impetus to undertake this research has evolved from ten years' experience in the field of fisheries. My career began by gaining qualifications in fisheries applied science at the Australian Maritime College (AMC) and by working in paid and voluntary positions in research institutions such as the Marine Laboratories, CSIRO, and the Tasmanian Aquaculture and Fisheries Institute (TAFI). A particular subject of interest at the AMC was seafood marketing.

After a period of employment in fisheries research I became aware of the significant role that computers and technology play in data collection and analysis of fisheries data. I also observed a communication gap between fisheries biologists and computer scientists that highlighted a need for multi-disciplinarity among people with fisheries and computing backgrounds. It became apparent to me that a combination of fisheries science and information systems would be important in pursuing my long-term vision. I then undertook a Graduate Diploma and an Honours degree in information systems (IS), and observed that information systems management, strategic information systems, information systems methodologies and techniques, electronic commerce and supply chain management were being used in agriculture, but with limited application in fisheries.

During my training in IS, I was employed by Tasmania's fisheries research institute, the Tasmanian Aquaculture and Fisheries Institute (TAFI), where I worked in the rock lobster section. When I started my Honours degree in information systems in 1999, I formed a partnership with the Tasmanian Rock Lobster Fishermen's Association (TRLFA) that continues today. On the strength of my Honours degree, funding was acquired through the Tasmanian Electronic Commerce Centre (TECC) to develop an

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[1] The thesis style uses the "Style Manual" by the Department of Communications, Information Technology and the Arts (2002) as a reference to the formatting of quotations, tables, figures and list of references. For quotes less than three lines long are written in quotes and are set within the text. Quotes more than three lines long are indented separate from the text. Reference to literature uses the author-date system (Department of Communications, Information Technology and the Arts 2002: 187) while quotes use the author-date system, plus the page number. For work that has three or more authors, only the surname of the first-listed author is used, followed by the expression 'et al ' (or 'and others') (Department of Communications, Information Technology and the Arts 2002) I also use the first person in this dissertation This style of writing encapsulates the interpretive stance on the research and acknowledges my personal and ethnographic involvement as a researcher within the research setting and with the participants. To write in the third person would falsely indicate a degree of detachment and objectiveness from the research subjects An acronym list is also provided to assist readers with acronyms throughout the text. In the text, the full name and acronym will be used the first time used, then only the acronym.

information service website and an electronic trading platform for the TRLFA. The objective was to undertake a doctoral research project to monitor the uptake and impact of electronic commerce in the Tasmanian rock lobster industry. In November 2000, I was awarded an Australian Research Council (ARC) Linkage Grant for that project. At the start of the doctoral program, an information service website was launched; however the electronic trading platform was still to be undertaken. I decided that the thesis topic should be reviewed and broadened to incorporate an analysis of emerging trends in information systems/technology (IS/IT) as these pertain to the seafood industry, hence the title "the role of information systems/technology: an integrative approach to managing the Tasmanian rock lobster industry".

Part One consists of two chapters that outline the rationale and background to the work, the research design and its significance to the Tasmanian Rock Lobster Industry and broader community. A multi-disciplinary topic, the research extends across four key bodies of knowledge: sustainability, supply chain management, seafood and fisheries, and information systems/information technology. The methodology reflects the need for an integrative approach to understand the industry supply chain in terms of its key participants, the business processes and flows, and information processes and flows. To gain an understanding of the positions held by industry participants requires obtaining rich ethnographic information that provides insights into their worlds, including their lifestyles, work lives, relationships, concerns, and visions. Much of the ethnographic information about industry members' operations provides the foundation to map the industry supply chain using information systems modelling techniques and formulate information systems/information technology solutions to be proposed to the industry. The information describes the physical processes involved in harvesting, processing, transporting, and trading rock lobster. It also describes the kind of information collected, stored, analysed and shared, and the decisions made from it. The ethnographic information also assists in evaluating the proposed information systems/information technology solutions to determine if these solutions could assist socially, economically and biologically with the industry's sustainability and viability. The two chapters in this Part provide a foundation to the rest of the work. Introductions to other Parts of the work appear where relevant in the thesis.

CHAPTER ONE: INTRODUCTION

This thesis is part of an ongoing research initiative engaging the Tasmanian Rock Lobster Fishermen's Association (TRLFA) to gain a better understanding of the supply chain of the Tasmanian rock lobster *Jasus edwardsii,* also known as southern rock lobster. In particular, there is a need to better understand product flow, information flow, price formation, market trends, and business culture; in relation to a larger problematic – ensuring the sustainability of industry, resource and communities in the face of manifold risks and uncertainties, particularly those pertaining to the effects of globalisation. Supply chains encompass a series of interlinking steps among all the activities associated with the flow and transformation of the raw materials to the end user, and collectively define the nature, character and value of the product at the time of receipt by the end consumer (Kalakota and Whinston 1997; Peterson et al. 2000; Turban et al. 2000). Tasmanian rock lobster fishers want more information and knowledge about their supply chain, and wish to advance their individual and collective understanding of the power of information to mitigate the risks and uncertainties of a global primary industry. These opportunities may address and ameliorate a widely-held perception that fishers and Tasmanian processors are 'price takers' for a product that has limited supply and is highly sought after in current major marketplaces. At the same time, it is clear that the TRLFA has also begun the search for potential information systems/information technology (IS/IT) solutions to improve market access, communications and information flows, and managing uncertainties. This search derives, at least in some measure, from a growing understanding that the supply chain is currently typified by lack of transparency, lack of equity in participation, and lack of trust. The development, description and testing of two solutions to this complex challenge forms a central part of this work, the aim of which has been to provide a competitive advantage to, and ensure a viable and sustainable future for, the industry.

The research design is underpinned by a threefold understanding of what is being investigated. First, a *sustainable rock lobster industry* in Tasmania depends on the maintenance of *sustainable fisheries* more generally – both in this only island state of Australia, and globally, and that depends on the success of strategies for the *ecologically sustainable development* of ecosystems as these have been conceived through international, national and local structures of governance and government. This triumvirate relationship might be considered the **context** for the research. Second, the

sustainability of industry, fishery and ecosystem is seriously at risk from various forces (Table 1-1), and these risks are constitutive of significant uncertainties for all those who are both willingly and unwittingly enrolled in the supply chain or affected by it. This multivariate consideration might be thought of as the **problem** that prompts the research. Third, uncertainties in, and risks to, the sustainability of industry, fishery and ecosystem may be mitigated by – among other things – new **solutions** to supply chain management that are facilitated by innovations in IS/IT. I return to these three matters - context, problem and solutions – once I have elaborated on the research design.

Table 1-1: Risk and uncertainties within the Tasmanian rock lobster industry

	Risks	**Uncertainties**
Financial	Increased costs of fishing licences, quota, vessels, fuel, interest rates, transport Reduction in beach and market prices	Beach and market prices Interest rates Fuel costs Demand Market preferences/global dynamics Employment of new entrants
Personal	Safety, lifestyle, livelihood	Future Ownership of supply chain Costs of participating in the fishery
Food Safety	Hygiene standards, cool chain	Handling practices Origin
Food Security	Consumer not having access to a food source that has integrity – proof of origin, quality of the supply chain in terms hygiene.	Handling practices Origin
Biological	Resource management and sharing, recruitment	Determining biomass of the resource, the total allowable catch and commercial catch. Growth and maturity rates (regionally variability) Egg production (local and non-local sources of supply)
Ecological	Increases/decreases in water temperature Contaminants in the water	Climate change pollution
Social	Lifestyle, resource sharing, community	Aging demographics of industry Future for new entrants

Questions, objectives and methods of approach

The seafood industry in Australia is generally regarded as a rural, regional and remote (or R3) industry, with participants - particularly at the start of the supply chain - mainly operating in areas considered geographically remote from 'the centre' (FRDC 2000). The industry, in common with those in most other industrialised economies, consists of numerous participants along the supply chain and includes equipment and bait suppliers, fishers, agents/brokers, fish handlers, processors, distributors, wholesale and retail buyers and restaurant buyers. Other participants or actors in the seafood industry

may include transport operators, quality assurance regulatory bodies, fisheries research scientists, food technologists, managers, compliance and enforcement agents (police or fisheries officers), and trade and market development government representatives.

In general terms, the length and nature of any fish supply chain depends upon the species and markets involved in its harvest, sale and consumption (Sengupta 2004; Kaplan 2000). For example an export product may involve fishers, packers/processors, local distributors, overseas distributors, retailers, and consumers, whereas a product traded domestically may involve only the fisher, wholesaler, retailer, and consumers. Activity is driven by demand from buyers (wholesalers and consumers) who control prices (Hurn & McDonald 1997). There are numerous supply chains with varying characteristics within modern seafood-based industries and generalisations rarely fit all chains (Sengupta 2004). For example, moves to restructure the supply chain for a single species fishery, such as abalone or rock lobster, will be very different to those appropriate for a multi-species trawl fishery. Therefore, when implementing IS/IT innovations, it is important to ensure that the intrinsic characteristics of fisheries are identified and acknowledged. Consulting with key industry stakeholders, and exploring the business and information processes and flows along the supply chain are key steps to gain an understanding of each industry supply chain.

In light of the foregoing, the key objective of the thesis is to determine if IS/IT can assist in creating a sustainable future for the Tasmanian rock lobster industry by managing uncertainty and risk, and by creating resilience within the industry to cope with change (Dovers & Handmer 1992; Ingeborg-Myhr & Traavik 2002). The focus of this research is on the business aspects of the Tasmanian rock lobster supply chain in terms of its management of information and business processes, trade and marketing, quality management, freight logistics, and resource management. A series of research questions derive from that focus:

1) What are the major processes and information flows along the Tasmanian rock lobster industry supply chain?
2) What current trends characterise the Tasmanian rock lobster industry supply chain?
3) What trends might emerge in the short to medium term future?

4) How can information systems and technologies assist the industry to become more sustainable?

5) How can IS/IT assist the seafood industry, in particular the Tasmanian rock lobster industry, to improve the business processes along the supply chain and assist in advancing sustainable fisheries for the rock lobster fishers, and their communities of place and interest?

These questions require a number of strategies. The first is to explore how IS/IT is already being used by members of the seafood industry, in particular, those in the Tasmanian rock lobster industry. I aim to understand how fisheries and the seafood industry are using information systems and technologies to improve their supply chain processes and quality assurance systems, improve knowledge, communication and information flows, and improve trade and marketing strategies. The second strategy is to investigate areas in the Tasmanian rock lobster industry that have potential for the development and adoption of IS/IT. I aim to develop data models reflecting the current industry supply chain and the proposed IS/IT concepts for the Tasmanian rock lobster industry, and to test the models with key industry stakeholders and participants. Based on the feedback from industry consultation, I then seek to provide recommendations for the Tasmanian rock lobster industry to undertake. To achieve successful re-engineering of the supply chain, whether it may be the adoption of IS/IT or just improving the business processes, there is a need to develop a strong understanding of the industry supply chain. It is necessary to identify key participants, and understand the issues, trends, relationships, and attitudes of supply chain participants in terms of the business processes, price formation, marketing, communications, and the economics of supply and demand driven by markets.

Fisheries and marine policy and planning by government and industry have generally focused on resource management and upstream supply chain participants such as fishers and processors (Bradshaw et al. 2001). However, little effort has been made to understand interrelationships between the social and business aspects of the Tasmanian rock lobster industry's various supply chains. For example, only in times of crisis is the spotlight directed towards other industry participants: consumers who change their preferences; transport providers who reduce their freight space; and the general instability that typifies the global market place. An integrative approach needs to be incorporated into policies and strategies for managing the industry (Kaplan & McCay

2004; Pontecorvo 2003; Smith 2002), and it needs to be mindful of the social sciences (Bradshaw et al. 2001), supply chain management, information and knowledge management (Malone & Yohe 2002), risk and quality management, transparency of the supply chain (Lamming et al. 2001), traceability, and systems analysis. The approach requires a comprehensive understanding of the activities of industry participants, particularly in terms of how they interact with each other, and how such engagements reflect on their values, relationships, and the cultures in which they operate. It also requires access to detailed information about industry participants along the supply chain, including their business processes, information flows, and relationships and networks. In light of these demands, I have selected an interpretive approach to gather information about the Tasmanian rock lobster industry supply chain, and to gain feedback about the proposed IS/IT solutions from stakeholders.

The research strategy, described in Table 1-2 maps out the processes undertaken, the methods, techniques, and tools used. Using a composite ethnographic/soft systems approach, the research strategy was designed so I could focus first on understanding the dynamics of the case study, the Tasmanian rock lobster industry supply chain, rather than a geographical setting and second on the development of two IS/IT solutions to address some of the issues facing the industry and its members.

The Tasmanian rock lobster industry case study is then embedded in the broader global and socio-economic context in which it operates and participates. It should be noted that the industry supply chain is still profoundly geographical and is about flows across space and time boundaries, about intra- and inter-regional dynamics, and about natural and human ecosystems. Furthermore, by gaining an insight into the entities or actors, flows, relations, dynamics, and strategies associated with the case study, I also gain an understanding of the role that IS/IT can play in relation to primary seafood/fishing industries. This emphasis does not detract from the importance of understanding this particular industry; however the lessons learned may also assist other primary seafood industries in similar situations.

To acquire the requisite knowledge of the industry, ethnographic participant observation research techniques (Denzin & Lincoln 2000; Kearns 2000; Neuman 2000) were adopted. The research strategy (Table 1-2) encompasses all three types of qualitative research described in Winchester (2000): the oral, textual, and observational. Participant

observation field research techniques included interviews and field notes, and literature such as fisheries policies and legislation. This composite approach allows the collection of formal and informal data from industry participants. The success of these research techniques is partly attributed to the rapport and goodwill already established with the industry, and their willingness for me to participate in social settings and make observations.

The research strategy also includes two proposed IS/IT solutions that are presented to the Tasmanian rock lobster industry. One explores the uptake and impact of the electronic trading project initially established with the TRLFA. The other proposes an integrative Rock Lobster Electronic Management System to representatives of the industry supply chain. This setting is the organisation or industry supply chain rather than a geographical setting, and uses a number of techniques to collect and analyse data at different levels.

Table 1-2 Research Strategy

Research Objective	Strategy	Methods
(a) explore how IS/IT is already being used by the seafood industry and, in particular, the Tasmanian rock lobster industry	collect preliminary data	literature, participant observation and field notes
(b) investigate areas in the Tasmanian rock lobster industry that have potential for the development and adoption of IS/IT	collect preliminary data mapping current supply chain	literature, participant observation and field notes, and business process models and information flow diagrams
(c) develop data models that incorporates IS/IT into the Tasmanian rock lobster industry	propose IS/IT models propose and map future supply chain	business process models, information flow diagrams, and entity relationship diagrams
(d) test the models with key industry stakeholders and participants	test models	interviews
(e) contribute to applied research in the interdisciplinary domain of environmental management and information systems	develop strategic framework for Tasmanian Rock Lobster Industry	SWOT analysis and CSF analysis

To determine if IS/IT could play a role in the Tasmanian rock lobster industry, two IS/IT solutions were proposed to key industry representatives. Through consultation with stakeholders, feedback was obtained to verify assumptions made of the current industry supply chain and the proposed systems, and information on the supply chain and the industry's current and future status were secured. As one of the objectives of the research is to understand the industry supply chain, it was necessary to include participants from each key part of the chain. It should be noted that the involvement of end buyers in the supply chain was beyond the scope of this research. Initially I

envisaged interviewing key representatives from the marketplace in China, such as wholesalers, restaurant owners and consumers. However this process would have required access to the research setting, business culture, and duty free point of entry or black market business that occurred, and that was not feasible.

Using data modelling techniques, current and future industry supply chains were mapped. Based on feedback from key industry stakeholders and a review of the industry supply chain and models proposed, an industry profile was established using SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis. An IS/IT solution was then recommended for the Tasmanian rock lobster industry as a result of using Critical Success Factor (CSF) analysis.

The data analysis uses themes and coding techniques to explore meanings in interview and field note transcripts, in addition to using data modelling and system analysis techniques such as physical processing diagrams, information flow diagrams, and entity relationship diagrams to assist in mapping the supply chain (Avison & Fitzgerald 1995). SWOT and CSF analysis (Ward & Griffiths 1996) were used to analyse the industry profile and proposed IS/IT solutions. State Government fisheries management literature (DPIWE 1997; 1999; 2001a; 2001b; 2003a; & 2003b) provided an understanding of legislation, policies, plans and rules that govern the Tasmanian rock lobster industry supply chain.

To assess the two IS/IT solutions in terms of their appropriateness for the industry, the involvement of the industry representatives varied. For IS/IT Solution One, which was to monitor the uptake and impact of the an electronic trading project on the industry, the participants involved were selected representatives of the TRLFA, a third party (electronic trading provider), and a funding body, TECC. My research role was as a participant observer at numerous focus group meetings and workshops. For IS/IT Solution Two, which was to present an IS/IT concept to key industry stakeholders and gain feedback through consultation and formal interviews, key stakeholders were identified and invited to participate in the project.

As highlighted in the preface, I have a degree of familiarity with the research setting and its participants, particularly with its key representatives. This familiarity has evolved from past research and project work where rapport has been established to the point

where I am accepted in various social contexts such as industry dinners or workshops. This acceptance has provided me with a privileged position – having ready access to the setting. It also reinforces the need to protect this privilege beyond the research, and to ensure that an appropriate standard of ethics and behaviour is upheld.

In addition to the personal standard of ethics to be upheld in relation to Australian industry participants, universities require that the researcher gain ethics approval and standards when studying human subjects. The capacity to adhere to these standards needs to be shown before gaining permission to formally access the setting in the context of the research. In regard to the interviews with key industry stakeholders, a letter and information sheet (Appendix 1) were sent to stakeholders inviting them to participate in the interviews. The letter and information sheet included an introduction to the project topic, specific details of the interview structure and schedule, such as interview duration, how the participants would be contacted, a sample of interview questions, notes of the use of audio-taped recording, contact details of ethics committee members, consent form, and post-interview feedback arrangements. This process was followed by a telephone call or email to gain assent and make appointments for interviews. Before the interview consent forms were signed, permission was gained to audiotape the interviews, and the voluntary nature and anonymity of the interviews was acknowledged. The interview questions were tailored to the specific roles of the stakeholders being interviewed: fishers, processors freight providers and government representatives. The proposed IS/IT solutions to the industry were presented and discussed, and perceptions and attitudes to them were captured for analysis. In my role as observer at meetings, workshops, and informal gatherings with industry participants, I also ensured the same standard of ethics.

Context

On the matter of sustainable development and sustainable fisheries

The Brundtland Report's definition of sustainable development is the basis on which many other definitions have been derived: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987: 43). Dovers and Handmer (1992) attempt to construct a 'definitional approach' to sustainability and sustainable development and to the challenges of global change:

> Sustainability is the ability of a human, natural or mixed system to withstand or adapt to endogenous or exogenous change indefinitely. Sustainable development is therefore a pathway of deliberate change and improvement, which maintains or enhances this attribute of the system, while answering the needs of the present population (Dovers & Handmer 1992: 275).

Bohlin (2000) describes how sustainability has changed from the static views of preservation of current resources for future generations towards more dynamic views that promote opportunities for future generations – one might add by mitigating risk and the effects of uncertainty using strategies such as precaution and innovations in technology and information management. This dynamic view of sustainability is supported by Environment Australia's[2] definition of sustainable development; "[U]sing, conserving and enhancing the community's resources so that the ecological processes, on which life depends, are maintained, and the total quality of life, now and in the future, can be increased" (Environment Australia 1992: 1). Or more simply, ecologically sustainable development (ESD) is:

> development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. To do this, we need to develop ways of using those environmental resources, which form the basis of our economy in a way which maintains and, where possible, improves their range, variety and quality (Environment Australia 1992: 1).

Dunphy et al. (2000) suggest that the main tenets of sustainability at the international level also encompass ecological and human sustainability and various regulatory systems around Australia. They also provide a broad definition of sustainable development (the processes to achieve sustainability), which highlights three principal aspects of sustainable development which "comprises types of economic and social development that protect and enhance the natural environment and social equity" (Dunphy et al. 2000: 23).

[2] Environment Australia is also now known as the Department of Environment and Heritage.

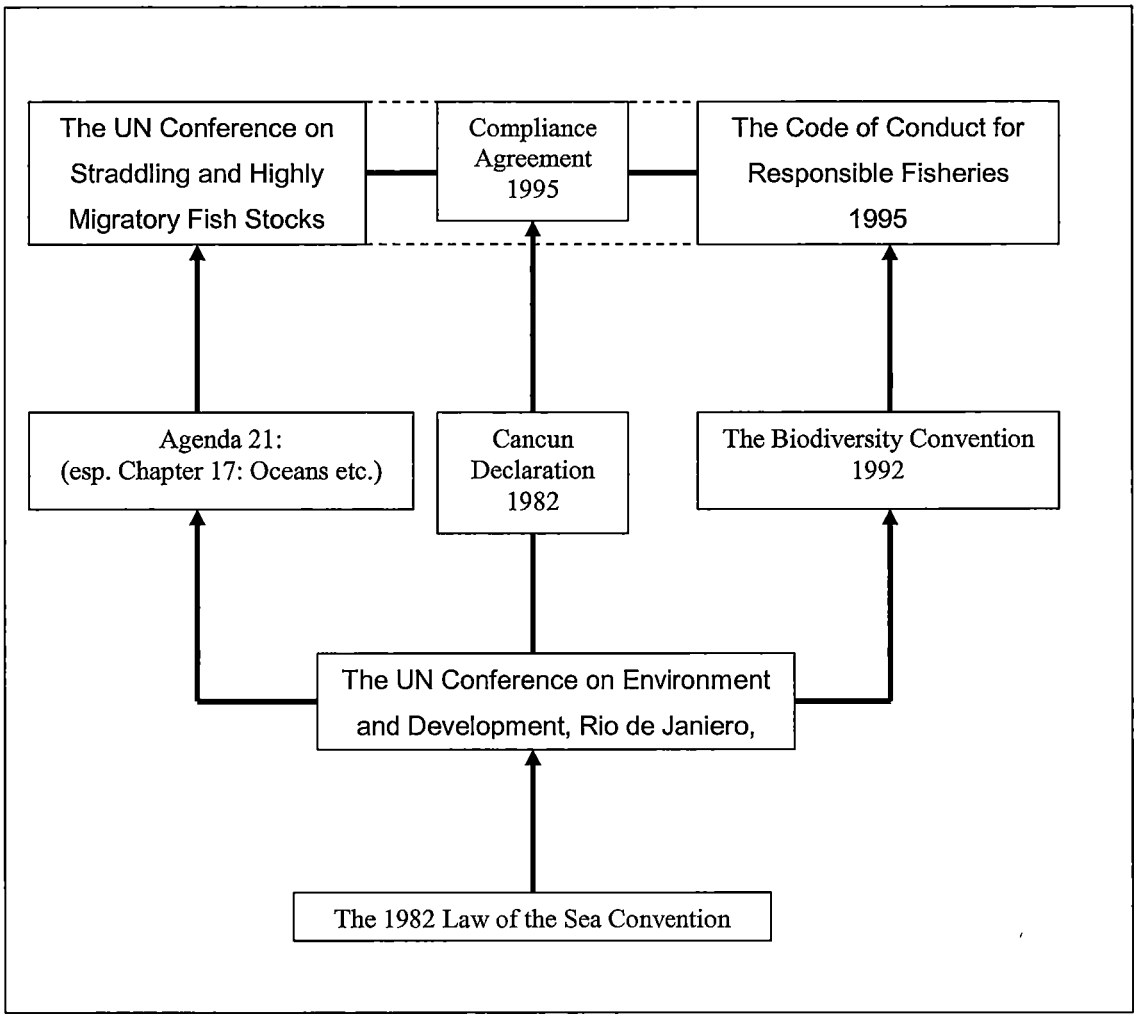
As a reaction to uncertainty about the resource and about the ecological well-being of marine habitats, and in light of disturbing and declining catch trends in the 1990s, the movement to 'responsible fisheries' and the precautionary approach to manage fisheries and the environment gained momentum internationally (Caddy, 1999; Hilborn et al. 2001) and with "unprecedented sequence of intergovernmental agreements on fisheries" (Hilborn et al. 2001: 21).

As Figure 1-1 describes, a range of international agreements give effect to these concerns, including the Rio Declaration, the Cancun summit, the United Nations (UN) Agreement on the Straddling Fish stocks and Highly Migratory Fish Stocks, Agenda 21 (Chapter 17), the UN Food and Agriculture Organisation (FAO) Code of Conduct for Responsible Fisheries, and the Treaty of the European Union (Caddy, 1999; Hilborn et al. 2001).

In Australia, with the release of the National Strategy for Ecologically Sustainable Development in 1992, concepts such as the precautionary principle and rights-based fisheries management have been incorporated into fisheries management and fisheries education, particularly in academic institutions such as the Australian Maritime College. According to the National Fisheries ESD Website <http://www.fisheries-esd.com>, the concept of Ecological Sustainable Development (ESD) is regarded as the:

> [f]oundation for natural resource management in Australia, and is a major component of fisheries legislation at both Commonwealth and State levels...The principles are also consistent with a number international treaties and initiatives such as the United Nations Convention on the Law of the Sea (UNCLOS) and the UN Code of Conduct for Responsible Fisheries (ESD 2004).

Figure 1-1: International agreements of relevance to fisheries formulated since the Law of the Sea was opened for ratification in 1982 (adapted from Caddy 1999)



At both federal and sub-national levels, these principles are major components of legislation, such as the *Environmental Protection and Biodiversity Conservation Act 1999* and the *Wildlife Protection (Regulation of Exports and Imports) Act (1982)* administered by Environment Australia, and Tasmania's *Resource Management and Planning Appeal Tribunal Act 1993 (No. 66 of 1993)* [3] and *Living Marine Resources*

[3] The objectives of the Tasmanian Resource Management and Planning System (RMPS) defined by Schedule 1 of the *Resource Management and Planning Appeal Tribunal Act 1993 (No. 66 of 1993)* are meant to advance sustainable development. Under this Act, sustainable development is defined as: "managing the use, development and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic and cultural well-being and for their health and safety while (a) sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs for future generations; and (b) safeguarding the life-supporting capacity of

Management Act 1995[4]. To reflect ESD in a practical sense and to demonstrate the implementation of these concepts, governments and industries have identified the need to develop a reporting framework and system. The need to implement ESD in the fishing and aquaculture industries is also reinforced by growing community and consumer expectations for environmentally friendly practices to be adopted in government and commerce. Concerns have been raised in various quarters about the interactions between human activity systems and the biophysical environment, and about the environmental impact of fishing practices. Such concerns have at least partly influenced the push for eco-labelling accreditation schemes to be established (MSC 2004; Cummins 2004). Todd (2000) refers to this phenomenon as the emerging emotion economy, which is driven by consumers who have certain expectations about food quality attributes, informed by a sophisticated appreciation of animal welfare, environmental management, traceability, or freedom from GM food ingredients. This phenomenon has already taken effect with a number of seafood industries including the Western Australia and Tasmanian rock lobster industries. The Western Australia rock lobster fishery was the first fishery in Australia to be accredited under the MSC scheme and to also obtain export exemptions under the *Environmental Protection and Biodiversity Conservation Act 1999*. In March 2002, export exemptions were gained by the Tasmanian rock lobster industry under the *Environmental Protection and Biodiversity Conservation Act 1999* administered by Environment Australia, in recognition of the industry being managed in a sustainable manner.

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air, water, soil and ecosystems; and (c) avoiding, remedying or mitigating any adverse effects of activities on the environment" (RMPS 2005: 1).

[4] In relation to promoting sustainable management of living marine resources within Tasmania and the Tasmanian rock lobster industry, the Act provides the means to establish management plans relating fish resources, to protect marine habitats and to repeal the *Fisheries Act 1959*. The purpose of the Act is to achieve sustainable development of living marine resources having regard to the need to – **(a)** increase the community's understanding of the integrity of the ecosystem upon which fisheries depend; and **(b)** provide and maintain sustainability of living marine resources; and **(ba)** take account of a corresponding law; and **(c)** take account of the community's needs in respect of living marine resources; and **(d)** take account of the community's interests in living marine resources. Also a person must perform any function or exercise any power under this Act in a manner, which furthers the objective of resource management. Under this Act, the Tasmanian rock lobster industry is administered and managed under a management plan *Fisheries (Rock lobster and Giant crab) Rules 2001* (DPIWE 2001a). This management plan is what governs the Tasmanian rock lobster industry in terms of harvesting, processing and selling of rock lobster from a resource management perspective.

The Environmental Management System (EMS) has been designed to assist individuals and organisations to implement ESD principles in their operations, with the ultimate goal of reducing environmental impacts. The EMS is a plan established by industry to identify issues needing to be addressed, to set targets and actions, and finally to establish a system to monitor and evaluate performance. The EMS adopted by the fishing industry is in addition to the fisheries management plans administered by a regulatory body, which includes the overall sustainability of the fishery (ESD 2004).

Despite the drive to establish sustainable fisheries resources, many early approaches have been concerned with biological and ecological sustainability of fisheries (Phillips et al. 2003). There has also been limited focus on how the markets affect the fishing behaviour and the exploitation of the resource. The 'silo' approach to fisheries management by managers has meant that the multi-disciplinary solutions that account for the social conditions of fisheries have been overlooked (Caddy 1999; Lane and Stephenson 1998). This oversight has contributed to the failures of fisheries management policies and plans – through the demise of fishing communities as a result of economic hardship, and continued overfishing – causing shifts in effort, conflict within communities and the lack of compliance among fishers (Bradshaw et al. 2001; Kaplan & McCay 2004; Rossiter & Stead 2003).

From my observations, fisheries management in Australia has predominantly focused on the biological sustainability of fisheries in accordance with ESD principles. Apart from the fisheries advisory committees, management plans have been largely undertaken in isolation from stakeholder consultation through socio-economic impact studies (Bradshaw et al. 2001), and the effects of external forces such as exchange rates, market and consumer trends, global issues, technology, transportation and the ownership shift of fishing and processing licences. Locally, the primary reason for a fragmented Tasmanian fishing industry supply chain is that the regulatory bodies operate in isolation from each other. Fisheries are managed on stock assessments in isolation of downstream supply chain trends such as market behaviour. The gap in fisheries management has caused social, economic and biological resource problems as it has often failed to consult and gain pertinent knowledge from fishers and other industry stakeholders when establishing plans and policies (see Kaplan & McCay 2004, Pontecorvo 2002, Rossiter & Stead 2003).

As a consequence of the significant impacts on fisheries that are caused by this limited focus, social and economic sustainability of fishing industries has become a topic of research and discussion in recent years. An integrative approach needs to be undertaken across fisheries research, management, and policy and strategic planning, where the biological, social and economic are interlinked. Dovers and Handmer (1992), Caddy (1999), Lane and Stephenson (1998) support this approach, and the need for convergent thinking across disciplines and fields of knowledge to advance sustainability processes and outcomes.

Sustainable seafood industries are implicit in the quest for sustainable fisheries more generally. In Australia, the seafood industry is the commercial sector of the fishing industry. The federal Fisheries Research and Development Corporation defines 'industry' as the activities of numerous businesses in the production, processing/manufacturing, and trading of particular products. In reference to the seafood industry, the term comprises enterprises and individuals associated with wild-catch or aquaculture resources and the transformations of those resources into products for sale (FRDC 2000). Demographic and employment statistics for the Australian seafood industry are difficult to obtain because of the Australian Bureau of Statistics classification is at a broad industry level and does not reflect the industry's occupations or sectors, particularly in-direct, seasonal, part-time and casual employment. The classification also fails to account for the role of women and other family members in supporting family businesses. The figures are often combined with other industries and categories (STA 2004). The mostly current reliable employment information recorded by Australian Bureau of Statistics was in 1997/8, where the Australian seafood industry (excluding processing, wholesale, marketing or retail sectors) directly employed 9553 people in 1997/8, a 5 per cent increase from the previous year (ABARE 2003).

Seafood is Australia's fourth most valuable food industry, after beef, wheat and milk (FRDC 2000). In addition to its value to fishers, seafood production is important to the processing, transportation, wholesaling and retailing sectors. Seafood is also important to the restaurant and tourism industries (FRDC 2000). Australian exports of fisheries products are heavily concentrated in seven countries – Japan, China, Hong Kong, Chinese Taipei, Singapore, Thailand, and the United States (Table 1-3).

Table 1-3: Top seven Australian exports of edible fisheries products, by destination

Edible Fish	2000/1		2001/2		2002/3	
	Tonnes	AUD'000	Tonnes	AUD'000	Tonnes	AUD'000
Japan	26,767	731,275	25,995	679,480	23,826	627,772
Hong Kong, China	11,276	430,938	10,769	428,310	9,770	355,507
United States	4,836	128,157	5,142	130,694	4,889	152,076
Chinese Taipei	6,107	179,526	4,374	144,842	3,255	90,043
China	4,209	49,399	4,652	70,867	5,111	72,266
Singapore	2,207	53,136	2,155	58,224	1,478	46,393
Thailand	2,399	17,503	3,401	22,767	1,927	7,882

Source: ABARE (2004)

Australia's National Food Industry Strategy (NFIS 2004) has also highlighted new and emerging opportunities for the nation's seafood industry, noting that from 1997/8 to 2001/2, the highest annual rate of growth in Australian exports have been sales to Greece, France, Malaysia, Spain, Italy (from a low base) as well as Thailand and Hong Kong (NFIS 2004).

The Australian seafood industry draws off the largest fishing zone in the world, has a very diverse range of species and, due to its oceanographic conditions and limited nutrient levels, can only support relatively small volumes of fish (FRDC 2000). However, Australians are able to produce several high quality, high value and low tonnage fisheries that are prominent in world markets (FRDC 2000; NFIS 2004) among them include rock lobster, prawns, tuna, abalone and oysters (Table 1-4).

Table 1-4: Top Five Australian Species 2002/3 by production value AUD

Fish	Tonnes	Value (AUD'000)
Rock Lobster	17,060	459,891
Prawns	25,896	354,898
Tuna[1]	14,321	305,261
Abalone	5,135	212,446
Oysters	9,855	62,423

Source: ABARE (2004)

According to ABARE (2004) in 2002/3 Australian fisheries production, including wild fisheries and aquaculture, had a gross value of AUD 2.3 billion with a production of 249,000 tonnes. Since 1999 there has been a steady increase in the gross value of fisheries production, however in 2002/3 there was a fall in production values (ABARE 2003). The decrease in total gross value was attributed to the fall in State and

[1] Total has been adjusted to allow for southern bluefin tuna caught in the Commonwealth southern bluefin tuna fishery, as an input into farms in South Australia.

Commonwealth wild fisheries value, while aquaculture continued to increase in value. The decrease in State and Commonwealth wild fisheries values has been partly attributed to the appreciated Australian dollar of 11 per cent (compared to 2001/2) relative to the US dollar and six per cent relative to Japan for the same period (ABARE 2004). This appreciated Australian dollar translates to lower export prices in Australian dollar terms for product, hence the fall in unit value of many fisheries (ABARE 2004). This trend was also observed in the Australia total export value (Table 1-5), which fell by 12 per cent from AUD 2.16 billion in 2001/2 to AUD 1.84 billion 2002/3 (ABARE 2004). It should be noted that the majority of fisheries exports are edible products such as rock lobster, tuna, abalone and prawns, and so the fall in export demand for any of these products is significant to the overall Australian fisheries export revenue.

Table 1-5: Australian exports of fisheries products 2000/3

	2000/1		2001/2		2002/3	
Species	**Tonnes**	**AUD'000**	**Tonnes**	**AUD'000**	**Tonnes**	**AUD'000**
Fish	**28,102**	**478,353**	**31,396**	**501,826**	**30,052**	**485,201**
Live	Na*	41,585	Na*	47,271	Na*	46,991
Tuna	12,171	264,486	13,503	319,215	12,424	319,604
Other	7,463	44,320	10,683	64,315	11,672	57,073
Fillets	3,308	25,334	3,996	27,385	3237	24,455
Canned	762	4,482	773	5,165	714	5,031
Dried, salted and smoked	291	15,703	178	15,958	222	18,608
Other fish products	4,106	82,443	2,263	22,517	1,783	13,439
Crustacean and Mollusc	**64,707**	**1,716,777**	**64,294**	**1,661,653**	**60,161**	**1,484,859**
Rock Lobster	13,345	532,648	10,942	492,608	11,535	4,63,106
Prawns	12,124	291,048	11,925	262,827	9,532	208,245
Abalone	3,546	249,277	4,010	263,128	4,193	216,115
Scallops	2,145	53,405	1,488	34,433	1,165	28,686
Oysters	246	6,283	219	3,501	163	1,742
Crabs	2,677	3,3015	2,256	29,863	1,714	21,091
Other	2,525	72,748	2,058	73,468	1,807	60,672
Total	**64,707**	**1,716,777**	**64,294**	**1,661,653**	**60,161**	**1,484,859**

Source: ABARE (2004) * Na – Not available

The decreasing trend from 2001/2 to 2002/3 has been largely attributed to global events such as 9/11 and the political and military instabilities that have arisen from it; Severe Acute Respiratory Syndrome (SARS); the rising Australian dollar; and fluctuations in airfreight capacity, including the collapse of Ansett in 2001[5]. In particular, the

[5] The SARS outbreak in early 2003 resulted in a fall in rock lobster exports mostly to Hong Kong and China, and was mostly attributed to a reactive decrease in restaurant customers and the downsizing in freight services as a result of a reduction in airline travellers (Overby et al. 2004). The Afghanistan and Iraqi wars have also contributed to this reduction in freight availability (Overby et al. 2004).

Australian dollar and the outbreak of SARS in Asia (ABARE 2004) during 2002/3 are factors that have influenced the fall in exports of live product to Asian markets. The fall in exports was attributed to an 11 per cent fall in the value of crustacean and mollusc exports that stemmed from a lower volume of exports and falls in unit prices of rock lobster and abalone. This fall in crustacean and mollusc exports also resulted in more abalone and rock lobster being processed into lower value canned and tailed products" (ABARE 2004: 6).

With regard to the major market place for Australian rock lobster, China, the reduction in export value since 2001 may also be attributed to increased competition of cheaper product from South America. Based on these trends, Australian fishers and export processors are realising the vulnerability and dependency of the Australian rock lobster industry on China, and the lack of understanding of the business culture of the Chinese importers. While the statistics presented by ABARE (2004) show very few rock lobsters are exported to China, they do illustrate the point that the majority of rock lobster is exported to Hong Kong. Hong Kong is the major entry point for rock lobster into China based on its "duty free point of entry" (DPIWE 2003b). These figures highlight the possibility for this marketplace to be misinterpreted by the industry, and by members of Australian and Chinese Governments whose representatives may claim that there is no market in China to warrant a free-trade agreement.

However it should be noted "Australian rock lobster exports to the United States have had an increasing trend over the same three-year period" (ABARE 2004: 43). This trend was attributed to the increased exporting of Western Australian rock lobster tails to the United States, and other Australian rock lobster industries seeking to diversify their markets. For example, Ferguson Australia Pty Ltd, a South Australian fishing company, is exporting value-added rock lobster product with the objective of diversifying markets for Southern rock lobster.

Globalisation of Seafood Chains

> Globalisation is seen as the intensification, widening and deepening, of international networks across the economic, military, technological, ecological, migratory, political and cultural flows (Held et al. 1991: 7).

In relation to trade, marketing, food production, primary industry and R-3 communities, globalisation is a phenomenon that characterises most industries regardless of national

boundaries, geography or country status. Over time, globalisation has changed how the supply chain is managed, and has removed much of the individualism and regionalism that once typified food production, trade and marketing. An example of globalisation in the seafood industry is the surimi industry. Mansfield's (2003) work on this industry highlights the fact that raw material can be harvested in various locations throughout the world, combined to make fish paste, and moulded into various seafood extender type products such as fish cakes and crab sticks. She explains why this industrialised product is so desirable as a food source. Attributes such as quality and malleability make it easy for the product to be geographically differentiated to meet various consumer tastes based on region, but still be a global scale industry.

Another example of globalisation in the industry is associated with fisheries management and environmental management. Fish species are not aware of national borders, and therefore some fisheries can cross a number of Economic Exclusive Zones (EEZ) and the high seas. To manage these fisheries, *United Nations Food and Agricultural Organisation's Code of Conduct for Responsible Fisheries, 1995*, and *United Nations Convention on the Law of Sea (UNCLOS), 1982*, were established to protect fisheries resources independent of the nation states. Cole argues that globalisation is a driving force:

> [C]reating significant shifts in state authority in economic, institutional and legal domains ... [S]ignificant transformations in fisheries policy-making in international economics, international institutions and international law-making which alter state authority in fisheries management. Thus, decision making at international, regional and national levels is increasing displaced from the state level (Cole 2003: 77).

The effects of transnational flows of organisations (Fulcher 2000; Sporer 2000) and the loss of autonomy of the local or the state economy reinforce the salience of Cole's observations. The question of ownership of fisheries licences and the supply chain by local or state communities can be observed particularly with fisheries under a quota management system. Tensions between corporate ownership and owner operation of fishing businesses are of increasing concern among fishers in the Tasmanian rock lobster industry. The globalisation of fishing businesses has the power to radically change local fishing communities and fishers' individual and collective abilities to adapt

to and participate in the global economy and international trade networks. The socio-economic impact of technological developments is becoming increasingly evident. "Employment in marine fishing has been declining steadily since the 1970s. Small-scale fishermen, often at the lower level of the decision-making scale, are particularly at risk: more efficient large-scale fishing threatens their existence" (Cole 2003: 81) and (OECD 2000: 5).

Guillotreau (2004) also highlight the effects of globalisation of fish trade, the rise of processing and concentration of the retailing sector on the European Union wild fisheries. This phenomenon has contributed to the reduction of fishers and traditional fish shops participating in the European fishing industry. In his estimation, the only supply chain participants making a better living out of the industry are the "middlemen", namely, processors and wholesalers, who supply product to the few big retailers. Similar patterns appear the case in Australia.

Held et al. (1991: 378) and Cole (2003: 79) further describe the effect of global interconnectedness in terms of fisheries governance and the global awareness as a so-called community of fate. Globalisation in fisheries management infers a global community concern of management and sustainability. This global concern can also be observed in consumer preferences of seafood. Mass individualization (Todd 2000) largely describes the tension between globalisation of food supply and the recognition of the regional and cultural differences of consumers. These concepts also have connections with the emotion economy (Todd 2000), since the "emotional, ethical, aesthetic or ecological origin [of foods] are influencing consumer purchasing decisions" (Todd 2000: 5).

According to DFAT (2001), globalisation has been influenced by policy considerations, such as declining barriers to trade (both through unilateral decisions by individual governments and through multilateral agreements) and the liberalisation of international capital movements. Among the policy driven factors, the decline in international trade barriers has been of critical importance. In Australia's own region, trade liberalization has been rapid. It has also been affected by factors outside the policy domain, including lower transport costs, improved communications; changes in technology, which facilitate cross-border economic transactions; and the tendency for demand for foreign

products to rise rapidly as incomes rise. Improvements in technology and transport have been particularly striking (DFAT 2001; Sporer 2000; Wilde 2001).

> Globalisation has been the consequence of advances in technology, particularly the convergence of computing and telecommunications. National borders and geographic niche markets have effectively disappeared from an electronic point of view and the increasing phenomenon of electronic commerce will have unknown outcomes in regional areas (Wilde 2001: 2).

At various scales, globalisation is changing trading environments rapidly. In many sectors, participation in complex supply chains across international borders, cross-border investment, inter-firm collaboration or movements of personnel across borders, cross-border investment, inter-firm collaboration or movements of personnel across borders are a key to trading success. "The very concept of national origin of traded goods to being eroded, with components, product ideas and research and development spread across a number of different economies" (DFAT 2001: 50).

As transportation and communications have improved, the availability of food varieties regardless of seasons and origin of production have increasingly become the 'norm', particularly in First World countries. Consumer expectations have therefore also increased to expect variety to be the 'norm'. However, to meet these expectations and to capitalise on these more affluent markets, the food industry has in many cases resorted to GMOs, food radiation and other processing methods, and global-scale food production such as surimi to cope with the demand and ensure "quality" is maintained (Adam 1999). These pressures can be significant on industries, such as the Tasmanian rock lobster industry, that are low volume, regional, seasonal, and have live product that has to be transport over 10,000 kms to reach its market place.

Consumer patterns are also changing worldwide, with more double income families, longer working hours, more disposable income and increased exposure to advertising (Thomson 2001). The trend has resulted in a movement towards convenience food stores and the consumption of refrigerated/packaged goods (NFIS 2004; Thomson 2001). Thomson (2001) adds to the reasons for the change in consumer patterns; the increasing globalisation and rationalisation of retailers and manufacturers (also noted by Guillotreau (2004)); the development of health, environment and animal welfare issues;

the increasing awareness of consumers as to how and where our food is grown and treated; food being a fashion item rather than a subsistence item; and finally the impact of new technologies, such as biotechnology and the Internet, on the traditional supply chain. Table 1-6 describes the new environment for globalised trade.

Table 1-6: The New Environment for Globalised Trade

1	Trade can involve adding value in complex supply chains across borders, with imports at competitive prices as key to success.
2	Trading opportunities often arise from, or are facilitated by, cross-border investment and inter-firm collaboration.
3	Innovation, either within the firm or by outsourcing/collaborative arrangement, is often critical to competitiveness.
4	Realising trading opportunities depends on close knowledge of shifts in demand in overseas economies.
5	E-commerce can be a key to exploiting trading opportunities, through participation in B2B supply networks and by creating customer awareness.
6	Small and medium enterprises can participate effectively in international trade.

Source: Adapted from DFAT (2001: 51).

The implications of these changes on all partners of the supply chain are significant, particularly in the food and agribusiness sector. Each partner in the supply chain has to cooperate to ensure the savings resulting from SCM leads to more profit returns for all. "An agribusiness organisation needs to do a number of things namely, identify new consumer needs and new usages, diversify into sectors within the existing geographical market, explore new distribution channels and invest in brands" (Thomson 2001: vii).

Fearne and Hughes (1999) elaborate on the globalisation and rationalisation of food supply chains in their description of supply chain developments in the UK fresh produce industry. There is a certain reaction to globalisation that stems from the very countries and regions that have capitalised on this phenomenon. The first initial reaction involves consumers from these countries requesting localised and regional live produce in restaurants as a demonstration of wealth and prestige. The second more grounded reaction is that market places, such as those in Europe, have experienced change, particularly as consumers react to food scares and concerns such as BSE and GMOs (Ingeborg-Myhr and Traavik 2002). These indisputable invisible hazards are associated with the industrial production of food on farms and in the chemistry 'kitchens' of large corporations (Adams 1999). Consumers are beginning to demand traceability of food products to identify places of origin and processing techniques (Denton 2002). The invisibility of hazards of industrial food production referred to by Adams (1999) is driving consumers to demand accountability and traceability of their food source to

minimise the level uncertainty and risk associated with food supply chains and establishing a 'precautionary principle' (Ingeborg-Myhr & Traavik 2002).

> The impact of a number of health scares including BSE in cattle in Europe, Bird Flu in Hong Kong and Viral Encephalitis in Malaysia has meant a significant investment by all in the supply chain in the development of workable, traceable and independent quality assurance systems. The importance of this to a country like Singapore is significant as they immediately banned pork from Malaysia and beef from Europe (Thomson 2001: vii).

Busch and Bain (2000) reiterate the transformation trends of the global agrifood system, and highlight the shift towards trade and consumption in non-traditional foods and "niche" commodities, such as fresh fruit, vegetables, and organic produce. This shift is in response to retailers and consumers rejection of production methods, techniques, and products of mass consumption and their concern about issues such as food safety, food quality, and environmental sustainability.

In light of these issues, raw regional live products that are subject to seasons and natural temporal risks are becoming increasingly desirable. I suspect this shift in consumer preferences is contrary to the objectives of a globalised economy. The third reaction may be a result of recent global events that have caused instabilities and insecurities relating to food safety and security, health and disease management, transport logistics and the economy (ABARE 2004; Overby et al. 2004). For example, we may see the effects of globalisation change as people's travelling behaviour also changes. If passenger air travel is reduced, then it likely to impact on transportation and freight space availability, which results in product variety reducing as food producers find it difficult to ship product to its destination.

In relation to SARS, Overby et al. (2004) argues that the rapid spread of the SARS epidemic owes itself to globalisation through the facilitation of airline travel. Consumers in places like Hong Kong did dramatically changed their behaviour due to the impact of SARS. Restaurants were deserted as the usual restaurant goers chose to eat at home and relied on food supplies from supermarkets (AFFA 2003a; AFFA 2003b; Overby et al. 2004). Yet, despite the impact of SARS, the market for live rock lobster is returning, although the questions remain 'what lessons have we learnt and how can we

best manage similar events in the future and to what extent are consumer requirements of food safety and quality used as a justification to establish trade barriers for marketplaces such as the US and the European Union'?

With the objective of facilitating improvements in the competitiveness and productivity of the seafood industry in a dynamic global economy, seafood industry stakeholders are looking to the development and implementation of new technological applications. As the global market place demands for structural adjustment in the agricultural food industries, collaborative marketing groups discussed by Murray-Prior et al. (1998) have been seen as a means to ensure that growers/producers maintain competitive advantage through improved business efficiencies along the supply chain and exploring new market opportunities (Gertler 2001; Peterson et al. 2000). These marketing groups also have the capacity to achieve the objectives through the use of IS/IT.

On the matter of Tasmania

Tasmania is a small island state located south of the Australian mainland. The term 'small' is in reference to both its geographic size of 68,401 km^2 and population, which was 478,426 in 2002/3 (DFAT 2004). Like those on many islands, first its indigenous communities and then settler peoples have been focused on maritime industries since before the mid 1700s when whalers and sealers began to exploit the rich resources of the Southern Ocean and contribute to a growing global market in mariculture, albeit from the most distant margins of Empire. Tasmania is an example of an R-3 area that is partly defined by its geographical separation from the Australian continent and other communities. Distance from major national and international marketplaces is and has not been the only inhibitor for this R-3 state. Bass Strait is frequently a rough stretch of water approximately 250km wide that separates the island from major transport and trading hubs in mainland Australia. Seasonal demands, infrastructure costs due to shipping low volume freight, and imbalance of northern and southern bound containers and other equipment (Tasmanian Freight Logistics Council (TFLC) 2002) can result in bottlenecks, delays, and quality assurance problems for Tasmanian products and industries. These characteristics are endemic to R-3s, but 'islandness' (Davidson 2003) and isolation are particularly implicated in the quality of transport logistics capabilities and telecommunications and information technology (Grimes 2000; Grimes 2003). If freight and transportation of exports and imports are constrained, then isolation and remoteness often take effect by reducing the flow of goods, services and people, and

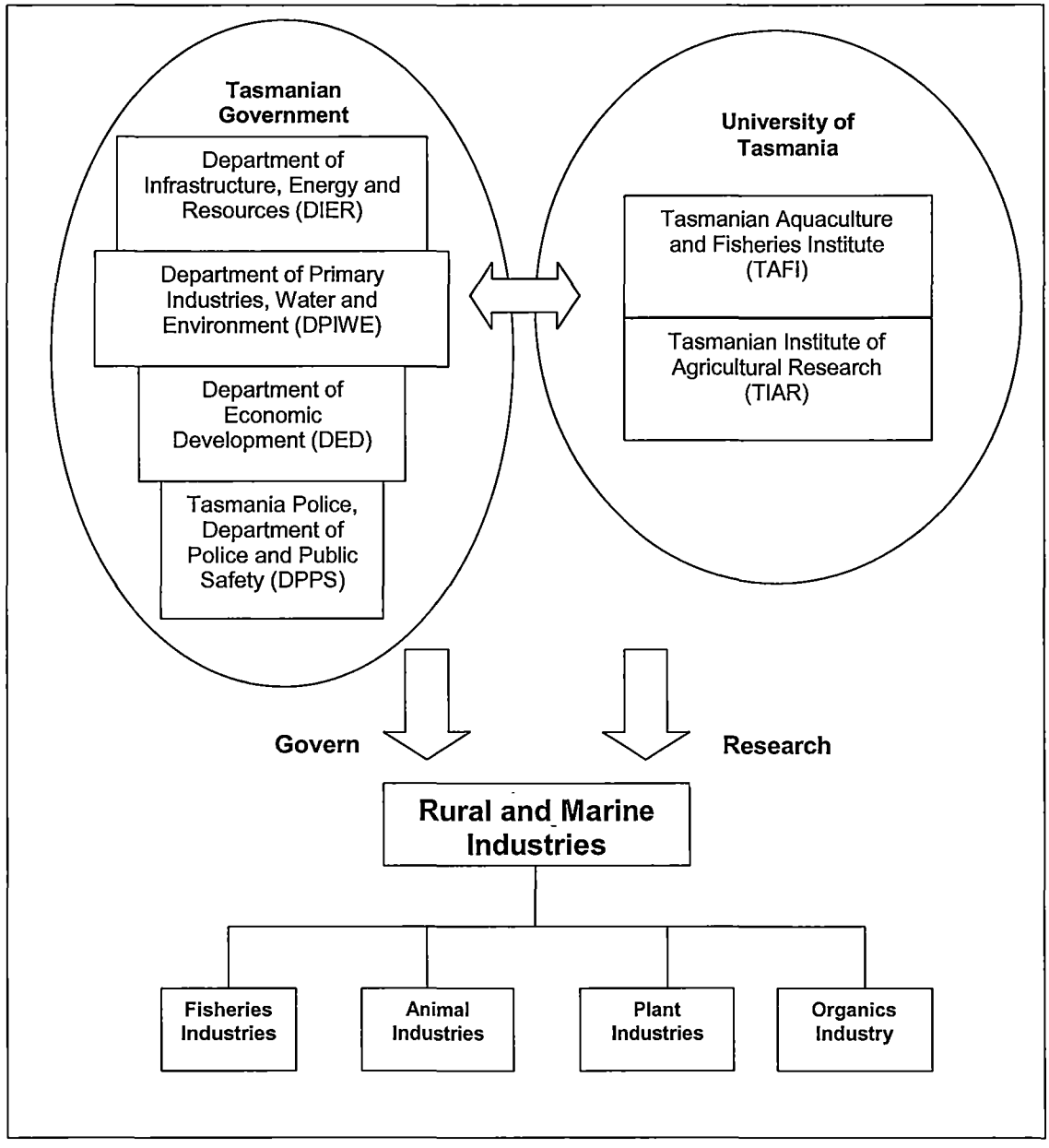
inhibiting local industry development. Local influence on the socially just, economically fair and environmentally appropriate outcomes of industry engagement – particularly in terms of global markets – is often diminished in such circumstances (Chuenpagdee et al. 2005). At least part of that lack of influence results from lack of information, and these themes are central to the research reported here.

In Tasmania, rural and marine industries are subject to a range of governance structures meant to provide the collective capacity to address rapid changes in the global market place, technology and production practices, and the emergence of new industries, particularly in aquaculture and horticulture (Figure 1-2, page 29).

The Tasmanian State Government recognises the need to assist industries to respond positively to these changes, and its Department of Primary Industries, Water and Environment (DPIWE) is charged with monitoring and managing resources, licensing and administration, developing industries in relation to trade and market development (DPIWE 2003a; DPIWE 2003c). Compliance is also a major function of the agency and its staff liaise closely with the Tasmanian Police in the Department of Police and Public Safety (DPPS), charged to enforce the rules associated with the *Living Marine Resources Management Act 1995*. DPPS is also responsible for search and rescue, covering both land and sea searches.

The Department of Infrastructure, Energy and Resources (DIER) has important functions in relation to Tasmanian rural and marine industries, particularly with respect to transport policies and management. Transport services are important for the economic well-being of Tasmanian industries, and DIER's role is to ensure these services are available for intra- and interstate shipments of goods to key marketplaces. Through its partnership agreement with the State Government, the University of Tasmania has two research institutes dedicated to undertaking research on Tasmania's rural and marine industries and resources. The Tasmanian Institute of Agricultural Research (TIAR) focuses on agricultural research such as managing pests and diseases in crops and livestock, and the Tasmanian Aquaculture and Fisheries Institute (TAFI) focuses on researching wild fisheries, the marine environment, and aquaculture, such as stock assessments, environmental monitoring of marine farms and farming new species. These institutes work closely with the University's schools such as Zoology, Aquaculture, Agriculture, and Geography and Environmental Studies.

Figure 1-2: Tasmanian Rural and Marine Industries, State Government and Research Institutes



Despite State Government intervention and significant attempts to market Tasmania as clean, green and innovative, for example via such quasi-government strategies as Brand Tasmania (www.BrandTasmania.gov.au), there is a popular perception among mainlanders that Tasmanians are inbred, parochial, and isolated from the rest of the world. This observation appears to be an example of a lack of understanding about Tasmania by urban counterparts, but perhaps it is also a reflection of how Tasmanians have perceived themselves. Phillips et al. (2002: 461) suggest, for example, that the

island's convict past may have contributed to the people's lack of confidence to challenge authority, which resulted in the development of a "political culture of paternalism, patronage and vested interest". Alongside a long period of relative economic strife, this state of mind could be attributed to the fall in the size of the Tasmanian population and economy over the last 30 years as people see the mainland and overseas as providing opportunities for employment and quality of lifestyle (Beer, 1998; Stratford 2003). This trend is also mirrored in most rural communities and townships (Table 1-7).

Table 1-7: Factors affecting the population sizes of country towns

Factors Affecting Population Sizes of Country Towns
1. The size and wealth of their hinterland populations (and also the stability of that wealth)
2. Their portfolio of basic functions, defined as 'export' industries, including manufacturing, education, tourism
3. The quantity of public services they distribute
4. Their residential attractiveness for retirees, the unemployed, and pensioners
5. The location and relative accessibility of other more commercially dominant places
6. The general quality of life they offer
7. The quality of local leadership
8. The opportunities available for economic development, including untapped resources such as mineral wealth
9. The extent to which corporate capital is prepared to invest in the town

Source: Sorensen (1995: 51-52)

However some of the once-disadvantageous characteristics that defined Tasmania geographically, economically and socially have gradually been recognised as competitive advantages and assets. As the world population grows, the global economy and economic rationalism expand; urban sprawl engulfs the Australian coastal landscape (particularly the eastern seaboard); security scares, pollution, and food and water management issues arise; there is an increasing realisation that safe, clean and green environments are no longer the 'norm'; and that these environmental factors are key motivators for immigration to Australia and internal migration to its coastal and rural communities (Burnley & Murphy 2004; Grossman 2000). Thus, there are growing indications that Tasmania is no longer the embarrassing, often forgotten, appendage to the Australian mainland, and is considered an important, safe, clean and green tourist destination, food source, and economy whose stakeholders demand high prices for their products such as wool, wine, cheese, apples and pears, vegetables, and seafood.

Information has become a central means by which Tasmanians are now beginning to take advantages of the shift in their fortunes. The Tasmanian State Government has

developed primary industry, transport, and information, communications and technology (ICT) policies to assist owners and managers of many island industries and businesses to communicate, trade, and share information with mainland Australia and overseas counterparts (DED 2004; DIER 2004; DPIWE 2003c). Primary industry policies include the establishment of the State of Growth project that aims to promote social, economic and environmental growth through partnerships between communities and primary industries (DPIWE 2003c). Transportation policies include land and marine transportation for passengers and freight, such as the purchase of three ferries to cover the Melbourne to Devonport and the Sydney to Devonport routes. ICT policies have included the development of an innovations program, such as the Intelligent Island program, to support the development of Tasmanian ICT businesses (DED 2004).

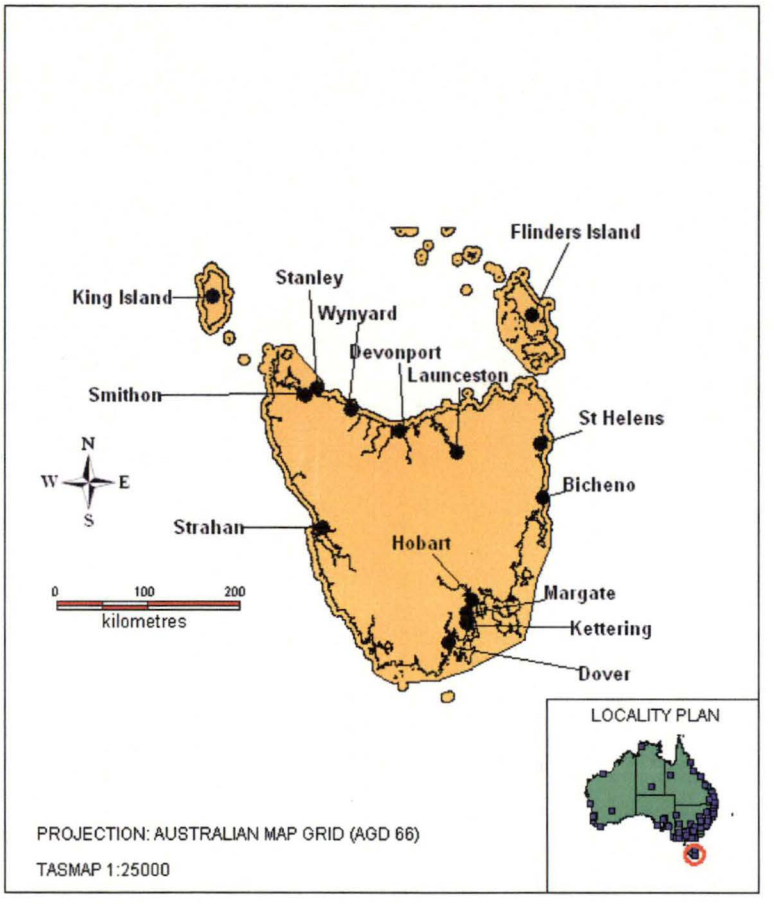
Collectively, these strategies may begin to erode inhibitors that have constrained the State from economic and social sustainable development for so long. Nevertheless, there are issues that Tasmanians still need to manage to ensure economic and social sustainability and these include the tyranny of distance to market places; the bottleneck of transport, freight and logistics; a small population base whose members are ageing; inferior and costly communications and infrastructure compared to urban counterparts; and difficulties associated with adjustment and rural restructuring in response to the changing global economy and marketplace. These issues are not entirely unique and are shared by other R-3s in Australia and overseas (Appleton 1998; Barling & Castleman 2000; Breathnach 2000; Coulthard et al. 2000; Coulthard 2001; Grimes 2000, 2003; Malecki 2003; Wilde 2001).

The Tasmanian rock lobster industry

The rock lobster industry has been part of the history of Tasmania for at least one hundred and fifty years, and its 'footprint' is widespread across the islands that comprise its territory (Figure 1-3) (Bradshaw et al. 2000; DPIWE 2003a; DPIWE 2003b; Ford 2001; Frusher 2001; Phillips et al. 2003; Williamson, Wood & Bradshaw 1998). The Tasmanian rock lobster is the target species harvested by the Tasmanian rock lobster fishery (DPIWE 2003b). The same species is also commercially harvested in two other Australian states - South Australia and Victoria – as well as in New Zealand. The local fishery has been managed by the Tasmanian State Government for over 100 years (Bradshaw et al. 2000; Phillips et al. 2003; Ford 2001). It is now part of a global industry supply chain that involves numerous participants including fishers,

processors, freight forwarders, airlines, and end buyers, all of whom are economically and socially significant to Tasmanians, particularly in coastal townships and communities.

Figure 1-3: Key Tasmanian Rock Lobster Industry Ports, Tasmanian Map 1:25000 polygon and coastal layer



Source: produced from data from the Department of Primary Industries, Water and Environment.

Tasmanian rock lobster is known for its size, sweet taste and firm flesh, and is highly desired in major export markets such as China, Hong Kong, Taiwan, and Japan. It also travels relatively well and East Asian consumers are prepared to pay premium prices for high quality live red rock lobster. Despite this favourable demand from the marketplace for this rock lobster, Tasmanian fishers and processors remain 'price takers' and vulnerable to market fluctuations as a result of the lack of transparency in the system. As a consequence, the fishery's peak body, the Tasmanian Rock Lobster Fishermen's Association (TRLFA), has sought to explore solutions to the dependency that fishers

have on others and on processes in the supply chain and market, and to address the demands upon it to ensure the fishery is both global in reach and sustainable in conduct.

Chuenpagdee et al. (2005:33) refer to a global problem in the sustainability of fisheries that informs my work. They note that to "make a living when alternative sources of employment are available and one's bargaining position is weak, the only response to falling prices is for fishers to increase their fishing efforts ... [and furthermore] it is widely recognised that if fisheries are not properly managed, the fishers' abilities to obtain income or food from them diminish. This is a problem in the South as well as in fisheries-dependent regions of the north, since alternative employment opportunities are frequently unavailable". In Tasmania, the commercial rock lobster fishery is managed under an output controlled individual transferable quota management system (QMS), introduced on 1 March 1998, to replace the failing input control management method, and engender bioeconomic sustainability of the fishery. In a jurisdiction such as Tasmania, where a quota system has been imposed to protect the fishery by setting a total allowable commercial catch, there is limited possibility to increase fishing effort in terms of size of catch, and therefore dependence on income from high market prices becomes increasingly pronounced. Therefore, the search for solutions to dependence tends to rely on technological innovation and investments in IS/IT to bypass parts of the supply chain in order to enhance transparency, value add and to reduce the 'leakage' of profit away from the harvesters.

The industry's economic significance is highlighted in Table 1-8 where the Tasmanian rock lobster production value and volume consistently rank third nationally from 2000/1 to 2002/03, with AUD 52 million (ABARE 2004) and 1520 tonnes (TAFI 2004) in 2002/3 against Western Australia and South Australia (ABARE 2004). Despite Tasmania's national position in terms of production and export value of rock lobster, Tables 1-8 and 1-9 highlights that, for the same three states from 2001/2 to 2002/3, there has been a significant decrease in the production and export value of rock lobsters. The decreasing trend is also reflected in the export of rock lobster by destination where the majority of rock lobster is exported live to Hong Kong, China, Japan, Singapore, Chinese Taipei, and Australian Pacific Economic Commission (APEC) (ABARE 2004: 42-43). The cause of this decreasing trend is similar to those affecting the Australian seafood industry.

Table 1-8: Australian Rock Lobster Trends 2000-2003 by State and Production Value* (AUD'000)

State/Value ($'000)	2000-2001	2001-2002	2002-2003
Western Australia	304,057	305,268	281,023
South Australia	83,097	91,862	82,666
Tasmania	55,578	64,450	51,707
Victoria	21,809	21,505	17,356
Queensland	4,981	5,113	7,356
NSW	4,408	4,717	5,441
Total	**481,048**	**501,767**	**459,891**

Source: ABARE (2004)

*Production value is the assessed value at the point of landing for the quantity produced and excludes transport and marketing costs (ABARE 2004).

Table 1-9: Australian Rock Lobster Trends 2000-2003 by State and Export Value* (AUD '000)

State/Value ($'000)	2000-2001	2001-2002	2002-2003
Western Australia	373,010	329,525	324,717
South Australia	86,446	84,208	77,058
Tasmania	36,247	35,009	27,880
Victoria	16,016	26,040	8,395
Queensland	15,644	12,680	21,591
NSW	5,087	4,733	3,005
Total	**532,648**	**492,608**	**463,106**

Source: ABARE (2004)

*Export value data are supplied by the Australian Bureau of Statistics on the basis of free on board value (ABARE 2004).

Australian seafood industry and Tasmanian rock lobster production and export trends from 2000/1 to 2002/3 highlight an important lesson for industry members about how global dynamics can have a significant impact on an industry reliant on major markets. Changes in consumer tastes and behaviour, food scares, quality issues, logistics, technology, wars, local currency, market fluctuations and competition are examples of what industry members needs to manage for risk, uncertainty and change, since these affect sustainability outcomes. These factors influencing the global seafood market are reiterated by the NFIS (2004) and Light's (2003) discussion on the effects of recent global events on the New Zealand seafood industry. Fishers are 'price takers' in the supply chain, particularly as beach prices (the price per kilogram for landed product) are largely set by processors who, in turn, react to demand from mainland and overseas buyers (Hurn & McDonald 1997). Many fishers find it difficult to understand how the price is determined and that incapacity consequently creates distrust among supply chain participants including the processors, distributors and end buyers (Richards, 1999).

> Fishers are intentional actors operating and learning in a complex open system that includes the weather, the seasons (day length, water temperature), the lunar cycle, rock lobster habitat, rock lobster, improving technology and equipment, other fishers, processors, all within the context of developments and price movements in various markets for rock lobster (Bradshaw et al. 2000: 32).

In Tasmania, the rock lobster industry is an important source of income and a minor but significant source of employment for Tasmanians. The Australian rock lobster fisheries accounted for 24 per cent of the total employment in the marine fisheries sector in 1997/8, followed by the prawn fishing sector, which employed 17 per cent (ABARE 2003). Australian Bureau of Statistics employment figures for 2001/2 indicated that 635 Tasmanians were employed in aquaculture, and 550 were employed in marine fishing (DPIWE 2003a).

These statistics did not include people involved in fish processing or as contractors (e.g. providing transport) who are classified to other industries e.g. manufacturing and transport. However in 1999, DPIWE estimated that approximately 1000 people were directly employed in the Tasmanian rock lobster industry. This figure assumes that each licensed vessel has a skipper and one or two crew, and adds an estimate for the processing sector (this estimate does not include seasonal and in-direct work in the total) (DPIWE 1999). As part of a national southern rock lobster economic assessment, an analysis of the Tasmanian commercial industry was undertaken by EconoSearch Pty. Ltd., which reinforced DPIWE's estimates of Tasmanian jobs (harvesting and processing sectors) that are reliant on the rock lobster industry (TAFI 2004). EconSearch (2003) estimated that there were 1350 Tasmanian jobs (harvesting and processing sectors), and the industry generated $184.5 million per annum ($65 million directly from landed value) in 2002. Based on limited ABS, EconoSearch and DPIWE fishing employment figures at a national and local level, I anticipate that there are many more indirect people employed in the Tasmanian fishing/seafood industry not being accounted for in the figures.

Much of the employment and expenditure associated with the Tasmanian rock lobster industry benefits smaller coastal towns and communities around the State, where

industry participants live and operate (Bradshaw 2000; DPIWE 2003a; DPIWE 2003b; DPIWE 1999; FRDC 2000; Frusher 2001). As demonstrated earlier in the discussion of Australian fisheries production and export trends, global events over the last three years have also affected the Tasmanian rock lobster industry, particularly in Hong Kong and China. Since then, the export market to Hong Kong and China has gradually recovered as consumer confidence strengthens. However full recovery will take some time as fishers and processors still experience low demand and low beach prices for their lobster from the major export markets. The low demand is primarily attributed to an over-supply of cheap lobster in China and on the domestic market as a result of SARS, exchange rates and quality issues associated with poor product condition at the start of the season, 1 November 2003 (Treloggen 2003a; Treloggen 2003b; Treloggen 2003c). As the rapid drop in demand of exports after the SARS outbreak demonstrates (Light 2003, Overby et al. 2004), the industry is vulnerable to changes in the international market. It has become clear that fishers and processors have generally failed to appreciate the risks of not diversifying their markets and setting up strategies to adjust to change. The industry has become increasingly vulnerable due to poor SCM and a lack of strategic planning. There is a need to strategically plan and explore the possibilities of establishing information systems to assist in capturing and managing information, and support decisions in relation to marketing, business processes and information flows.

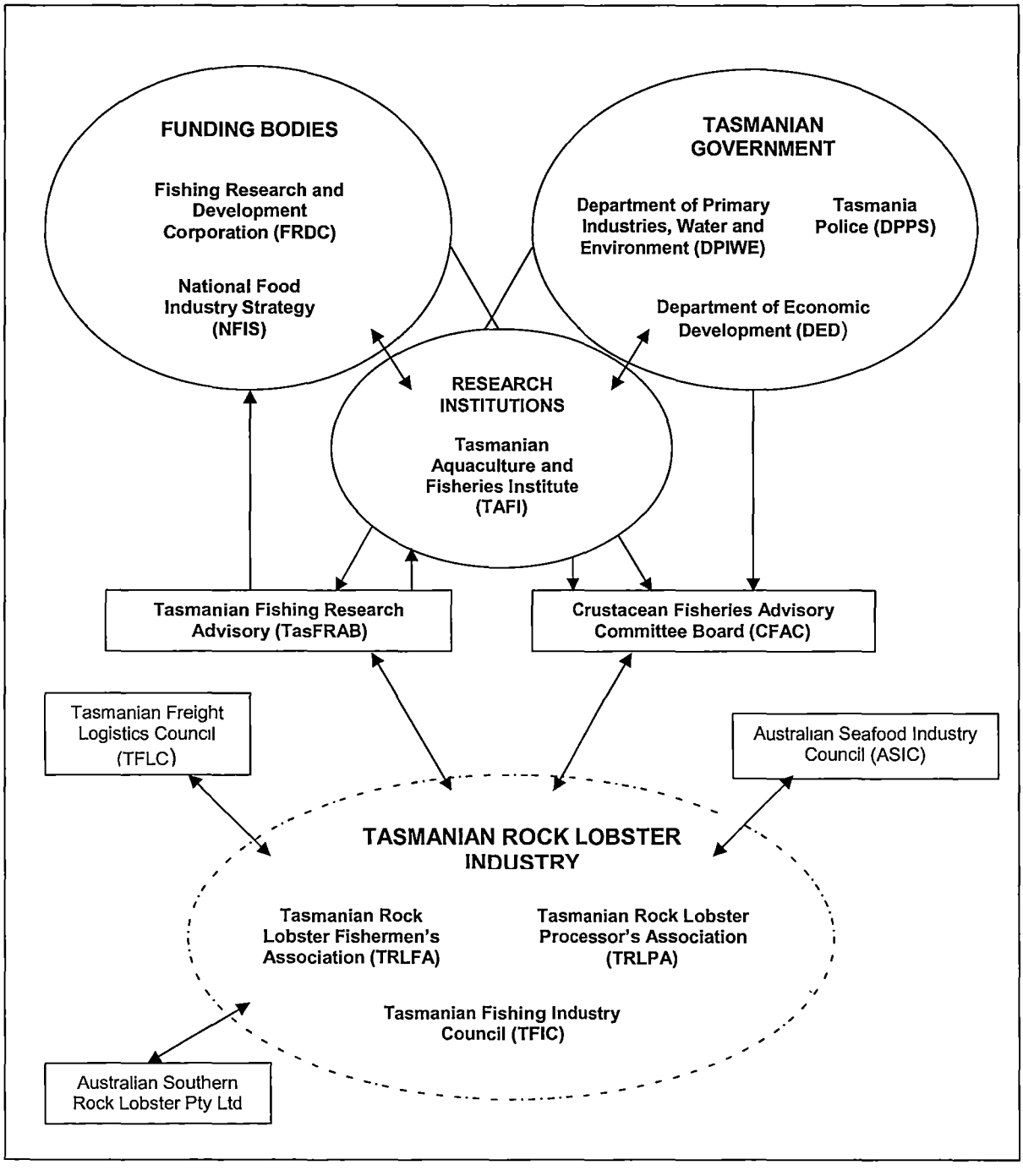
Many participants in the Tasmanian lobster industry operate in R-3 areas and are remote from international marketplaces. One of the industry's main characteristics is that its members and operations are relatively dispersed throughout Tasmania with no central trading hub such as New South Wales' Sydney Fish Market and Victoria's Melbourne Fish Market. Fishers live and operate throughout the State "Many commercial rock lobster fishing vessels also work out of St Helens and Bicheno on the east coast of Tasmania, King Island and Smithton in the north-west, and Flinders Island in the north-east" (Bradshaw et al. 2000: 33) (see Figure 1-3), and many of the processors are also distributed accordingly. Hobart, Launceston, Devonport, Wynyard, Smithton and Stanley are considered trading and transport hubs for seafood due to the availability of airfreight facilities. Based on this remoteness from marketplaces, information sources about transport logistics and market demand are even more critical to industry members' decision-making processes.

The Tasmanian rock lobster industry supply chain consists of multiple participants or actors. Business processes, interactions, and relationships among these participants have sometimes been tense, but necessary to ensure the product reaches the market place and financial gains are achieved. The industry also involves numerous organisations such as industry associations, research institutions, and government agencies that are focused on resource management and, to a lesser extent, industry development and marketing. The Crustacean Fisheries Advisory Committee (CFAC) and the Tasmanian Fisheries Research Advisory Board (TasFRAB) are particular forums where industry peak bodies such as the TRLFA, Tasmanian Rock Lobster Processor's Association (TRLPA), and the Tasmanian Fishing Industry Council (TFIC) represent industry members when dealing with State and Commonwealth Governments and other organisations, such as the TAFI, on issues associated with fisheries management, research priorities, and policy development. The industry associations also represent the industry in the public arena, such as the media, when handling topical issues affecting the industry, and undertaking research on such matters as public perceptions of fishing practices, environmental and food safety practices, and marine protected areas. At the national level, TFIC reports to the Australian Seafood Industry Council (ASIC). Funding bodies such as the National Food Industry Strategy (NFIS) and FRDC are significant players in the industry, providing financial assistance for industry development projects. Figure 1-4 describes the key actors in the Tasmanian Rock Lobster Industry, and highlights links among national funding bodies, State Government, industry advisory boards, and industry associations. Each is described in turn.

The TRLFA, the peak body for the Tasmanian rock lobster fishers, represents the industry to State and Federal Governments. The TRLFA has a Chief Executive Officer, President, Secretary, Treasurer and a board of fishers who represent members in each part of the State. Its main sources of information come from fishers, processors, the marketplace, government, and research institutions. The TRLFA also has to manage legislation, management plans and policies, be publicly accountable, have knowledge of trade barriers and export regulations, and understand market requirements, all with fishers' best interests as a priority. IS/IT is regarded by the TRLFA as a potential tool to assist the industry supply chain. The TRLFA's role is increasingly moving towards collaborative marketing and industry development work with other states that share the same species of rock lobster, including Victoria and South Australia via the

development of Australian Southern Rock Lobster Pty Ltd. The TRLFA's vision of the future is to ensure industry sustainability outcomes, biologically, economically and socially, and to encompass marketing and industry development work in addition to supporting biological research.

Figure 1-4: Key actors involved in the Tasmanian rock lobster industry



This vision by the TRLFA is not dissimilar to many of the fisheries described by Kitts and Edwards (2003) who have establish cooperatives to better manage their share of the harvest, profits, reduce costs, improve product quality, and negotiate of prices. This

approach is necessary for R-3 industries to participate and survive in a global economy especially as global food chains are increasingly influenced by consumer responses to risk, uncertainty and quality (Mentzer & Moon 2004; Todd 2000) and by similar concerns among major retailers/wholesalers (Fearne & Hughes 1999). The approach is also necessary to manage environmental accountability in fishing and processing operations, and advance sustainability outcomes (Gertler 2001).

In 2003, rock lobster industry leaders from South Australia, Victoria and Tasmania established Australian Southern Lobster Pty Ltd. The company has brought together the three main producing states of southern rock lobster and aims to manage the implementation of a strategic plan. Chaired independently, the Board meets regularly seeking relevant expertise and communicating widely to organisations such as Environment Australia, FRDC, Directors of Fisheries, relevant advisory boards and Federal and State funding agencies. The objectives of the company are: 15 percent compound growth in average licence value through to 2012; industry commitment to taking responsibility for development planning; securely positioned lobster products in niche markets, predominantly in Asia, Europe and USA; the culture of the Australian based fishers and processors will be integrated through chain alliances and investments, and the adoption of e-commerce practices and tools; industry R&D and generic market development programs will be funded by industry; industry will embrace aquaculture to ensure that wild catch and aquaculture present complementary offerings to an enhanced rock lobster product line; and establish technologies and procedures for reseeding and enhancement of wild rock lobster stocks (Southern Rock Lobster Pty Ltd 2003).

TFIC is another industry body with an interface to industry and Commonwealth and State governments, and it represents commercial fishers, processors and marine farmers. TFIC is represented nationally by the Australian seafood industry's peak body, ASIC and, in turn, assists national initiatives led by ASIC at a regional level (ASIC 2003). TFIC's priorities extend to the processor level and not beyond. However with more national supply chain initiatives occurring, particularly with the new Food Standards Australia and New Zealand (FSANZ) food safety standards, TFIC's role may eventually include the whole supply chain.

ASIC is the peak body representing commercial fishing, aquaculture and post-harvest seafood industries in Australia. ASIC is located in Canberra, close to the seat of Federal

Government. However, it remains responsive to the interests of State, Territory and Commonwealth waters fishing operators and aquaculturalists (ASIC 2003). ASIC's mission statement is "Through industry leadership and representation, to provide a single united voice for all sectors of the Australian seafood industry on national issues of importance to the industry" (ASIC 2003).

ASIC and the Fisheries Research and Development Corporation (FRDC) are founding members of the non-profit company Seafood Services Australia Ltd (SSA 2003), which was established to provide support and services to the seafood industry including seafood businesses, government and R&D agencies, training organisations and providers, and other service providers. SSA's vision for the Australian seafood industry is for it to be sustainable, profitable, internationally competitive, socially resilient, and engaged in responsible industry practices that enjoy the confidence of the community (SSA 2003). Key areas are seafood supply chain development ('water to waiter'); environmental management systems; seafood safety and quality; trade and market development; and seafood industry occupational health and safety (SSA 2003). SSA is about ensuring that seafood businesses stay in business and adapt to changes in domestic and global markets; they must cope with the increasing need to ensure quality maintained through food safety handling practices and environmental practices (SSA 2003).

SSA also has involvement with the National Food Industry Strategy Ltd (NFIS), which is an industry-led company funded by the Commonwealth Government to be a 'change agent' in the Australian food industry. The NFIS Ltd is working to a national strategy for the food industry and is guided by the National Food Industry Council, a committee comprising six Australian Government Ministers and leaders from the food industry and relevant government organisations (NFIS 2003). NFIS was established in late 2002 to support the Australian food industry to position itself as a global producer by 2007. Current NFIS activity within the seafood sector offers an industry-driven opportunity to embrace this approach in a strategic manner (NFIS 2004). NFIS was established by and for industry members to assist Australian food and beverage businesses to increase innovation in the industry; increase skill levels; realise greater efficiencies and productivity; introduce improved safety and quality; and increase exports of Australian food around the world (NFIS 2003). Four key theme areas in NFIS are innovation, market development, the business environment, and environmental sustainability. The

bottom line is to improve the skills, efficiency and capacity of the Australian food industry; increase exports of Australian food; increase Australia's market share of world food trade; encourage investment in, and the commercialisation of innovation within the industry; improve the safety and quality of the industry; and do so without any diminution in their capacity to meet domestic food needs (NFIS 2003).

The NFIS, SSA and the Western Australian Department of Fisheries have been collaborating on a joint project, the Australian Seafood Strategy for Export Growth (ASSEG) Project. It advocates aim to develop a national strategy to achieve significant export growth for Australian seafood by establishing agreed national growth targets; identify priority opportunities to achieve these export growth targets; include feasibility assessments and a demonstration pilot project; identify impediments to export growth; and establish ongoing processes to take advantage of opportunities for maximizing export growth and to address identified impediments.

Established as a result of research work undertaken as part of the ASSEG project, the National Seafood Export Forum was undertaken on 23rd February 2004 in Melbourne. It provided an opportunity for industry stakeholders to workshop the research to achieve stakeholder consensus on the aims outlined above. At this Forum I had the opportunity to observe participants of the fishing/seafood industry from other fisheries, states, and regions. I was able to gain an understanding of the trends and issues associated with the fishing/seafood industry at a national level, which were transferable to the local Tasmanian rock lobster industry and vice versa. Proposed outputs from the Forum included identification of the top five priority export market opportunities for Australian seafood and an assessment of industry support for a model pilot project to trial a supply chain into a priority market. The final output was the formation of a technical working group to consider activities to address impediments and take advantage of opportunities in the market. The day consisted of seven working groups, which were tasked to identify export market opportunities and develop strategies and actions to achieve this. From the outset, it became apparent that diversity of the Australian seafood industry made this task complex because there were sectors that were significantly different geographically and operationally. The diversification of seafood in terms of species, harvesting methods, post-harvesting methods, markets and region is an example of the diversification of the industry. From the tenor of general discussions and workshops, it became apparent to stakeholders that consensus on one strategy may not necessarily

meet the specific needs of individual industry sectors. It was acknowledged that this industry is particularly fragmented and contrasts with other food industries such as beef, poultry or pork, where the product is marketed along with value-added variations of the same product. There was also a concern at the Forum that major industry stakeholders would dominate strategies and directions.

Several themes emerged at the Forum: individual operators compete against industry groups; vested interests are powerful; big business competes against small business; there is a lack of cohesion; the complexities of dealing with the global market place are pronounced; industry managers are reluctant to adapt to change, uncertainty and risk, and operate in an "unlevel" playing field; there are trade barriers and a need to protect disease free status; quarantine laws and competitive advantages may be eroded; the profile of the industry needs raising in relation to the value of products; and globalisation may negatively affect local economies and communities. Such themes contributed to the findings described in Chapter Three concerning the current industry profile.

With specific reference to the Australian rock lobster industry, there are a number of national and State industry committees and sub-programs for marketing, industry development, and SCM. At a national level, the FRDC Rock Lobster Post-Harvest committee sub-program, established in 1996, supports the live section of the rock lobster industry. The sub-program's mission is to conduct research to increase the value of the rock lobster catch for Australia through improvements in post-harvest practices such as reducing appendage loss, improving international transport and processing practices, and information transfer. The sub-program aims to increase the percentage of rock lobsters delivered to factories in a condition suitable for live export and to examine if better methods could be identified for industry members to use in identifying those lobsters selected for overseas shipment. A key requirement of the sub-program is for industry to play a dominant role in determining what, if any, research is carried out in the post-harvest sector. As a consequence, sub-program members are required to visit states and discuss with industry members and researchers about post-harvest needs.

Members of the Tasmanian rock lobster and abalone industries have also established a Tasmanian post-harvest committee, which has an independent chair and is supported and endorsed by DED. The committee is influenced by a number of industry

representatives. The committee aims to deal with concerns over the viability and economic sustainability of the rock lobster and abalone industries by enlisting independent researchers to undertake projects on the industry supply chain.

The Tasmanian rock lobster fishery is under the Tasmanian Government's jurisdiction and is managed and enforced by two government agencies, DPIWE and the Department of Police and Public Safety (DPPS). Important objectives that inform work in these two government agencies are to manage the resource and ensure the allocated quota is not exceeded and that non-quota and illegal fish are not harvested for commercial reasons.

The resource is managed through the collection of catch (number of rock lobster caught per day) and effort data (number of pots lifts per day, number of day and night shots, and area fished and depth) from commercial fishers' logbooks (paper-based record book), which are required to be completed daily and sent monthly to DPIWE (Appendix 4). Quota management and compliance are achieved using quota docket books and telephone reports. These documents record numbers and weights harvested, moved, and sold from fishers to processors, retailers, and the public. Quota docket books are paper-based records and consist of two parts.

Part A is to be completed by the rock lobster fishing licensee and includes information such as rock lobster entitlement number; vessel distinguishing mark; date, time and location of unloading; number and type of containers (bags) of rock lobster; exact number and weight of rock lobster (taken from the daily catch log); destination of consignment (must be a licensed lobster receiver); name and signature of the holder; were all the rock lobster unloaded from the vessel; weight and number sold to unlicensed receivers; and the receipt number issued by the paging service. The original copy of this completed part of the docket book must be sent to DPIWE within 48 hours of unloading.

Part B is to be completed by processing licensees or fish handling licensees and includes information such as the time of departure from unloading site; name of driver with signature and date; exact weight of rock lobster; type and registration number of vehicle; and receipt numbers issued by the paging service. Similar to Part A, the original copy of this completed part must be sent to DPIWE within 48 hours of receipt of stock. Receipt numbers are then recorded on quota docket books. Numerous

telephone reports can be made and include those related to unloading (fishers); emergency unloading (fishers); unloading into a fish cauf; movement report; sale of rock lobsters; dispatch; and cancellation. Appendix 4 provides a table of the information details required for each report. Particular reports such as the movement report apply to both fishers and processors (DPIWE 2001). Tagging is also required for rock lobsters sold in the Tasmanian domestic market, and prevents the sale of illegally caught lobsters in local retail premises and restaurants. The tag, issued by DPIWE, is stamped with a unique number. The tag is not transferable and must not be used more than once. The tag must be placed on the horn that is on the left side of the rock lobster head facing away from the person (DPIWE 2001).

Recreational rock lobster fishers are also managed by the use of licensing, restrictions on fishing practices, size limits, bag (5 rock lobsters per day) and possession limits (10 rock lobsters per day), seasons, restricted area, and the clipping of lobster tails to prevent the sale of non-quota species in the marketplace (DPIWE 2001). All such management measures are meant to prevent over-fishing of the resource and, to ensure that neither commercial nor recreational fishers exceed their allocation of the resource.

Each year, DPIWE allocates quota to licensed fishers on the basis of the total quota allocated by the Minister. TAFI produces harvest strategy evaluations and risk assessments of quota options based on stock assessment research, and the CFAC reviews and recommends the best available option to the Minister. The Minister then decides on the Total Allowable Commercial Catch (TACC). The quota year is managed using allocated quota, fishing seasons, area restrictions (such as Marine Protected Areas), and size limits. Fishing seasons are defined by the biology of the rock lobster: females are protected during the breeding period; all lobsters are protected during the peak moulting periods[6]. Size limits are defined by the dimensions of the carapace and are aimed to protect immature lobsters from being harvested, and to ensure adequate egg production and therefore recruitment. Traditionally the peak fishing period for lobster is from November to January. Typically, relatively low beach prices are paid at that time of year (approximately $25/kg). During winter months, catch levels fall and the beach prices peak in winter at about $54/kg for 2002/3 (DPIWE 2003b). Since QMS was introduced there has been increased demand by export markets on a limited supply of rock lobster that has consequently created higher beach prices and a shift in

[6] Females are still caught but not retained during moulting period.

fishing effort towards the winter months (Bradshaw et al. 2001; Ford 2001; Frusher et al. 2003).

There has been close scrutiny of the industry's socio-economic and bioeconomic effects since the introduction of the QMS (Bradshaw et al. 2000). Phillips et al. (2003) support work by Bradshaw and Wood (2000, 2001 & 2003) and suggest that the implementation of the QMS was shaped by "vested interests" primarily driven by the desire to generate increased returns for a small number of quota owners.

> The sticking point was whether quota would be allocated by catch history or by an equal allocation by pot. Large catchers [*sic*] stood to gain from allocation by catch history, while a number of small catchers would be allocated more quota than they were then catching if allocation was equal-per-pot ... The majority of fishers stood to gain from equal-per-pot allocation and successfully lobbied members of the Tasmanian parliament for the introduction of quota management according to this mechanism (Bradshaw & Wood 2003: 517).

Phillips et al. (2003) suggest that the social implications of a QMS, such as the reduction in fleet size, have not been adequately considered. The implications include increased local unemployment and increased entry costs for potential new fishers. Consideration of social aspects of changes in fisheries management systems is an element that has only recently been undertaken in Australia. For 2002/3, the TACC for the fishery was 1523.5 tonnes and it is likely to remain around that level for the foreseeable future (DPIWE 2003b). Despite evidence from stock assessment reports indicating that there is increasing catch rates (Gardner et al. 2004), unfavourable weather patterns and lower financial returns on the catch in 2002/3 and 2003/4 made it difficult for some industry members to catch their quota (Treloggen 2003a; Treloggen 2003b; Treloggen 2003c; Treloggen 2004).

The sustainability of the Tasmanian rock lobster resource is also being questioned by Bradshaw and Wood (2003) who argue that the fishery should not be managed on a Tasmanian-wide basis, but in zones that reflect the local environment in terms of bottom type, water temperature, weather patterns, and habitat. They argue that the exploitation of the resource in certain areas may not be sustainable, and that an increase in the TACC may exacerbate this rate of unsustainable exploitation in local areas.

> The differences [between local environments] help one to appreciate that the Tasmanian commercial rock lobster fishery is made up of a number of different zones and needs to be managed as such if local outcomes are to be sustainable in all areas of the fishery (Bradshaw & Wood 2003: 513).

Bradshaw and Wood (2003) draw upon the fishing behaviour of fishers and the intrinsic characteristics of the local environment to determine that effort is concentrated in particular areas. Market pressures of major markets are also seen to have influence over fishing behaviour as fishers respond to specific product requirements and concentrate effort on specific regions for the purpose of targeting the "deep red" lobster (Treloggen 2004). TAFI's stock assessment report 2002/3 (Gardner et al. 2004) indicates, based on current catch rates and trends relating to the legal-sized biomass, that the Tasmanian rock lobster resource is sustainable, but spatial management needs to be considered. Gardner et al. (2004) acknowledge the shift in fleet behaviour and effort into shallow waters and specific regions for the purpose of targeting the "deep red" lobster. Although the overall Tasmanian rock lobster "resource" may be considered sustainable against a series of performance indicators, the sustainability of local environments may be questioned if the removal of inshore rock lobster continues. Despite the argument raised by Bradshaw and Wood (2003) about the sustainability of the Tasmanian rock lobster resource, in March 2002 the industry gained export exemptions under the *Environment Protection and Biodiversity Conservation Act 1999* in recognition of the industry being managed in a sustainable manner (DPIWE 2003b).

The processing sector of the Tasmanian rock lobster industry has 45 licensed processors (DPIWE 2003b) of which five processors process lobster. The processors include Tasmanian owner operators, and Australian and Chinese owned operators who employ managers to operate factory facilities in Tasmania. "The Tasmanian licensed processors purchased 90 per cent of the catch taken during 1999-2000. The remaining 10 percent was sold directly by fishers to the public, to retail outlets, or to interstate buyers, or were landed outside Tasmania" (DPIWE 2003b: 2). The processors provide a service for fishers in terms of holding, packing, marketing and shipping of rock lobsters. The processors are intermediaries between fishers and end buyers, and therefore need to make a viable margin on top of the beach price to make a profit and cover operating and capital overheads such as premises, labour and transport costs. Processors are also

subject to government regulations regarding quota management and compliance. They are required to complete quota docket books and telephone reports for DPIWE upon receipt and dispatch of rock lobster. Information such as beach price is also provided to DPIWE on a monthly basis. Processors who export are required to obtain Australian Quarantine Inspection Service (AQIS) certification and documentation. Processors who ship product domestically are only required to comply with local and State government quarantine and food safety regulations. To reduce the complexities involved in exporting, many processors opt to ship product to AQIS certified exporters in Melbourne or Sydney.

The transport sector is another key element of the Tasmanian rock lobster industry supply chain, and includes domestic and international airfreight services. As the majority of Tasmanian rock lobster is shipped live to its destination, time is of the essence and airfreight the only viable option. Domestically the main airfreight services include Australian Air Express Pty Ltd, Qantas Link Pty Ltd, Virgin Blue Pty Ltd, and a number of small charter airlines. The issues associated with Tasmanian domestic airfreight have been topical over the years, with fluctuations in airfreight capacity resulting from the collapse of an Australian airline, Ansett, as well as flow on effect from September 11th, the wars in Afghanistan and Iraq, and SARS.

The "air-freighter" generally ships hard cargo and flies at night, which is regarded as the wrong time for processors trying to ship perishable products out of the State and connect with other flights. Thus, exporters of perishable products rely on the movement of passenger aircraft from Launceston and Hobart airport, and connections to international flights. Minimal delays at airports are critical. Chartered aircraft are another airfreight option, but are more expensive than passenger aircraft. The major disadvantage for exporters/processors who use passenger aircraft is that airline companies prioritise the movement of people. Therefore freight is often subject to "offloads", meaning that when passenger numbers are high and more baggage space is required, freight needs to be unloaded to make way for baggage. This necessity costs the processor in labour costs and time required to recover "offloaded" products from airports, return products to factories, return rock lobsters to holding tanks, and schedule new flights.

Destinations largely determine the carrier used by exporters. As the majority of Tasmanian rock lobster product is exported to Hong Kong and China, carriers such as Cathay Pacific Pty Ltd are commonly used. For exporting, freight forwarders are required to arrange domestic and international flights, handling between flights, and export documentation. Freight forwarders are intermediaries between exporters and airlines. Like processors, to remain viable the freight forwarders need to make a profit margin for their services.

In summary, the Tasmanian rock lobster industry has a unique product that is highly sought after by major markets (ABARE 2003; Bradshaw et al 2000), and the harvesting, processing, management, analysis and governance of the resource involves a great number of actors. Fishers are 'price takers' in the supply chain, particularly as beach prices are largely set by processors who, in turn, react to demand from mainland and overseas buyers and consumers. In Tasmania, the rock lobster industry is an important source of income and a minor, but significant, source of employment. Much of the employment and expenditure associated with the industry benefits smaller coastal communities around the State. However since 2001, global dynamics and the dependency of the industry on these major markets have seen a fall in demand and return for processors and fishers. These issues highlight an important lesson for the industry about how global dynamics can have a significant impact on an industry relying on a major market place. Changes in consumer tastes and behaviours, food scares, quality issues, logistics, technology, wars, market fluctuations and competition are examples of what the industry needs to understand in organising its management. The industry has become increasingly vulnerable to exogenous forces due to poor SCM and a lack of strategic planning. There is a need to strategically plan and to establish IS/IT to assist in capturing and managing information, and supporting decisions related to marketing, business processes and information flows.

A larger problematic

Risk and uncertainty in the industry

Risk is the possibility of experiencing loss, hazard, danger, misfortune or potential harm. Uncertainty is a state of being in doubt or a condition where the outcome of acts or events may only be estimated. Fisheries are inherently risky and outcomes in them always uncertain. Central to this research is a concern to explore the significance of risk and uncertainty as characteristic of fishing, the lifestyles and work practices of fishing communities, and the supply chain and market practices involved in the sale and consumption of fish products. This exploration is important where one wants to provide a level of security to the resource and to fishing communities as they seek to create sustainable fisheries and empower themselves via new forms of decision-making in a context of increasing global complexities (Chuenpagdee et al. 2005; Mahon et al. 2005). It is also central to the task of providing some measure of surety to larger social and jurisdictional groups (states, nations) who depend on the industry.

The literature on risk and uncertainty is extensive (Beck 1992; Beck 1995; Bromley 1989; Dovers & Handmer 1992; Macnaughten & Urry 1998; O'Malley 2000). So too is the scholarship on the effects of risk and uncertainty on food, food security and fisheries (Adam 1999; Caddy 1999; Charles 1994; Grynberg 2003; Molsa et al. 1999; Ruitenbeek 1996). While much of that literature refers to global problems – climate change, overfishing in legal fisheries, illegal, unreported and unregulated fishing, policy failures, or market perturbations – much also focuses on the local implications of these global issues. Very little refers to Tasmania (but see Bradshaw et al. 2000; Bradshaw & Wood 2003; Frusher et al. 2003).

Opportunities to achieve sustainability by managing change, uncertainty, ignorance and establishing resilience are described by Dovers and Handmer (1992). They explore the possibility of applying systems theory to problems of sustainability and change, and note that it is possible to take into account the complexities of human systems and their interaction with the environment by using an interpretive soft systems approach instead of a positivist 'hard' science approach. Dovers and Handmer (1992) also promote both the need for convergence thinking across disciplines and for a holistic systems approach to manage change and ensure sustainability.

> Recognition that additional knowledge will not by itself provide all, or even the main, answers, means that in effect we have to learn how to manage in ignorance. Rather than pull our energy and faith into attempting to reduce uncertainty, or ignoring it, we have to develop strategies to reduce the impacts of uncertainty and change (Dovers & Handmer 1992: 270).

Caddy (1999), Fowler (1999) and Lane (1998) also push for both multi-disciplinary and interdisciplinary approaches to manage risk and uncertainty in relation to sustainable fisheries management. They also recognise the need for integration of human systems and ecosystem research and management so strategies can be develop to promote sustainable harvesting.

Tasmania is largely defined by its geographical boundaries and, in particular, its peripherality and economic and political dependence (Australia 1998; Parliament of Tasmania 2004; Stratford 2005; University of Tasmania Centre for Regional Economic Analysis 1987, 1995). The Tasmanian rock lobster industry has played a significant part in the social and economic development of Australia's only island state (DPIWE 2003a; DPIWE 2003b; Frusher 2001; Williamson, Wood & Bradshaw 1998). However, and particularly of recent times, emerging pressures of globalisation, rationalisation of businesses, technology development, and changes in management regimes have affected how R-3 industries and communities manage change (e.g. Barling & Castleman 2000; Breathnach 2000; Coulthard 2001; Grimes 2000; Grimes 2003; Hoggart & Paniagua 2001; Malecki 2003; Wilde et al. 2000). The lifestyles and work lives of Tasmanian fishers and processors have been geographically remote and detached from the rest of the world, such status once – but no longer – providing some immunity from global trends in risk and uncertainty in the industry. Technological developments and innovations in refrigeration, transportation and telecommunications have provided opportunities for Tasmanian rock lobster industry members to participate and trade in the global market place such as the American frozen tail market and the live export trade into Asian markets (Frusher 2001). In turn, these developments have provided other opportunities to seek markets that pay premium prices for the Southern rock lobster. Despite the benefits to fishers and processors of participating in the global market place, there is increased exposure to new challenges (for example, changes in consumer demand) and exogenous forces (market prices, for instance) (Fisher 1997). For the industry to remain viable these risks and the uncertainties that they engender

need to be identified and managed (Christopher & Lee 2004; Lane & Stephenson 1998; Witting 1999).

The mitigation of risk to fisheries, fishing communities and the supply chain needs to be achieved at various scales, from the local to the global. Locally, for example, innovations such as transportation and telecommunications have affected people in R-3 communities as they gain access to information, facilities and services (Barling & Castleman 2000; Coulthard 2001; Wilde et al. 2000). Transportation and telecommunications may allow people in small towns to have greater choice of goods, employment and places to live. Townspeople may be prepared to travel further for greater variety of goods at competitive prices; for example, a major supermarket in the capital city may be compared favourably to the local town supermarket. Such shifts in consumer preferences increase pressure on local businesses, and affects local employment and social cohesion. The survival of rural industries, such as fishing or farming, is vital to ensure these local townships and businesses remain sustainable.

Globally, matters are somewhat different. China imports approximately 95 per cent of the Tasmanian rock lobster exports (DPIWE 2003b; Griffiths & Pauley 2002). Duty-free points of entry in Hong Kong are used to import rock lobster and are controlled by six wholesale buyers in China who re-tank and re-distribute the rock lobster to restaurants throughout China (DPIWE 2003b; Griffiths & Pauley 2002). At these duty-free points, the transparency of the physical flow of the product and associated business processes becomes uncertain for upstream members of the supply chain (especially fishers and processors) because the flow of reliable information is constrained by language, business culture practices and poor connectivity across different systems of information technology (Lamming et al. 2001; Pontecorvo 2003). Upstream players suspect that this uncertainty is contributing to wholesalers' competitive advantages in terms of price manipulation, making fishers and processors 'price takers' for a product that is of high value, in high demand, and limited in supply. Hurn and McDonald (1997) highlight the point that consumer income and exchange rates accounted for much of the price risk faced by Tasmanian rock lobster fishing firms when the Japanese market was dominant.

The vulnerability of fishers and processors to exogenous and disadvantageous forces is also heightened by a lack of effort on their parts to diversify markets when prices have

been good, thus ensuring ongoing reliance on traditional markets where their power is diminished. In short, when prices are good in the dominant marketplace and money is available, industry members are not motivated to seek and invest in alternative markets that may initially require selling the rock lobsters at a lower price. But when demand and prices drop in the dominant marketplace, when there is a need to rely on alternative markets, when no alternative markets have been developed, and when there are limited funds to invest to establish new markets, industry members suffer to the extent that they can lose their livelihoods.

The effect of this cycle is such that the uncertainties that characterise the dominant market place, such as SARS and the variable exchange rate, have made fishers and processors concerned for the viability and sustainability of the industry. Light (2003) reiterates the effects of unpredictable global events, the dependency of exporters on key markets, and the need to reduce risks through market diversification in the New Zealand seafood industry. Two prominent New Zealand exporters, the Nelson-based Sealords Pty Ltd and Moana Pacific Fisheries Pty Ltd exemplify how seafood enterprises have minimised the effects of world events through market diversification (particularly locally), maintaining buyer-seller relationships, and exploring new opportunities (Light 2003).

To reduce exposure to manifold risks, seeking alternative affluent markets is an option for members of the Tasmanian rock lobster industry; however this search means meeting various new market requirements, understanding new business cultures, consumer preferences driven by concern over the quality of global food chains (Henk & Hans 1997), and their management and traceability (Viaene & Verbeke 1998). To achieve these specifications, the industry should consider how IS/IT can play a role in assisting with data collection and dissemination of information, transparency (Lamming et al. 2001), tracking of product, and knowledge management (Malone & Yohe 2002). In addition, the industry should also see the value of IS/IT as a collection of tools to aid precaution in fishing practise (Ingeborg-Myhr & Traavik 2002) so that industry members can manage uncertainty and risk along the supply chain by integrating disparate information systems, and collecting tacit knowledge about the resource and undocumented information related to product handling, processing, transportation and marketing. In this quest for greater independence and empowerment, technology has played – and will continue to play – a significant ongoing role in the Tasmanian rock

lobster industry (Frusher 2001), particularly in relation to improving efficiencies in harvesting and post-harvest management and compliance. However little effort has been made to utilise technology to develop IS/IT for the industry supply chain. A computer-based supply chain information system would assist the flow of information along the supply chain by integrating disparate information systems and capturing tacit knowledge (Dampney et al. 2002) and could extend to quality management, customer service, improved market access, and knowledge about market trends and consumer behaviour. This approach may help with increasing margins, reducing costs (effort and time), and minimising risks by ensuring greater market share and sustainable returns to reinvest into the industry.

Solutions

Supply Chains – risks, tools and approaches

Supply chains can have numerous applications in manufacturing and distributing parts, in interlinking business processes in a virtual world (Kalakota & Whinston 1997), or in the global food industry via the 'paddock to plate' philosophy (Mowat & Collins 2000; Todd 2000). Kalakota & Whinston (1997), Peterson et al. (2000), and Turban et al. (2000), support the definition that supply chains encompass all activities (a series of interlinking steps) associated with the flow and transformation of the raw materials stage all the way to the end user, and collectively define the nature, character and value of the product at the time of receipt by the end consumer.

> The chain therefore includes all of the scientific, production, commercial, technical, structural, policy and related activities involved in the matching of the product to a consumer need, its production, storage, packaging, marketing, sale and transport, including in-chain and in-store quality management (Peterson et al. 2000: 5).

The objective of a supply chain is to obtain benefits by streamlining the movement of goods from the production line into the customer's hands by providing early notice of demand fluctuations and coordination of business processes across a number of cooperating organisations. It is also about meeting customer requirements. Many industries have developed initiatives to implement supply chains such as just-in-time, quick response, efficient consumer response, vendor managed inventory, and continuous replenishment, which all have the same goal: to manage the supply chain

effectively (Kalakota & Whinston 1997). Yet, not all initiatives adopted by industries are applicable and some are subject to industry supply chain characteristics such as product type, manufacturing processes, and markets. For example, the Tasmanian rock lobster industry is based on a wild fishery where supply and consistency of the rock lobster product is largely uncertain, and contrasts with the aquaculture industry that is based on a controlled fish product. However, this context does not remove the need for the Tasmanian rock lobster industry to be customer focused and explore initiatives to improve the coordination of business processes along the supply chain.

The supply chain can be broken up into three parts; upstream activities involving material and service inputs from suppliers, internal activities, involving the manufacturing and packaging of goods, and downstream activities involving the distribution and sale of products to distributors and customers (Turban et al. 2000). In contrast with traditional supply chain initiatives, there is a need for individual businesses or organisations to look beyond their four walls (Sengupta 2004). At the end of the day, supply chain management begins and ends with the wants and needs of customers and consumers. It is important to take into account the numerous supply chains that can cross-national borders, and other associated organisations that may be suppliers or buyers. Giannakis and Croom (2004) highlight three dimensions relating to supply chains: the synthesis of the business and resource network; the characteristics of synergy between different actors in the network; and the synchronisation of all operational decisions related to the control of the production and delivery of goods and services. With regard to the Tasmanian rock lobster industry, peak bodies such as the TRLFA need to develop a better understanding of their supply chain, particularly in terms of the market requirements, consumers and customers, and the business processes and networks among the supply chain members within and beyond Tasmanian and Australian shores. By achieving a better understanding of the supply chain, strategies can be adopted to improve the management decisions of the rock lobster product, the supply chain, fishery and industry.

According to Kalakota and Whinston (1997: 287), supply chain management (SCM) is a 'philosophical' approach and a methodology that takes a holistic view of the supply chain, and is "more than just a bag of tools or a method for linking disparate information systems". SCM is considered equal parts art (presentation, sales techniques, and service) and science (forecasting, data analysis, sourcing, margins, and

distribution). SCM "is a generic term that encompasses the coordination of order generation, order taking, and order fulfilment/distribution of products, services, or information" (Kalakota & Whinston 1997: 287). SCM is also known as 'value chain' or 'demand chain' management, which has the following principles: build value; focus on the customer; and be demand led. According to Peterson et al. (2000), SCM has an objective approach such as through-chain and value-chain analysis, and benchmarking to "identify those areas capable of improvement as well as those in which the industry is disadvantaged relative to competitors, to remove non value-adding steps and to insert or improve value-adding opportunities along the way" (Peterson et al. 2000: 6). They suggest that through-chain analysis and benchmarking are "potent tools for optimising quality and economic performance in any industry, and in particular, food and fibre industries" (Peterson et al. 2000: 6). Mowat and Collins (2000) reiterate that supply chain management can improve the link between product quality and consumer behaviour.

SCM has evolved from its core processes around logistics/operations processes through the incorporation of theoretical concepts and research in strategic management, industrial organisation, institutional and production economics (transaction costs), inter-organisational relationships, knowledge management and systems theory. On this point, Giannakis & Croom (2004: 29) suggest that the general scope of SCM cuts across the physical, functional and legal boundaries of companies. "The domain of SCM is not concerned solely on a single unit of analysis, but takes a broader view across interacting and interdependent functions, groups and organisations".

These descriptions of supply chains and SCM are observable in the Tasmanian rock lobster industry. Within a supply chain context, the industry is able to be better understood because of its business processes and flows, information processes and flows and relationships and networks, which extend across numerous organisations, business units, groups and individual participants such as sellers, buyers, resellers, and distributors. Throughout the remainder of this work, then, I explore the supply chain concept in relation to the seafood and Tasmanian rock lobster industry, with particular focus on relevant trends, strategies and issues associated with sustainable outcomes, SCM and IS/IT.

A significant and problematic aspect of the Tasmanian rock lobster industry chain and supply chains in general is trust and transparency. Trust is economically very important for a supply chain, and is particularly an issue that the industry needs to address to ensure a sustainable and viable future. "Trust is an intangible attribute that is widely recognised as a prerequisite to supply chain success" (Fawcett et al. 2004: 20). In the business world, trust enables members of the supply chain to rely on each other, and recognises vulnerability, while promoting collaboration, flexibility, risk taking, shared information, and shared resources. In this regard, Kwon and Suh (2004) highlight the need for information sharing to reduce levels of behavioural uncertainty and improve levels of trust. The lack of trust (also referred to as mistrust) is a significant obstacle for the supply chain that simultaneously stems from and contributes to uncertainty.

For the industry to cultivate a culture of trust among fishers, processors, wholesalers, and consumers is it necessary to improve general understanding and awareness of each supply chain members' roles and the business culture, establish supply chain transparency (Lamming et al. 2001) through open and reliable communication and information sharing (Kwon & Suh 2004), and develop personal relationships. Fawcett et al. (2004) highlight five key behaviours that will cultivate a culture of trust and promote collaborative improvement: day-to-day promises met; open rather than selective information sharing; behaviour that communicates that the other party is a valued team member; personal relationships that bridge organisation boundaries; and relationships that are mutually viewed as fair and beneficial. The supply chain can promote trust when players improve their understanding of consumer behaviour and use that information to establish product quality standards that reflects consumer preferences (Cummins 2004; Mowat & Collins 2000; MSC 2004). O'Keefe (2001) reiterates the value of culture, reputation and relationship assets as a foundation for long-term supply chain success, and particularly relating to Business to Business (B2B) electronic commerce in the perishable food industries, such as the Tasmanian rock lobster industry.

Seafood Supply Chains

Quality chain management (QCM) systems monitor the quality of the product and associated processes. QCM principles can be applied within an industry supply chain to products, processes, packaging, distribution, sales and consumption; or within organisations or businesses, such as when fishers hold rock lobsters on a fishing vessel

and need to maintain quality assurance systems. Issues affecting QCM include customer perceptions and the drive to improve efficiency and effectiveness of the chain using business re-engineering concepts (Bremner 2002). These opportunities are also apparent in the computer-based Food Track system, which was set up in 1997 for the UK agricultural food industry (Wilson & Clarke 1998). QCM is associated with traceability, food safety standards, customer service, and environmental standards.

Traceability is a central element of QCM, especially because of the 'chain reversal trend' where consumers/customers are driving the supply chain as a reaction to concerns about sustainability, environmental regulations, pollution, food safety and eco-labelling (NFIS 2004). Traceability in food production is an active business management tool, which enhances the industry or business systems, particularly in supply management and QCM (Frederiksen et al. 2002). Defined by ISO (2000)[7], traceability is the "ability to trace the history, application or location of what is under consideration, and notes that when considering products this can relate to the origin of materials and parts and the processing history" (Denton 2002: 10). It comprises three levels: "primary traceability of raw materials and ingredients; secondary traceability within processing and packaging; and tertiary traceability within the distribution and sales system for the end product" (Frederiksen et al. 2002: 15).

The drive for traceability coincides with consumer demand for assurance of quality and increase measures for food safety. Consumer awareness of food quality assurance and safety has been raised by high profile scares and crisis such as the bovine spongiform encephalitis (BSE) (Frederiksen et al. 2002; Leat et al. 1998). These scares within the food industry have led consumers/customers to question traceability systems, particularly in terms of the systems' speed and effectiveness in triggering alerts to high risk areas along the supply chain. As many of these problems have occurred in Europe, much of the research has focused on European food chains, such as the UK and Scottish agri-food industry (Leat et al. 1998; Wilson & Clarke 1998). The impact of food security crises has had direct effects on all supply chain members such as processors, wholesalers and retailers. Brand protection requires "all the business reasons associated with traceability including efficiencies, damage control, recall procedures, identity

[7] (ISO 2000. Quality management system systems – Fundamentals and vocabulary. European Standard [EN ISO 9000:2000, Point 3 5.4.], European Committee for Standardisation Brussels, Belguim.)

protection and so on" (Frederiksen et al. 2002: 15). The consequence for food industry managers failing to adopt traceability systems in their industry supply chain is closure of their business due to the "precautionary principle", also noted by Ingeborg-Myhr and Traavik (2002), and the occurrence of inoperable costs. Legislators are now enforcing traceability in order to protect the public (Denton 2002).

> Management of relationships, instead of transactions, is said to be the future focus of supply chain management (Christopher 1998), and traceability systems are essential to maintain positive communications based on mutual confidence and information exchange (Frederiksen et al. 2002: 15).

Strategies for traceability in seafood supply chains are still in their infancy due to the complexity of the industry. Its diversity is in contrast to other protein based industries such as the beef industry, as various species are traded globally such as finfish, shellfish, and crustaceans. Fishing industries also trade species in a variety of forms such as live, chilled, frozen, and valued-added such as smoked. In addition, the source of many of the seafood species are from specialised fisheries throughout the world where they have specific fish handling and food safety requirements. Many of the fishing industries are fragmented and are operated by individuals that have limited cohesiveness with other businesses involved in the industry. The length of the distribution chain ranges from short and direct chains supplying fresh fish to local communities, to long and complex chains sourcing raw materials and supplying processed products worldwide. These chains also vary according to the number of participants in the supply chain, and seafood can change ownership and be handled many times along the supply chain (Denton 2002).

For both legal and commercial reasons, many of the distribution chains appear to generate a large amount of information, such as catch numbers and weights, region fished, and product condition, which is used along the chains for compliance, resource monitoring and trading, however much of this information is lost in respect to chain traceability. For example, the Tasmanian abalone and rock lobster fishing sectors, whose members are required to complete logbooks for resource management and quota compliance, involve fishers, fish handlers and processors.

On information systems and information technologies

Information systems (IS) is a "set of interrelated components working together to collect, retrieve, process, store, and disseminate information for the purpose of facilitating planning, control, coordination, analysis and decision making in businesses and other organisations [which] ... transforms information into a form usable for coordinating the flow of work in a firm, helping employees or managers make decisions, analysing and visualising complex subjects, and solving other kinds of problems" (Laudon & Laudon 1995, 5). This definition and description applies to numerous businesses linked as an industry organisation where each industry participant along the supply chain is equivalent to a business unit in an organisation. Relatedly, information technologies (IT) are tools to advance those broad aims and concern me only in that regard, and only in relation to electronic (computer-based) technologies.

The emergence of IS/IT has had significant impact on the global economy and business in general, particularly with access to the Internet, email, satellite phone, and information management systems (DFAT 1999a; DFAT 1999b). IS/IT is regarded as an enabler of business activity, providing increased information flow and facilitation of services regardless of geography or national boundaries (DFAT 1999a; DFAT 1999b). Mainframe and personal desktop computers have revolutionised the work place and the nature of work undertaken. Workers are able to communicate, search, enter, retrieve, analyse and create via their workstations. A computer can be viewed as a portal to organisations and the world, particularly with the advance of network technology (DFAT 1999a; DFAT 1999b). With the assistance of technology more efficient information management systems can be achieved with the development and deployment of databases to enter, store and retrieve information in digestible form by day-to-day workers. With the vast array of software applications available to be used on computers, the possibilities are endless.

Technology in the seafood industry has been a major contributor to increasing the efficiency of effort (FRDC 2000). Technology contributes to areas such as processing, transportation, trade and marketing and business management. Electronic technology plays a significant part in the business operations whilst on board the vessel, in the processing plant, and during transportation. Aquaculture scientists exploit technologies involved in fish breeding and rearing, feed, disease management, and harvesting and post-harvest processes. Wild fisheries utilise technology such as GPS, Echo sounders,

and gear design to improve the efficiency of locating and catching the fish. Increasing the efficiency of effort to catch fish also means reducing the operating costs and increasing margins. Seafood enterprises, government, associations and marketing groups have also utilised technology to improve business efficiency whether it is for harvesting or post-harvesting. Examples include information service websites, auction systems (Kaplan 2000), electronic trading platforms, electronic logbooks, freight logistics tracking systems, and cool chain systems, satellite communication, and Vessel Monitoring Systems (VMS). Fishers have become so efficient in their harvesting practices that government authorities have had to implement various management strategies to ensure resources are not over-fished. These strategies include input and output control methods. Input control methods aim to limit effort by also limiting fishing gear, vessel size, locations and times. Output controls, such as quota, limit the amount of resource fishers can harvest. Fishing seasons and size limits can also be applied to an output control management regime to protect sensitive environmental areas, and immature, berried and moulting rock lobsters. To ensure maximum efficiency of effort, vessel size and technology are generally unrestricted in an output control method regime. However there is an increasing trend that technology may need to be managed to optimise biological, social and economic outcomes.

Creating a Competitive Edge: Strategic Information Systems and E-Trading

Strategic Information Systems (SIS) are defined by Laudon and Laudon (1995: 67) as "[i]nformation systems used in solving a business organisation's long-range, or strategic, problems". There are IS applications concerning the firm's competitive advantage in terms of prosperity and survival.

> Such problems may entail creating new products and services, forging new relationships with customers and suppliers, or finding more efficient and effective ways of managing the firm's internal activities. The objective of such systems is to provide solutions that will enable firms to defeat and frustrate their competition (Laudon & Laudon 1995: 67).

For businesses or industries to remain viable, they must be focused on their competitive advantages and personnel must manage "competitive forces such as substitute products and services, the bargaining power of customers and suppliers, and the threat of new competitors entering the market" (Laudon & Laudon 1995: 67). Table 1-10 describes

the four basic competitive strategies that businesses can use to counter competitive forces.

Table 1-10: Basic strategies to counter competitive forces

1.	Low-cost leadership: produce goods and services at price lower than that charged by competitors
2.	Focus on market niche: create new market niches by pinpointing a target market for a product or service that the firm can provide better than its competitors
3.	Product differentiation: develop unique new products or services
4.	Linkage: develop tight linkages to customers and suppliers that "lock" customers into the firm's products and suppliers into the price structure and delivery time determined by the purchasing firms

Source: Adapted from Laudon & Laudon (1995: 67)

Strategically implementing IS/IT in industries and organisations is a matter influenced by the intrinsic characteristics of the supply chain and the relationships forged among members of the supply chain, not least among them the degree of shared trust, transparency, and cohesiveness. Knowing the industry or organisation is important, particularly understanding the context and vision; key information gathered; who gathers it; how it is processed; and what information is passed on to other supply chain members. Using systems analysis and design techniques and tools (Avison & Fitzgerald 1995), the context and vision of the industry or organisation can be mapped and modelled. Table 1-11 highlights the important forces that affect the pace and effectiveness of progress using IS/IT. These factors vary in importance over time and with various organisations, and highlight the need to undertake extensive research and assessment of the industry, and to understand proposed technological applications before implementing IS/IT concepts.

Table 1-11: Factors affecting IS/IT progress

1	capabilities of the technology
2	economics of using the technology
3	applications that are feasible
4	skills and abilities available to develop and use the applications
5	pressures in the particular organisation or its industry to improve performance
6	ability of the organisation to make appropriate judgements about the deployment of IS/IT and the associated resources

Source: Adapted from Ward & Griffiths (1996: 2)

Ward and Griffiths (1996) classify four types of strategic IS/IT use (Table 1-12). These are in descending order of commonness of occurrence in the analysis, and immediately enable organisations to consider areas of opportunity to improve business processes.

Table 1-12: Classification of four main types of strategic IS/IT use

1	Those which share information via technology based systems with customers/consumers and/or suppliers and change the nature of the relationship
2	Those which produce more effective integration of the use of information in the organisation's value adding process
3	Those which enable the organisation to develop, produce, market and deliver new or enhanced products or services based on information
4	Those which provide executive management with information to support the development and implementation of strategy (in particular, where relevant external and internal information were integrated in analysis)

Source: Adapted from Ward & Griffiths (1996: 21)

Ward and Griffiths (1996) also describe the success factors for SIS in (Table 1-13).

Table 1-13: Success factors associated with strategic information systems

1	External not internal focus: looking at customers, competitors, suppliers, even other industries, as well as business relationships and similarities with the outside business world
2	Adding value not cost reduction
3	Sharing benefits within the organisation, with suppliers, customers, consumers, and even competitors on occasion
4	Understanding customers and what they do with the product or service
5	Business-driven innovation, not driven by technologies
6	Incremental development, not the total application vision turned into reality
7	Using the information gained for the systems to develop the business

Source: Adapted from Ward & Griffiths (1996: 25-7)

Electronic Commerce (EC) has been variously defined (Kalakota & Whinston 1997). EC is not just about having a Web site or a marketing tool, and can involve many aspects of a business or industry. For example, it can assist in re-engineering industry supply chains to review and streamline business processes which can be achieved by improving communications, transport logistics, supply chain relationships, and transactional and procurement efficiencies. At the same time, EC provides opportunities to strengthen existing markets and explore new market opportunities.

EC has evolved from simple financial transactions within financial institutions to a worldwide network of transactions and communications that can be accessed easily through user-friendly interfaces (Kalakota & Whinston 1997; Turban et al. 2000). There are four main types: Business to Business (B2B), consisting of EC transactions between businesses; Business to Consumer (B2C), retail activities on the web; Consumer to Consumer (C2C), where consumers can trade goods and services with each other and with businesses, the latter being called Consumer to Business (C2B) (Globefish 2000). Turban et al. (2000) claim that EC has many links with other

disciplines, particularly marketing, management, economics, and sociology. EC has potentially important implications for areas such as fisheries science, seafood marketing, and fisheries management. The benefits identified for EC adoption in Tasmanian businesses and industries are similar to those identified in other R-3 areas in Australia; for example creating improved communication links with the marketplace regardless of location throughout the world (Coulthard et al. 2000; DFAT 1999a; DFAT 1999b). In general, new technologies may enhance a firm's ability to communicate and trade globally. The underlying competitive advantages for industries are the intangible assets such as culture, corporate reputation, trust, supply chain transparency and relationships with customers (Fawcett et al. 2004; Kwon & Suh 2004; Lamming et al. 2001; O'Keefe 2001) highlight that. These assets are foundational to long-term success of perishable food industries whose members are exploring B2B electronic commerce, such as the Tasmanian rock lobster industry. Ultimately IS/IT allow these assets to be value-added.

On IS/IT and the sustainable development of fisheries

The relationship between sustainability and IS/IT has emerged from different fields of knowledge. IS/IT economic specialists argue that competitiveness and sustainability are mutually reinforcing (Bohlin 2000; Breathnach 2000; Willard & Halder 2003). Furthermore,

> industrialisation and growth without attention to sustainability may not only be problematic for some ill-fated groups of society but may seriously limit any region's aspiration to prosperity, as the dynamic repercussion of unsustainability on its citizens may be significant and take unexpected turns (Bohlin 2000: 1).

Strategies and policies supporting sustainable information societies aim to ensure sustainability environmentally, socially, culturally, and economically through the appropriate facilitation of IS/IT. Technology, information and knowledge are key factors in ensuring industries and business remain competitive and survive the exogenous and endogenous forces that come with participating in a dynamic marketplace (Malone & Yohe 2002). Socially and culturally, information and knowledge, provided they are distributed equitably, can also assist communities to gain access via the Internet to educational, government, and financial services and

information such as Government and banking services (DFAT 1999a; DFAT 1999b). Finally, technologically transferred information and knowledge can assist processes to advance sustainability by increasing awareness of ecological challenges (Malone & Yohe 2002). IS/IT can assist in providing new service based employment opportunities that are less resource intensive (dematerialisation) (Alakeson et al. 2003; Bohlin 2000, Britton 1996; Willard & Halder 2003). It can also provide a medium to promote and facilitate quality assurance of supply chains (Ward & Griffiths 1996), such as monitoring and recording codes of practice in relation to production, manufacturing, processing, transport, and trading.

In the global food industry, sustainability labelling schemes (De Boer 2003), such as the Marine Stewardship Council (MSC 2004; see also Cummins 2004), are becoming prominent as part of the emotion economy (Todd 2000). The emotion economy demands greater accountability about food origins, codes of practices in relation to animal ethics, environmental impacts in relation to harvesting, farming, mining or manufacturing, and processing and handling. Quality assurance and traceability (Lamming et al. 2001) that use computer-based systems are increasingly being used to address the concerns and requirements of consumers and the general public. Tracefish (Denton 2002) and RFID technologies are IS/IT examples used to assist in traceability of perishable products such as fresh fish. The Tracefish project aims to utilise fisheries logbook information and information systems applications as a basis to trace product along the supply chain. RFID technologies can assist in monitoring of environmental conditions during transportation such as temperature, time, and altitude. These technologies are able to capture, store and transmit this information using radio transmitting/receiving devices.

Despite the positive contributions IS/IT can bring to industries and communities, it has also been well documented that IS/IT development may have negative effects socially, economically, and environmentally (Barling & Castleman 2000; Breathnach 2000; Coulthard 2001; Grimes 2000; Grimes 2003; Johnston 2000; Tochtermann 2000; Williams and Millington 2004). The term "rebound effects" (Bohlin 2000; Johnston, 2000; Schauer 2004; Willard & Halder 2003) refers to occasions when environmental, economical or social gains using IS/IT are outweighed by increased resource-intensive or polluting demands elsewhere. Issues associated with implementing IS/IT strategies, such as the inequities associated with the "Digital Divide" (Garrison 2000) and

information-rich and information-poor societies (Bohlin 2000; Breathnach 2000; Schauer 2004), are factors that contribute to negative impacts on social cohesion in communities globally whether in the United States (Garrison 2000; Malecki 2003), the European Union (Grimes 2000; Grimes 2003), Asia (Li 2000) or Australia (Coulthard, 2001). Hence the need for better understanding of the linkages between sustainability and the emerging information society. Williams and Millington (2004) reiterate the potentially detrimental affects of technologies on the environment and society particularly when anthropocentric approaches are used as a basis for advancing sustainability outcomes.

The role of sustainability and sustainable development in the seafood/fishing industry, and in particular the Tasmanian rock lobster industry, will be discussed in more detail later in this thesis. I explore how sustainability has been interpreted and used in fisheries research and industry management approaches; consumer and public movements for greater industry accountability relating to business impacts on the environment; and how sustainability is interpreted from economic and social perspectives in relation to fishing communities. I also analyse the Tasmanian rock lobster industry's place in R-3 communities and in relation to other fisheries and seafood industries, locally and globally. I argue that the management of the Tasmanian rock lobster industry needs to be integrative to ensure a sustainable future.

Despite some literature on the negative effects of IS/IT on R-3 communities (Barling & Castleman 2001; Coulthard 2000), IS/IT can also assist industry to manage and adjust to change. Malone and Yohe (2002) and Ward and Griffiths (1996) suggest that IS/IT strategies can play a role in the industry in terms of improving supply chain management, knowledge management, and assisting with strategic planning and ensuring competitiveness in a global economy.

Based on Dovers and Handmer's (1992) connections between sustainability, risk and uncertainty, and evidence of a more integrative approach to sustainability, the key message for me is that it is impossible to capture all information to avoid uncertainty, but it is possible from a whole systems approach to establish indicators of change with the aim of managing uncertainty through information and knowledge (Bohlin 2000; Breathnach 2000; Caddy 1999; Fowler 1999; Lane 1998; and Willard & Halder 2003).

The next section explores the supply chain concept and its relationship with sustainability, IS/IT and the Tasmanian rock lobster industry.

Systems Thinking, Theory, Analysis and Design

To develop any IS, the central component is systems analysis, which involves gathering the necessary data and developing plans for new systems (Hawryszkiewycz 1994). It is an important activity that takes place when new IS are being built or existing ones changed. A systems analyst is a person that performs these tasks and is often a change agent. The tasks involved with systems analysis are not easy as there is a need for many people to be satisfied and potentially many conflicts need to be resolved. A systems analyst needs to identify, understand and solve problems and issues associated with developing and implementing a system in an organisation or industry. Mindful of these needs, Hawryszkiewycz (1994) asks why are special activities, such as systems analysis, needed to build IS. For good IS, it is necessary to set up processes to ensure that all stakeholders have all the data needed for their work. Equipment must be selected and new programs developed in order to support those processes. IS are often made up of interrelated tasks. Changes to any one of these tasks or the addition of new tasks can affect the existing system. Therefore it is necessary to spend considerable time gaining a thorough understanding of a given IS and its problems (Avison & Fitzgerald 1995; Hawryszkiewycz 1994), it then becomes possible to propose useful changes to the IS to make it more useful and avoid unforeseen effects. Based on the usual sequence of steps to determine, design and build IS, systems analysis is used to understand existing systems and what is required of them.

Systems development methodologies are often used in building IS, as they define the steps to ensure that systems are effectively built (Avison & Fitzgerald 1995). A system science approach has often been regarded as positivist and coming from fields such as biology and computer science ('hard' systems approaches) (Avison & Fitzgerald 1995); however, systems theory can be applied to "problems in the social and management sciences in an often less quantified way, dubbed 'soft' systems approaches" (Dovers & Handmer 1992: 265). Checkland (1981) also describes the attributes of 'soft' systems approaches and acknowledge the involvement of people within systems. In short, the academic training and world view of the researcher or system analyst will determine the methodology selected.

Designing an IS for the Tasmanian rock lobster industry is a mammoth task because there are numerous organisations and participants along the industry supply chain. Each is like an island of information, and all have their own information systems, and databases that range from legacy systems[8] to recent technology, for example, relational databases such as Oracle or SQL 2000. Each system has its business rules, and these reflect the culture of each organisation. To try and link each of these systems along the supply chain requires extensive analysis and design well before implementation of any system. Consultation with organisations and users is paramount (Avison & Fitzgerald 1995; Sengupta 2004). In this research, I focus on systems analysis and design, taking into account user requirements, and do not deal with the application of the new IS in the Tasmanian rock lobster industry.

Recapitulation and Emphasis

Thus far, I have outlined the impetus for this research, described the research design and detailed the significance of the work.

It is useful to reiterate that the key aim of the dissertation has been to determine whether and to what extent IS/IT can engender higher than currently experienced levels of sustainability and certainty for members of the seafood industry using an integrative management approach to improve information and knowledge management, business processes and relationships along the supply chain. The key message is that an integrative approach, which promotes convergent thinking and co-management, is instrumental in advancing sustainability outcomes for the industry, the resource, and the rural communities who rely on it.

The relationship between sustainability and the fishing/seafood industry is about the management and preservation of the resource and the ecosystem that the industry depends on, while maintaining economic viability for an industry. As the commercial fishing/seafood industry is about harvesting the resource to achieve economic returns, fisheries policies and management plans need to ensure economic viability and social sustainability without compromising the future of the resource. The management of a resource in conditions of manifold risk and uncertainty becomes a complex task for

[8] Legacy system – an existing working computer system that is to be used in a new business process (Hawryszkiewycz 1994:4).

fisheries managers, scientists, and industry peak bodies, as users with competing agendas, such as commercial fishers and processors, recreational fishers, consumers, and the public, seek access to the resource. The sustainability theme then extends to the communities that rely on the existence of fishing/seafood industries. Worldwide, many of the members of fishing/seafood industries live and work in R-3 communities. Kaplan (2000) provides examples of fishing industries and their marketplaces in New England and the Spanish Mediterranean, and highlights the economic, cultural and social significance they have on fishing communities. Jentoft et al. (1998: 7) notes that "[M]arketing ventures are directly related to the important issues of co-management and the diversity of the fishing community" and (Kaplan 2000: 165) adds that "The fairness of marketing systems and the different groups within the fisheries that this affects are very much related to the political and social dimensions of fisheries management".

The Tasmanian rock lobster industry is an example of a primary industry comprising participants who mostly work and live in R-3 communities (Frusher 2001). The struggles experienced by members of the industry, such as the tyranny of distance from key market places, facilities and services, are part of everyday life in such communities. Members of the Tasmanian rock lobster industry, like those in many other fishing/seafood industries in Australia, struggle with the tensions between lifestyle and business, with an increasing emphasis on the latter. Participating in a global economy requires strategic business planning (DFAT 1999a; DFAT 1999b; Ward & Griffiths 1996), yet many fishers have been happy to offload their catch at the end of the trip, get paid a good beach price, and go home and forget about it all for a few weeks. However, concerns over price formation and lack of transparency in various processes have generated increasing interest in the supply chain and the markets, particularly among new entrants facing high debt loads and increasingly complex financial management needs. In overcoming issues relating to the tyranny of distance, access to information and services, and the market, technology has been a key enabler for R-3 communities and primary industry sectors (DFAT 1999a; DFAT 1999b). Air, rail and road transport move commodities to and from the market place with efficiency greater than in the past. Regardless of time zones or geographical and national boundaries, telecommunications such as telephone, facsimile, satellite, email and Internet are enablers of enhanced communication in the market place and with participants along the supply chain. Finally, the development of e-commerce has enhanced the capacity to deliver

information services and facilities such as online banking, B_{PAY} and access to information service websites, community groups, and auction houses.

The relationship between sustainability and IS/IT is about the advocates in two fields of thought working together to improve lifestyles, the economy, information and knowledge management about the environment, and the reduction of resource use. According to Grossman (2000), sustainability links with information societies, environmental planners and landscape ecologists, and there is a need for all stakeholders to be aware of developments in each field.

> The economic and social development of the information society seems to ignore the tasks necessary for sustainable development. This is worsened by the fact that often people in the area of sustainability are unaware of the ongoing evolution of the information society (Grossman 2000: 180).

In addition, many, 'new economy' businesses and industries are knowledge-based and use IS/IT, and are often quite powerful agents of change. Regional populations engaged with the new economy need to be innovative and have knowledgeable key people leading such innovation.

> Sustainability is impossible without the new economy. A large chunk of the necessary dramatic decrease in resource consumption – material resources, energy, land, nature – can be achieved with intelligent products, intelligent production, intelligent transport, and intelligent management (Grossman 2000: 181).

The failures of IS/IT projects have been well documented (Avison & Fitzgerald 1995), and predominantly the causes have been due to lack of user and stakeholder consultation. Authors such as Barling and Castleman (2000), Bohlin (2000), Coulthard (2001), and Grimes (2000 & 2003) provide a tonic to the positive contributions IS/IT can have to R-3 industries and communities. Some IT practitioners have had limited understanding of the industries they service. Such failures are also brought about by homogeneous government IS/IT policies and initiatives that are not universally applicable (Barling & Castleman 2000; Grimes 2000, 2003). Inequity of telecommunication services and the social and economic effects of IS/IT on rural

businesses from larger businesses outside a given region, and the "rebound" effect of IS/IT in relation to consumption of resources are just some of the issues R-3 industries and communities have to contend with.

In relation to trading of seafood and the role of IS/IT, Kaplan (2000) describes computer-based auction systems as contributors to fairness or equity in the auction process. Co-management auctions involving fishers and government appear to be regarded as fairer and more successful. "Conditions of equity and enforcement of marine regulations at the marketing end of fishing activities is still one of the weakest links in fisheries management and without compliance from the diverse fishing community, so many of whom participate in the marketing sector, it will remain so" (Kaplan 2000: 176). Therefore any IS/IT strategies developed for the Tasmanian rock lobster industry to improve quality assurance and business processes along the supply chain will only be successful if there is support and compliance from the majority of supply chain participants.

The application of IS/IT may not bring all the benefits that are claimed by governments or members of the IS/IT sector (Barling & Castleman 2000; Coulthard 2001; Grimes 2000, 2003). Some IS/IT applications may contribute to the demise of small rural towns (Barling & Castleman 2000; Coulthard 2001) through inter-settlement and inter-regional competition, consequent closure of facilities, and higher unemployment and associated social problems. Ultimately these possible effects may contribute to out-migration from R-3 areas. Grimes (2000, 2003) notes that such outcomes are counter-intuitive, since the adoption of IS/IT should provide access to transport, communications and services for R-3s. In turn these innovations could, in principle, ensure the survival of townships, particularly as industries are able to access the global market place and information services, such as online banking, which would be almost equal to those enjoyed by city counterparts. Often the negative effects of technological adoption in rural areas are associated with innovation, design and implementation stages (Barling & Castleman 2000; Coulthard 2001). In such cases, the technology may not be appropriately applied due to poor consultation and limited understanding of industries, businesses and organisations (Avison & Fitzgerald 1995). A consequence is that the cost of technology may outweigh the benefits of increased services. Cost may also be 'rebound effects' from environmental and social impacts of technological innovations

(Bohlin 2000; Breathnach 2000; Garrison 2000; Schauer 2004; and Williams and Millington 2004).

The TRLFA appreciates the possible benefits that IS/IT could bring to the industry in terms of improving SCM and market strategies. However the lessons from failed IS/IT projects need to be transferred and incorporated into Tasmanian rock lobster industry IS/IT projects. Hence the importance in this research for me to identify and consult with the key stakeholders along the supply chain when developing a new system to collect, manage and disseminate information and track product. The need to ensure that the application of IS/IT is suitable for the industry is significant; when applied appropriately, these tools can assist industries to be more competitive, adaptive, and sensitive to the demands of risk management.

In the context of fisheries research, management, policies and planning, the uptake of integrative strategies has been limited (Kaplan & McCay 2004; Pontecorvo 2003). Many fisheries scientists and managers assess resource and industry sustainability in isolation from supply chain participants' knowledge and fishing behaviours (Bradshaw et al. 2001, Rossiter & Stead 2003), and with limited consideration of downstream influences such as fluctuations in the market and global trends in, for example, transport logistics. This issue of insularity has led to failures in fisheries management where managers and scientists are unable to address the issue of supply uncertainty (Pontecorvo 2003). To overcome such uncertainty, there is a need for convergent thinking (Dovers & Handmer 1992) and for intellectual disciplines and key industry stakeholders to look beyond the borders of their subject or organisation.

By aiding our collective capacity to understand the business processes and information flows, IS/IT and SCM may improve and facilitate strategic planning and help stakeholders achieve greater market intelligence by collecting, managing and analysing information. IS/IT also provides indicators of change to the industry so its members may adjust their activities and adapt to change. The strategic planning process and having market intelligence are about establishing resilience and sustainability for the industry and the R-3 communities that rely on it. The process allows members of the industry to target markets better, have greater capacity to adjust to changes in consumer trends, and ultimately provide viable career structures.

To advance from a theoretical understanding of the challenges facing the Tasmanian rock lobster industry to a position that gives the practical capacity to aid its sustained development, a strategic framework needs to be established to encompass factors involved in strategic management in three layers: external environment; pressure groups and stakeholders; and internal business planning. Based on the rate of change and the effects on the global business marketplace, external factors such as the economy, society, politics, law, ecology and technology are significant influences on business and industry functions. Therefore "careful monitoring of these factors may provide opportunities and identify potential threats" (Ward & Griffiths 1996: 53).

Pressure groups are characterised by making demands of the enterprise and demands for acknowledgement (Ward & Griffiths 1996). Specific examples include consumers demanding food safety standards and quality assurance of seafood products, and the general public expecting greater accountability from the fishing industry in relation to environmental impacts of fishing practices. For the industry to respond to these pressure groups, its members' activities need to be constantly monitored (Ward & Griffiths 1996). Finally stakeholders who have direct financial interests in the enterprise also demand a fair share of the financial return created. All stakeholders expect some form of material and financial benefit from business or industry. In summary:

> The enterprise must consider the signals coming in from the external environment and the threats and opportunities posed by the pressure groups and then consider what strategies it, as an enterprise, is going to undertake. It then has to establish the means of incorporating these into its business planning along with the need to achieve its chosen mission by effective development and use of resources (Ward & Griffiths, 1996: 57).

Finally the relationships between and among supply chains and SCM, IS/IT and sustainability of the industry relate to the need to understand the industry across inter-organisational, geographical, and legal boundaries, and to identify and address weaknesses through the use of IS/IT to ensure long-term viability and sustainability. To understand the industry is to identify its richly contextual relationships, networks, information processes and flows and operational business processes and flows. According to Fawcett et al. (2004) and Lamming et al. (2001) trust and transparency are

key factors in improving the long-term economic success of a supply chain by enhancing understanding, communication, the development of relationships, and the sharing of information (Kwon & Suh 2004). Information sharing particularly "reduces the level of behavioural uncertainty, which, in turn, improves the level of trust" (Kwon & Suh 2004: 4).

CHAPTER TWO: METHODOLOGY

In this chapter I present the methodological framework and research strategy used to explore the role of IS/IT in the seafood industry, with particular reference to the Tasmanian rock lobster industry. In that industry, policy and planning in government and industry have generally focused on resource management of the fishery and on post-harvest monitoring of the product movement from fishers to processors for compliance purposes. Until recently, limited efforts have been made to understand the social and business aspects of the supply chain and to recognise that many other participants and stakeholders comprise the industry. Only in times of crisis is the spotlight on their significant influence: for example in relation to consumer changing preferences; transport providers reducing freight space; and general instability typifies the global market place. An integrative approach needs to characterise policies and strategies for managing the industry, and SCM, risk and quality management, traceability and systems analysis would advance such an approach, and enhance a full understanding of the values, activities, and cultural milieux of all industry participants. For these reasons, in this chapter I also elaborate on the importance of key stakeholders in the industry supply chain.

The research setting and the subjects studied stem from a two-year researcher-industry partnership involving research projects and consultancy work with the TRLFA between 1999 and 2000. In January 2000 the TRLFA commenced a project to establish an information service website and electronic trading (e-trading) platform by the end of 2000, which would be in time for the start of the doctoral project in March 2001. The idea for our collaborative work was jointly initiated as both parties shared a common view of the industry and its future. We also shared the view that IS/IT could assist the industry in realising strategic opportunities and enhancing their competitive advantage in the marketplace. Sustainability outcomes could be achieved for the industry by enhancing the members' ability to adjust to change in consumer preferences, exchange rates, or changes in transportation arrangements, for example. This background gave me a foundation to establish rapport with stakeholders and gain access to the research setting. However it was not without its pitfalls. It was clear that my project was supported by the TRLFA, and other supply chain members, such as processors, may have seen this as a bias. But indeed, the initial project application extended invitations to the processing sector's peak body, the TRLPA, but they declined the offer to

participate. Despite the lack of support from that Association, the members of individual processing companies were willing to participate in the research.

Research Methods

The various strategies outlined below are part of the traditions of interpretive and qualitative research more generally. Multi-method and inter-disciplinary in focus (Denzin & Lincoln 2000), such research uses a set of interpretive practices to gain an understanding of the subject. To understand the Tasmanian rock lobster industry supply chain, gather the rich information, and gain feedback of the propose IS/IT concepts, an interpretive approach is warranted.

An interpretive approach "seeks explanation within the realm of individual consciousness and subjectivity, within the frame of reference of the participant as opposed to the observer of action" (Burrell & Morgan 1979: 28). Orlikowski and Baroudi (1991: 5) describe interpretive studies as attempts to "understand phenomena through assessing the meanings that participants assign to them". Participants and the social processes that occur around them determine particular realities which are reinforced by their beliefs and understanding of the reality, and motivations and agendas of actors (Orlikowski & Baroudi 1991).

An interpretive approach does not preclude the need to collect information about the supply chain that is 'factual'. However, industry participant perspectives and observations in relation to these are at the forefront of the research, because human activity systems are complex and "may react differently when examined singly as when they play a role in the whole system. Something is lost when the whole is broken up in the 'reductionist' approach of scientific analysis" (Avison & Fitzgerald 1995: 365).

Ethnography

To understand the Tasmanian rock lobster industry supply chain is to understand the participants (actors or entities), the relationships, networks and information flows among them, and the external and internal environments that comprise the network. Therefore, I also rely on ethnography, which often requires participant observation and field research; is sometimes based on a social constructionist perspective; and allows

researchers to participate in research settings (Neuman 2000), in order to describe and understand the various effects of socio-spatial relations.

The closeness of fit between ethnographic research and IS is demonstrated by "providing researchers with rich insights into the human, social, and organisational aspects of information systems" (Myers 1999: 2). For this study, ethnography is applied via participant observations of industry meetings, conversations in the participants' settings, formal interviews, and participation in pertinent industry conferences and workshops. By using this composite approach, I have been able to source information against the research questions and objectives. I have also been able to gain information about the industry in relation to its current and possible future status; the industry supply chain and its business processes, information flows, and industry participants; and various IS concepts.

Much of the information and knowledge gathered from members of the Tasmanian rock lobster industry about their business operations is acquired through experience and knowledge passed down the generations, and that oral tradition is particularly apparent with fishers. Processors also share some of these characteristics. This orality means that much of the information about the industry and changes to it is stored in the heads of industry members rather than in logbooks or computer systems. This kind of information and/or knowledge is referred to as tacit knowledge (Dampney et al. 2002: 3), "held by individuals but not able to be readily expressed. It is expertise, skill, and 'know how', as opposed to codified knowledge". This knowledge can be acquired through intimate relationships, for example, between a skipper and his/her deckhand, and is in contrast with articulate or explicit knowledge (Neuman 2002), which is "typically acquired through formal education, writings, books, rule sets, legal code" (Dampney et al. 2002: 3).

Against the observed external forces potentially affecting the Tasmanian rock lobster industry's survival, I aim to understand both tacit (fishing behaviour) and articulate knowledge (fishing logbooks) in order to assist members to model quality chain management, and industry and market development. By recording such knowledge and information in a computer-based information system, improved knowledge management and decision support is possible for the industry. Hence, an improved understanding of the industry supply chain may emerge, and that may have benefits for sustainability

outcomes such as a diversified market strategy. To achieve these ends, one of the practices of ethnography, namely participant observation, is warranted.

In participant observation, researchers are characterised by the:

> depth of their involvement in a community, their recurrent contact with people, and their relatively unstructured social interactions that stood out in their work ... Participant observation is concerned with developing understanding through being part of the spontaneity of everyday interactions (Kearns 2000: 108).

Kearns (2000) recommends that researchers choose settings based on their degree of familiarity with a given study setting. He also describes four possible research roles: complete observer; observer-as-participant; participant-as-observer; and complete participation. For this study, I have been an observer-as-participant. By participating in social interactions with industry participants, I have been able to foster a sound understanding of the culture, relationships and nuances that are associated with them. Participant observation techniques also temper the potential influence that I may have in formal structured interviews. These techniques are appropriate in certain circumstances such as industry meetings, and informal meetings at a pub or over lunch. However familiarity can bring pitfalls. "There is a danger that the researcher is over-familiar with the community, with the result that there is 'too much participation at the expense of the observation' "(Kearns 2002: 113). For this study, I have avoided this dilemma by being faithful to the research strategy, research questions and objectives.

Systems Theory and Analysis

To represent and analyse the findings gathered from participant observations in terms of the suitability and utility of IS/IT in the Tasmanian rock lobster industry, a systems approach is useful to understand organisations, industries, businesses and communities to develop new IS or understand existing IS. These systems do not necessarily relate to the use of technology; as a field IS is more about how information is used and moves through an organisation or industry, and about the processes to achieve this movement. IS can be formal or informal (Avison & Fitzgerald 1995), and may not necessarily reply on computer technology alone. It is possible to have a fully functional manual IS; however computerised technology can achieve many of the manual processes more

efficiently (Avison & Fitzgerald 1995). Often organisations have composite IS, which consist of both computer technology and manual or human systems.

In the world of IS, numerous methodologies can be used to successfully develop computer-based IS for organisations. In terms of a system's suitability for an organisation or industry, the degree of success can depend upon the designer's philosophical stance, assumptions and approach. The designer's stance can vary from emphasising the subjective aspects of an IS, to stressing more scientific and/or pragmatic approaches (Avison & Fitzgerald 1995; Dovers & Handmer 1992; Rose 2002; Stewart & Ayers 2001). For example, some methodologies such as Structured Systems Analysis and Design Method (SSADM) are positivist in approach and most human activity is not included in the development process. In contrast, Checkland's Soft Systems Methodology (SSM), as described in Avison & Fitzgerald (1995), is interpretive and accounts for such activities. Methodologies that fail to include human activity (users) in the development process contribute to many failures in the adoption of computer-based information systems.

> The reason for the emphasis on the human and organisations aspects of information systems is that it is well proven that many of the failed information systems where not due to the technology, but due to the human and organisational problems, such as lack of planning, costs, abandonment, poor training and lack of consultation with the users and gaining their business knowledge (Avison & Fitzgerald 1995: 6).

The term *users* includes anyone who works with an IS who is not part of the technical team and is unlikely to be an expert in computing. Users are often portrayed as a homogeneous group, but there are many different types of users and it is important to include them in the development process of any information system because they have a stake and/or financial commitment in the success of the information system. Users may include data control clerks, managers, secretaries and problem solvers (Avison & Fitzgerald 1995) and, in the case of the Tasmanian rock lobster industry, include fishers, processors, fisheries scientists and managers, transport providers and end buyers.

Many techniques used for IS development are used interchangeably with other methods. However some techniques are more appropriate based on underpinning values.

Examples of techniques include rich pictures, root definitions and conceptual models, entity modelling, data flow diagramming, decision trees, decision tables, entity life cycle, object orientation, structure diagrams, and matrices (Avison & Fitzgerald 1995). In this study, I have selected the techniques and tools most aligned with my own values, and most notably my commitment to advancing broadly based sustainability outcomes for the industry, species and its habitats.

For a computer-based information system to be successfully produced for the Tasmanian rock lobster industry, it is necessary to map the current industry supply chain with a view to model human activities and physical processes involved in ordering, catching, processing and selling the lobster. These stages enable a sound understanding of those IS in use, and highlight areas where a computer-based IS could be appropriately applied. Information flow diagrams may then be used to describe the detail within the industry supply chain, and be applied when developing models for a new system. The models can then be validated by gaining input and feedback from key stakeholders. The techniques to achieve this validation will be discussed later in this chapter, but it is useful to note here that SSM and Effective Technical and Human Implementation of Computer-based Systems (ETHICS) are examples of qualitative interpretive systems design methods that accommodate the subjective. Hence their utility in this study where my aims are to understand the industry supply chain in terms of its human activity, business processes and information flows, and to then develop and present to industry stakeholders particular IS concepts, and a strategic framework that will promote better sustainable management of the industry.

Checkland's SSM

Checkland (1981) developed SSM with the objective to apply 'soft' systems theory to understand organisations and human activities. He argues that systems analysts apply their craft to problems that are not well defined. These 'fuzzy', ill-structured or soft problem situations, which are often complex, are common in organisations (Avison & Fitzgerald 1995). It may be easy to model data and processes, but to understand the real world, people need to be included in modelling processes because they have different objectives, perceptions and attitudes (human activity systems). SSM stems from this realisation and is developed through action research, whereby systems ideas are tested on clients and analysts are participants in the action (Rose 2002). Checkland's underlying view of systems development is "heavily influenced by traditional waterfall

models" (Rose 2002: 1). Alternatively an interaction – transformation – interaction (ITI) model views systems development as more of a "social and managerial task, rather than a technical one" (Rose 2002: 1).

Avison & Fitzgerald (1995) presents a seven-stage SSM framework adapted from Checkland (1981), who argues is a logical sequence to follow (Table 2-1). However it is possible to start at any stage of the framework, and assuming that the process is iterative, backtracking and further analysis may be required (Avison & Fitzgerald 1995). These stages provide the scaffolding for a research plan that incorporates consultation with key stakeholders and modelling current and proposed supply chain systems for the industry.

Table 2-1: The seven stages of SSM[9]

Stage	Description
1	Problem definition and scope; provides an unstructured view that gives some basic information
2	from the range of views of the individuals involved
3	Structured approach; expresses the problem situation, using the criteria CATWOE or Client, Actor, Transformation, *Weltanschauung* (world view), Owner and Environment; from findings from stage 3, the analyst(s) selects the view, which gives them an insight into the problem; this stage allows the root definitions for system to be created
4	Conceptual modelling; using the root definition
5	Comparing; using conceptual models from stage 4 and the root definitions formed at stage 2; this comparison process leads to a set of recommendations regarding change
6	Assessing the feasibility and desirability of these recommendations
7	Suggesting actions; using stage 5 recommendations to improve the problem situation

Source: Adapted from Avison and Fitzgerald (1995: 368-374)

Mumford's ETHICS

ETHICS has a dual role; one an acronym and the other to imply that the methodology embodies an ethical position. The methodology was devised by Enid Mumford in 1995 and is based on the participative approach to IS development. "It encompasses the socio-technical view that for a system to be effective the technology must fit closely with the social and organisational factors" (Avison & Fitzgerald 1995: 353). The primary objective of this methodology is to ensure that the technology and system design improve the working life and job satisfaction of users. Mumford (1995) views the development of computer systems as an organisational issue; and not simply a technical one fundamentally concerned with the process of change. To determine if a system is able to fit appropriately within an organisation it needs to be measured against five areas of fit related to knowledge, psychology, efficiency, task-structure and ethics.

[9] Please note that stages 1 and 2 of SSM framework are grouped together and involves defining the problem and the scope.

ETHICS also underscores the importance of users or stakeholders becoming involved in decision-making processes concerning design and operation of systems (Avison & Fitzgerald 1995). The development of computer-based systems is seen as a change process and likely to involve conflicts of interest among participants or actors in the process. Mumford (1995) distinguishes the practical mechanism of participation with structure, content and process. Avison and Fitzgerald (1995) further describe the structure of ETHICs as the mechanism of participation that can be consultative, representative or consensual (Table 2-2).

Table 2-2: ETHICS: Three mechanisms of participation

Consultative	The participants give evidence to the decision makers, which possibly, will influence the decision makers but does not bind them in anyway. This form of participation is the weakest and not recommended for detailed design.
Representative	A structure where selected or, preferably, elected representatives of the various interests make in decisions about systems design and operation. This form of participation is most appropriate for tactical or middle management decision making. In computing terms, this form of participation might be at the system definition stage where the system outline and boundaries are discussed and a fairly wide spectrum of interests are involved.
Consensus	All the constituents make decisions. This form of participation is most suitable at the detailed design stage where the decisions probably affect the day-to-day work practices of the people involved.

Source: Adapted from Avison and Fitzgerald (1995: 91)

The Industry Supply Chain Stakeholders

Selected characteristics of industry supply chain stakeholders who were interviewed for this dissertation are described in Table 2-3. The six fishers with whom I spoke to were regarded as representatives of their diverse community. The four processors with whom I spoke were also diverse in the kinds of operations in which they were involved, and included among their ranks fishers with processing/handling licenses and processors of abalone and finfish. Of the 45 licensed processors, who comprise the industry, many are independent operators; however the variance in operations is defined by the parameters dictated to by the market place, State and Commonwealth regulatory bodies, freight providers and fishers. These parameters provide some continuity in practice. Finally, the two freight providers interviewed represented three main groups involved in the supply chain: domestic airlines, international airlines and freight forwarders.

An interview was also conducted with a representative of the Marine Resources Division, DPIWE, who also oversees the Rock Lobster section, which employs two part-time managers who also have commitments to other fisheries. The participant's

area is responsible for the resource management and policy of the Tasmanian rock lobster fishery (commercial and recreational), which includes relying on catch and effort data and stock assessment information, quota management, and compliance. The Marine Resources Division's jurisdiction stops once the rock lobster is dispatched to the processing plant. The journey of the rock lobster beyond the processor is regarded as the responsibility of the industry, other department divisions and agencies such as State of Growth (DPIWE 2003c) and DED. Based on these parameters that define the Division, the participant could only comment based on their observations with what happens to the rock lobster beyond the processor.

The Marine Resources Division works closely with the TAFI whose members undertake stock assessments, which includes catch and effort data provided by DPIWE, in addition to other data sources. Interviews were undertaken with two TAFI researchers who are tasked with conducting scientific research on the Tasmanian rock lobster fishery, with particular emphasis on stock assessments that use catch and effort data. TAFI also undertakes specific fisheries research projects for DPIWE and the rock lobster industry. The research primarily has a biological emphasis; however in the last five years, socio-economic research has become more significant.

Additional information about emerging industry trends has been collated through the use of participant observation at industry events such as conferences, industry forums, meetings, and from general liaison with members of industry councils, committees, sub-programs, and companies at a state, national and international levels. The observations include information about supply chain initiatives relating to environmental management and quality management of the product and supply chain. Much of the information collected has been opportunistic. Each of these groups is briefly described below.

Table 2-3 Industry Supply Chain Stakeholders interviewed in this research

Stakeholder	Agency	Description
Fishers	Tasmanian rock lobster fishing community including the industry peak bodies, the TRLFA and TFIC	Fishers interviewed included: • day fishers • fishers who take trips of more than 10 consecutive days • fishers who fish in different regions off Tasmania • leased quota and quota owners • owners of small and/or large vessels • fishers who were also processors and marketers
Processors	Tasmanian Rock Lobster Processor's Association (TRLPA)	Processors interviewed included • owner-operators • Australian owned processors with managers • processors from a variety of regions; including north-west, east-coast, and south-east and processors who concentrate solely on Tasmanian rock lobster
Transport	Freight Forwarders	international freight forwarder Tasmanian Freight Logistics Council
Transport	Airlines	domestic airlines Tasmanian Freight Logistics Council
Fisheries Research Scientists	TAFI	two representatives
Industry Developers	DPIWE	representative of the Industry Development branch
Fisheries Manager	DPIWE	representative of the Marine resources division
Licensing	DPIWE	representative of the Licensing and Administration division
Compliance	DPIWE	representative of the Quota Audit Unit
Trade and Market Development	DED	representative from Trade and Market Development Branch
Policing and Enforcement	DPPS	representatives from the Marine Police Section
Quarantine	Australian Quarantine and Inspection Service (AQIS)	Program Manager – Fish Exports, Food Inspection Operations

Information about compliance with and enforcement of the quota management system for the Tasmanian rock lobster industry was gained from interviews with the Licensing and Administration Branch and Quota Audit Unit, DPIWE, and the Marine Resources Division, Tasmania Police, DPPS. The collaborative effort of both these agencies aims to monitor the movement of rock lobster from the point of capture by the fisher to the point of departure from the processing plant. Weights and numbers against licences are the main focus of fisheries and police officers to ensure quota compliance. For recreational fishing of rock lobster, the aim is to ensure bag limits and seasons are complied with, and that rock lobster is not traded non-commercially.

Interviews were also conducted with representatives from the Trade and Market Development Branch of the Department of Economic Development (DED), Industry Development branch, DPIWE, and the Fish Exports, Food Inspection Operations in the AQIS. Members of the Trade and Market Development Branch are responsible for

trade and market development of individual businesses and industries, particularly relating to export. For example, a post-harvest committee has been established for the Tasmanian rock lobster and abalone industries to undertake industry and market development initiatives. The Branch also is involved with trade missions and managing international delegates such as Chinese and Taiwanese rock lobster buyers. In addition to the fisheries management role undertaken by DPIWE, the industry development of primary industries is also another aspect. From an industry development perspective, DPIWE requires information about where production and financial growth is, in particular, in the wild fisheries sector. AQIS also plays a significant role in the export part of the supply chain. It is a requirement that processing factories wishing to export product overseas comply with AQIS standards and obtain certification.

Recording data

Field Notes

Field notes are an important part of the research strategy, and provide a means to collect pertinent information in situations where other research techniques would be deemed inappropriate, intrusive or not possible (Kearns 2000). My role as a researcher in this project was complex because I was also an active participant in it. This dual role was managed using participant observation research techniques such as field notes and journal notes, which allowed me to gather information about the project, its participants and the progress.

Given my past experiences with working with members of the Tasmanian rock lobster industry and the rapport that I have developed with them, I was often invited to attend meeting venues or social gatherings where conversations and discussions relating to the adoption of IS/IT concepts or industry trends took place. In these situations, it was deemed inappropriate and intrusive for other techniques, such as in-depth interviews and tape recording, to be used to, even if these industry members initially provided consent.

> Rapport with another person is basically a matter of understanding their model of the world and communicating your understanding symmetrically ... Achieving and maintaining rapport, or a productive interpersonal climate can be critical to the success of an interview (Dunn 2000: 64).

Interviews

Twenty interviews were conducted with key industry representatives along the industry supply chain. The purposes of the interviews were to provide an insight into the current business processes, information flows, relationships, conflicts, and culture of the industry, and to derive feedback on IS/IT Solution Two. Industry participants were also regarded as potential users of the system. Semi-structured interviews were deemed appropriate since the interview layout was content focused (Hay 2000).

As noted in Chapter 1, industry participants were invited to participate in the project and were sent a letter and information kit (Appendix 1) as required by the University of Tasmania ethics system. The kit included an interview schedule, which included a series of questions or themes that needed to be raised with the participants. Before commencing each interview, a consent form was signed by the interviewer and interview participant. Audiotape recording was also a major part of the interview, and this was subject to permission by the participant. It was also made clear that participants could stop the audiotape or stop the interview whenever they wanted to and that their participation in the interview was entirely voluntary.

The semi-structured interview questions were tailored to the specific role of the stakeholder. Flexible questioning was necessary as each participant varied in terms of personality, circumstances, and interview setting. I needed to adapt to the situation and the interview questions needed to reflect this. The flexibility of the interview was advantageous as it assisted in building rapport and allowed, in a controlled sense, for the participants to elaborate on topics. In some instances, the duration of the interview was up to four hours, but on average it was between one to two hours. The proposed IS/IT models were presented and discussed. From these interviews, the perceptions and attitudes towards the proposed system were captured for analysis.

Rapport with participants enhanced interview outcomes. The success of any interview was gauged by the willingness of participants to answer questions. In some cases, I was asked to come back the next day for another couple of hours, because there was so much information capture. Any uneasiness at the start of an interview was generally handled by making general conversation, provide an introduction into my research and

background, accepting a beverage, and being prepared to fit around their business (interruptions to the interview were common due to business related demands).

Literature

Government literature was thematically analysed to gain an understanding of the regulatory processes and procedures that govern a significant proportion of the Tasmanian rock lobster industry supply chain. With particular concern about the movement of lobster volumes between fishers and processors, State Government agencies, such as DPIWE and Tasmania Police, regulate and enforce the quota management regime. DPIWE is responsible for the fisheries management, policies, planning and compliance of the Tasmanian rock lobster industry. The role of Tasmania Police is to enforce these regulations through random inspections, surveillance, gathering evidence and charging offenders for non-compliance such as not correctly reporting the quota or exceeding the quota. The regulation governing these processes significantly influence the industry supply chain in terms of information flows, physical product flow, business processes and behaviour, and supply. The fisheries policies and management plans are published on Tasmanian Legislation Online website <http://www.thelaw.tas.gov.au> (DPAC 2004) and DPIWE's website <http://www.dpiwe.tas.gov.au> (DPIWE 2004). These policies and plans are fundamental to the understanding of much of the supply chain processes undertaken by the industry.

Data Analysis

The analysis of field notes, interview transcripts, and literature is based on the research objectives and questions, and is reflected in the research strategy (Table 1-2). The data analysis is a two-staged approach: themes and data modelling; and reviewing the IS/IT Solutions against the industry profile and the mapped supply chain, and are described below.

Stage One

The first stage of the data analysis used themes and data modelling techniques. The themes were used to understand the industry supply chain in terms of the industry's current and future status and feedback on the proposed systems. The interviews and field notes were thematically analysed to map the perceptions, attitudes and opinions of

the key industry stakeholders in terms of their issues, concerns, constructive suggestions, relationships, culture and behaviour. Using the themes and government literature, key information was also collated about the industry supply chain, and allowed for data modelling to occur in a logical manner. The current key requirements and process of operation relating to the quota management system, market place, transport providers, processors and fishers were mapped. Against the current industry supply chain, a proposed industry supply chain is constructed representing a computer-based information system.

Tape-recorded data and field notes were transcribed, with some interviews taking up to two days to complete. Each transcript was filed electronically and in hard copy against the participant's name and supply chain category, for example: fishers, processors and fisheries managers. As the interview structure was content based, the questions posed had specific objectives or themes, which needed to be answered. The themes or topics were a framework for the information collected from the interviews. Each transcript was read in detail and pertinent information was highlighted and a summary of each supply category was produced. The summary was grouped against key interview themes derived from the interview questions proposed and included: information collected, technology used, process of operation, quality, marketing, and future. Against these five themes, sub-themes were identified which were appropriate for mapping the industry supply chain, providing insights into the industry's current and future status, and providing feedback to me on IS/IT Solution Two. For example, the process of operation theme was predominantly focused upon obtaining information about the supply chain processes from each industry stakeholder's perspective. The process of operation theme gave me a detailed description of the business processes, ethics, culture, and codes of practice and standards. Each transcript was analysed for further themes to emerge, and involved a high level coding of the text, for example, sentence based. This process was undertaken without the aid of a computing package such as *NUD*IST*, based on personal preference to code the text myself, and assisted me to become immersed in the data and recall the interview experience with the participant. The task was also manageable because there were a relatively small number of industry stakeholders with transcript interviews. From the interviews, stakeholder perceptions and attitudes towards the proposed system were captured for analysis and included assessment of the suitability and practicality of the proposed system for the

industry, and of the ability to meet the desired outcomes, degree of acceptance, suggested improvements, and requirements and specifications.

From the themes gathered from the interview data and field notes and as part of the development of an IS/IT strategy discussed in Ward and Griffiths (1996), SWOT (Strengths, Weaknesses, Opportunities, and Threats) Analysis was used to gain an understanding of the industry and business position. The analysis also identified areas of greatest concern that required action.

Further analysis of the data was also achieved using systems analysis and design techniques to establish a modelling method. Models such as business process modelling, data flow modelling, and entity-relationship modelling highlighted the business processes, information flows, relationships or networks, and key players involved in the current industry supply chain. From the models, a proposed industry supply chain was derived incorporating a computer-based IS concept. The modelling and mapping of the industry supply chain in both its current and future state was assisted by using data modelling software; Microsoft Visio 2000 Professional Edition, and guidance from a System Architect tutor.

The business process model was used to represent the physical flow of the rock lobster and the associated business processes involved in the process of transforming and transporting the product from the fisher to the end buyer. The information flow diagram (IFD), similar to a data flow diagram (DFD), was used to demonstrate the information flows in the system. IFDs or DFDs are a common modelling tool used by systems analysts to model system components, which are "the system processes: the data used by these processes, any external entities that interact with the systems, and the information flows in the system" (Hawryszkiewycz 1994: 134). IFDs also include key entities or actors, processes and control processes. A component of the IFD, the process, describes how the input data is converted to output data or, in this case, information. The processes within the Tasmanian rock lobster industry are essentially what make the system work. The control processes are significant as they allow the product to flow along the supply chain (like a light switch). At these points control measures can be established to gain feedback on key indicators such as quality.

A high level IFD is effectively an industry value chain (Ward & Griffiths 1996). This model demonstrates the role that information plays, not only in terms of achieving business objectives but also in terms of how it can be used by suppliers, customers and competitors to affect the potential achievement of those objectives:

> The product of such analysis is an understanding of the information "entities" that all players in the industry need to manage to achieve success, and this can lead to an extension of the IS requirements and potentially new or modified objectives ... The external value chain and high level entity models then form a framework within which more detailed considerations and more specific techniques, such a data flow analysis and modelling, can be used (Ward & Griffiths 1996: 257)

The context diagram is also a high level IFD, and represents the current computer-based IS in terms of the key players and information flows. To model the whole industry supply chain system, it is usual to begin with the context diagram, which "shows all the external entities that interact with the system and the information flows between these external entities and the system" (Hawryszkiewycz, 1994: 136). The context diagram does not describe the system in detail. To represent the detail and describe the system processes it is necessary to draw IFDs.

Entity-relationship modelling is often used in more positivist system methodologies such as SSADM (Avison & Fitzgerald 1995) as it is often used to describe the data structure in a static way. However this modelling technique is useful to design databases, representing the entities and relationships. ER models show the relationships of the key entities or entity groups relevant to the business. The main purpose of the models is to define the underlying information architecture, independent of any functional considerations. The models also "provide a means of clarifying company wide business language, and are the source of the initial entries into the business unit's data dictionary" (Ward & Griffiths 1996: 170). For this thesis, ER models are used to represent the proposed relational database for the Rock Lobster Electronic Management System, including entities, attributes, and relationships.

Stage Two

Based on the SWOT analysis, and information flow and entity-relationship models, an understanding of the industry supply chain in its current and future proposed state is achieved. In addition to the insight into the industry, feedback from consultation with key industry stakeholders on the proposed business cases highlight key issues and suggestions. Further IS strategy analysis techniques are then applied to determine what key factors need to be achieved for a successful implementation of a proposed system for the industry.

According to Ward and Griffiths (1996), Critical Success Factor (CSF) analysis is under many guises ("key issues analysis", "do wells") and is a commonly used tool in the IS strategies toolkit. Against the system objectives, issues are listed, highlighting key factors that need to be achieved for consensus between key industry stakeholders for the coherent progress of the IS strategy. CSFs are vital in the strategic planning process, and assist in assessing the proposed business cases against the industry profile and providing a recommended IS strategy.

Validation of IS/IT Solution Feedback

Validation of information collected from interviewed industry participants was achieved by inviting them to an industry forum. The Tasmanian rock lobster Rock Lobster Electronic Management System was presented on the 25th November 2003, at TAFI. At the forum, I had the opportunity to present the IS/IT concept to industry members in a workshop environment, complimented by a demonstration of a version of the concept using trial software developed and presented by Dr Amos Barkai, Ocean and Land Resource Consultants (OLRAC). Barkai is known for the development of the OLFISH electronic fishery management system software, which has been adapted and implemented in many fisheries worldwide including the E-Boat project in the South-East Trawl Fishery. By using my findings and data models, and system specifications, he developed and demonstrated a trial system for the Tasmanian rock lobster industry. The presentation and demonstration aimed to assist in communicating the concept to industry and to gain constructive feedback from its members in terms of its appropriateness for the Tasmanian rock lobster industry and others industry sectors, and its worth as a trial project. The workshop gave industry representatives another opportunity to validate feedback of IS/IT solutions from the interviews and to air issues they deemed relevant to the topic. A report was produced and sent to all invited

industry representatives, so industry representatives who were unable to attend still had an opportunity to provide feedback.

Summary

In this chapter I have presented the theoretical context and methodological framework for the dissertation. My objectives were to explore the role of IS/IT in the seafood industry and, in particular, the Tasmanian rock lobster industry, in addition to gaining an understanding of the Tasmanian rock lobster industry supply chain. These objectives meant obtaining rich information about the industry participants, including their business processes, information flows, and relationships and networks. To acquire this knowledge, a qualitative interpretive research approach was proposed using an ethnographic/soft systems methodology. This approach allowed for participant observation research techniques to be used such as interviews and field notes, in addition to interpretive systems analysis and design techniques such as data modelling. This approach also allowed for formal and informal collection of relevant data from industry participants and mapping the industry supply chain. The success of these research techniques was partly attributed to the rapport and 'good will' already established with the industry, and permitted me to make observations while participating in social settings. Data analysis involved a two staged process: firstly using themes and coding techniques from the interview and field note transcripts, and secondly using data modelling and system analysis techniques such as SWOT and CSF analysis. These data analysis methods assisted in mapping the supply chain, analysing the industry profile, and analysing the IS/IT Solutions.

PART TWO: MAPPING THE INDUSTRY AND UNDERSTANDING THE ROLE OF INFORMATION SYSTEMS/INFORMATION TECHNOLOGY

Preface

Part Two introduces the Tasmanian rock lobster industry supply chain, and maps and evaluates a new IS/IT Solution with a view to providing a strategic plan for the industry. Chapter Three profiles the industry using information gathered from in-depth interviews with key industry participants, and from field notes of industry meetings, forums and conferences. Information about the industry is analysed using a SWOT tool and provides a profile of the current status of the industry and its members, and permits me to understand various perspectives about the industry and it members' future. The findings from Chapter Three underpin the IS/IT solution for the industry, developed in Chapter Four. Solution One was an industry project initiated prior to the start of this thesis. It is reviewed in Chapter Four, and lessons learnt from its failure became the foundation for Solution Two, which is then elaborated upon. Chapter Five presents an analysis of the industry supply chain by mapping the current business and information processes and flows. I then replicated the mapping processes using Solution Two as a means to highlight how it may impact upon the current supply chain. The work in Chapter Five forms the backdrop for a review of Solution Two based on industry stakeholder feedback, which is described in Chapter Six. Critical Success Factor analysis is then used to develop a final recommended IS/IT solution and strategic plan for the industry to adopt.

CHAPTER THREE: PROFILING THE INDUSTRY

In this chapter I profile the Tasmanian rock lobster industry, having consulted key industry stakeholders, participated in seafood industry meetings, forums, and conferences, and reviewed the literature. The information gathering process has provided me with rich insights into members' concerns about the current and future viability of the industry, the risks and uncertainties associated with their dependence on few major markets, and the need to manage public and consumer pressures for accountability associated with environmental management and the quality of supply chain. These issues and trends are significant, and are shared among members of the local industry, the Southern rock lobster industry and, more generally, the Australian seafood industry. Many of the issues experienced locally mirror those at the national level. The issues and experiences can be shared across states, regions, species, sectors, cultures and distances. IS/IT strategic analysis techniques, such as SWOT analysis are common business techniques to profile the current status of the industry and gain insights into members' perspectives for the future. From this analysis, I am able to identify areas of high risk that need to be addressed, in addition to identifying existing strengths and opportunities for the short to medium term.

Industry Profile: Now and the Future

The Tasmanian rock lobster industry is in flux and how industry participants choose to manage this constant change depends upon current and future scenarios. For any organisation or industry to establish an IS/IT strategy, it is a prerequisite to understand internal and external threats, business units and relationships, organisational maturity, product profile and status, and competitive forces (Ward & Griffiths 1996). To understand these forces, a strategic analysis of the industry's position is necessary using a SWOT analysis to consider business strategies and objectives, and to identify how IS/IT may affect the industry in terms of products, services and economics, and how it may be used to alter the relative strengths of those forces.

> Perhaps the key product at this stage of analysis is the understanding of the organisation in terms of business units, their relationships and the similarities and differences between them, and the environments in which they operate. This [knowledge] enables a basic investment stance on IS/IT

> to be adopted – innovative, aggressive, and defensive or survival – and this [stance] will act as guidance to the types of opportunities to be sought (Ward & Griffiths 1996: 255).

Tables 3-1 to 3-4 describe the current Tasmanian rock lobster industry profile using SWOT analysis. They highlight key industry participants' visions, and are based on an integrated thematic analysis of field research, participant observations, journals and field notes, and in-depth interviews. I have also drawn on field notes from the Australian Seafood Strategy for Export Growth (ASSEG) Workshops held in Hobart and Devonport in November 2003, and from industry association meetings, conferences and forums throughout the duration of the study.

Strengths

The Tasmanian rock lobster industry remains competitive in the global marketplace because of the characteristics and desirability of its product. Table 3-1 highlights the key strengths of the Tasmanian rock lobster industry derived from the SWOT analysis. The Tasmanian rock lobster is one of the most valued rock lobsters in world. The industry's major market place, China, pays a high dollar value per kilogram for the Tasmanian rock lobster attributes such as sweet flavour, firm texture, deep red colour, its origin, and low volumes regulated by government fisheries regulation and management. The industry is also recognised by the Commonwealth Government for its status as an environmentally and biologically sustainable fishery with Environment Australia providing export permit exemptions under the *Environment Protection and Biodiversity Conservation Act 1999*. These export permit exemptions allow the industry to be free of export restrictions and taxes that are imposed on Australian fishing industries that do not comply with environmentally sustainable practices. Robust compliance and enforcement strategies ensure this status is maintained and the resource is protected.

Table 3-1: Internal Strengths of the Tasmanian rock lobster industry.

STRENGTHS (INTERNAL)
High value (also seen as a potential weakness)
High quality products
Clean green, natural environment
Well managed sustainable fisheries
High Australian standards such as AQIS which is recognised in the market place
Accredited fisheries
Low Volume of product
Ability to enforce fisheries rules and regulations to protect and manage the resource

However these strengths are undermined by a number of weaknesses and emerging threats from within and external to the supply chain.

Weakness

Table 3-2 highlights the key industry's internal weaknesses derived from the SWOT analysis. Many of these weaknesses are described in more detail and include industry fragmentation, individual focus, the lack of trust, lack of consumer awareness, and the directions of fisheries research and management. Many of the weaknesses are exacerbated by the threats and visa versa.

Between 1999/2000 and 2002/3, members of the Tasmanian rock lobster industry have generally enjoyed high prices for their lobster (Frusher et al. 2003). This trend has been mostly attributed to currency fluctuations, "a duty free point of entry" to China via Hong Kong (DPIWE 2003b), and a high demand from the marketplace for Southern Rock Lobster. However a number of global and local events have contributed to significant change in the value of this lobster, particularly in the 12 months from March 2003 to March 2004 during the outbreak in Asia of SARS and the Avian Bird Flu. These external influences on the price of lobster have only exacerbated underlying weaknesses in the industry's supply chain management, market and industry development strategies. Yet even prior to these events, some members argued that the industry was unsustainable, but short-term high returns for lobster provided little incentive for many fishers and processors to review industry's viability and dependence on one major marketplace; to establish market diversification initiatives; and to review business processes along the supply chain. Recent unviable returns have driven industry members to unite with South Australians and Victorians, who share the same species and marketplace, and establish a Southern Rock Lobster marketing group.

Table 3-2: Internal weaknesses of the Tasmanian rock lobster industry.

WEAKNESSES (INTERNAL)

• Reliance on major market places
• China
  o Black market for rock lobster due to high tariffs
  o Many Australian sellers and few buyers in China
  o Driven by price over quality
  o Market knows the producer better than the producer knowing the market
• Producers are price takers not makers
• Target markets isolated to a few markets for the purpose of short term economic return
• Buyers play on the gullibility of sellers relying on one market
• Fishers and processors seek a short term high beach price
• Reliance on one market place limits product diversification and therefore limits opportunities for market diversification
• Lack of processing capacity to value add and to spread the product mix
• Lack of market intelligence
  o Market knows producer better than other way around
  o No links between the fishers and buyers at the other end (inaccurate feedback of information)
• Cultural weakness (lack of understanding of markets)
• Lack of agreement among processors to work together
• Federal government negotiating with China to reduce tariffs
• Need a lead agency or formal agency for market intelligence (Austrade is not regarded by industry as an effective industry agency)
• European Union
  o Tariffs
  o No market
  o Too many hoops
• US
  o *Bioterrorism Act* (US)
  o Poor communication systems
  o No information flow of what is needed for each market
  o Need Universal Standards
• Poor market connection at point of harvest (end point user focus)
• Black markets (not just in Australia, but competing with other black markets)
• Fisheries management for sustainability
  o Limited volumes of marketable product in fisheries as a result of total allowable catch (TAC)
  o Sustainable management indicators
  o Divorced from market
  o Management unresponsive to market trends/situations
• Australia is competing on an uneven playing field (need to negotiate for lower tariffs)
• Ageing population
• Quality
  o Lack of quality standards throughout the supply chain
  o Inconsistency
  o AQIS standard for export product versus overseas standards
  o Lack of custody and stewardship once the product leaves the country
  o No control of product at receiver's end
  o No mechanism for independent inspections in country of product destination
• Industry fractured
  o Competitive nature
  o Competition on price
  o Not organised
  o Risk takers
  o Short term gain
  o Based expectation $ on premium prices
• Vested interest against collaborative marketing
  o Corruption
  o Lack of funds to gather quantified market intelligence at an enterprise level
• Information flow from market to producer
• Seasons

- Limited natural climate
- Seasonality (continuity of supply)
- Co-ordination of season, inflexible to market forces

- Illicit supply chain
- Costs of doing business such as freight costs and capacity, fees and levies, fuel and cost of quota

Industry Fragmentation and Individual Focus

Fragmentation and the individualistic focus of fishers and processors are significant challenges to the industry's economic sustainability. For fishers, there is an increasing tension between lifestyle and business. Many really only have the skills and time for fishing, and may not possess the capacity to undertake supply chain management, industry development and marketing initiatives. However, collectively, these complex and needed activities may be possible by sharing skills, knowledge, and enthusiasm. Yet fishers are competitive and protective of their fishing grounds and knowledge, compromising the potential efficacy of collective efforts via the actions of their Association.

The characteristics of the processing sector described by DPIWE (2003b) in Chapter Two are supported by my interview findings. Industry fragmentation and an individualistic focus were also observed in my findings, although its constituency is more varied than the fishers. There are, for example, a number of different types of operators: Chinese owner-operators who are exporters based in Tasmania, Melbourne, and Sydney; interstate investors who employ managers to operate factories, and sell lobsters to exporters; and Tasmanian owner-operators who are also exporters. Processor-exporters have direct ties with overseas marketplaces, but the Chinese generally have stronger networks and better communication with wholesale buyers in Hong Kong and mainland China. Other processors generally rely on information supplied by their exporters, many of whom are Chinese.

This variety suggests one reason why the processing sector is also fragmented and internally competitive. A processor-exporter with a sound understanding of the marketplace and its business culture has a significant competitive advantage. Those with limited understanding find the business culture very complex, and may seek alternative markets where 'legible' business relationships can be established.

The Lack of Trust

Relations among fishers and processors are characterised by lack of transparency about business operations and price formation, which has led to lack of trust or mistrust:

> The politics is amazing in that industry. I have been in offices where the processors have artificially inflated the prices so the fishermen will come to them, and they just hold onto the product so no one else can sell and they put the price up. They know how much everyone is carrying. They are competing on volume (Airline Manager, pers.comm., 2003).

> Processors are a little bit different [*sic*] to the fishermen. They really do not tell the fishermen when there are peaks in the prices. So you have fishermen catching fish at low prices and they tank them in factories like this, and then there is a peak and then they sell them, and where they should be making $12/kg they are making $25/kg or more and that is not passed onto the fishermen (Fisher, pers.comm., 2003).

> A lot of the exporters down here have a very good product and they could control the market, if they didn't see each other as enemies (Freight Forwarder, pers.comm., 2003).

> You do get some that work together and coordinate shipments, and they will say this is the beach price we are going to pay, this is the price we are going to sell for, and I will make a living and not be greedy. Then you get others that will not work together and argue, and that is where the market falls over (Freight Forwarder, pers.comm., 2003).

Fisheries Management and Research Directions

The SWOT analysis highlights a significant weakness in Tasmanian State Government fisheries policies and management approaches for the Tasmanian Rock Lobster industry, as they are divorced from downstream influences, such as market fluctuations on upstream industry members of the supply chain.

> Our charter is to manage the resource; once it is caught, we are not involved in what happens in the supply chain, except to ensure that only quota fish is being processed through the processors (Fisheries Manager, pers.comm., 2003).

> [Downstream influences] are beyond our charter to manage the resource sustainably and basically once the fish is landed, our marine resource managers are not involved in the market development and promotion and that sort of thing. So we are not really interested in that area. However the Department of Economic Development, Food and Beverage Division and its Export Division would be a lot more interested if that [downstream supply chain] information was made available (Fisheries Manager, pers.comm., 2003).

This stance was also shared by fisheries researchers at TAFI, who stated that the institute's key mission is stock assessments and the sustainability of the fishery as a biological resource. Downstream industry supply chain management is beyond that mission; however the economics of the fishery would be considered useful by researchers in the assessment of the resource.

> The main focus for fisheries scientists is the sustainability of the resource and determining whether catching lobster has a detrimental impact on future recruitment of soft shellers and undersized lobsters where there is greater mortality caused by handling (Fisheries Researcher, pers.comm., 2003).

Processing industry information, such as that about marketing and price trends, is not seen as the role for scientists unless specific research projects are identified. Marketing and industry development are considered the industry's responsibility. However, TAFI is becoming interested in how changes in the market environment affect the industry as a whole, and how they affect fishing communities in terms of socio-economic and ecological impacts.

Within the scientific community, there is also a growing appreciation that industry members have a wealth of knowledge that needs to be tapped into.

> [We] shouldn't analyse our fisheries without the knowledge of the fishers themselves and their dynamics, and market dynamics. All those things influence our fisheries ... It is not a static system, it is dynamic, which is what we need to understand to better manage the fishery (Fisheries Researcher, pers.comm., 2003).

As a consequence, in partnership with various stakeholders, TAFI's new research plan includes the statistics of lobster and normal stock assessment studies; ecosystem projects on the impacts of fishing on the ecosystem; socio-economics and human capital assessments; and industry development, including marketing.

Opportunities

Given the strengths of the Tasmanian rock lobster industry and the attributes of Tasmanian rock lobster product, there are many opportunities derived from the SWOT analysis to explore to enhance industry viability, manage risk, and become more strategic and competitive (Table 3-3).

Through market diversification, opportunities are possible for rock lobster that fails to meet Chinese market expectations. Markets that have different tastes provide opportunities for processors/exporters to value-add and further process the brindle lobsters, for example, sashimi. Working with other complimentary food sectors such as wine and olive oil, may result in new marketing initiatives being established. Such opportunity needs to go hand in hand with improved industry handling practices, market intelligence, and supply chain relationships between fishers and processors.

Table 3-3: External opportunities for the Tasmanian rock lobster industry.

OPPORTUNITIES (EXTERNAL)
• Value-adding and further processing that reflects changing consumer tastes in China
• Review market sectors and supply chain
• Product development
o Packaging and value-adding
o Partnering with complimentary products such as Wine, olive oil and garlic
• Market diversification (includes domestic)
• New markets:
o European Union
o United States
o Domestic market
• Greater supply chain transparency to benefit fishers, processors and consumers.
• Networks, relationships, and trust reciprocity
• Improved cooperation through co-ordination and improved industry practices
• Provide market information
o Product information
o Product recognition
o Match market needs with production
• Improve trade conditions such as subsidised trade
• Centralised market intelligence on competing countries by sector (market intelligence)
• By establishing a lead agency, the industry has the opportunity to learn about other countries' business strategies so it can be applied in Australia
• Mentoring for market opportunity and business management and strategy
• Changing culinary styles by educating consumers about seafood products (preparation and cooking)
• Australia is competing on an uneven playing field (need exporters to form an export cartel)
• Target historic markets of competitor countries with sustainability problems (unsustainable practices)
• Coordinated advertising promotion approach of Australian seafood through Federal Government
• Quality improvement and promotion (role for Austrade or lead agency)
• Fishers and processors to form a cooperative marketing company that provides opportunities to diversify markets and ensure viability of fishing and processing sectors

Threats

Table 3-4 highlights the industry's key external threats impacting on the Tasmanian rock lobster industry. Derived from the SWOT analysis, market dominance of China, trade agreements, quality requirements, lack of consumer awareness, and freight logistics. Many of these key threats are caused by weaknesses in the industry supply chain.

Table 3-4: External threats impacting the Tasmanian rock lobster industry.

THREATS (EXTERNAL)
• Rising AUD$
• Global uncertainties (for example SARS and Afghanistan and Iraqi wars)
• International competition organised to target Australian markets and compete against local seafood
• Subsidised product from overseas producers
• Apathy and arrogance by Australian seafood industry
• One market focus
• Fragmentation of industry
o No concerted effort (individual efforts)
o Markets able to hold the industry to ransom
• Black markets
o (Not just in Australia, but competing with other black markets)
• Ageing demographics
• Quality (potential corruption)
• Vested interest against collaborative marketing (potential corruption)
• Illicit supply chain
• Costs of doing business such as freight costs and capacity, fees and levies, fuel and cost of quota
• Offshore ownership of quota (loss of control of market price by fishers and processors)

Market Dominance of China

To the frustration of most fishers, another impediment to the industry's economic sustainability is the controlling interests of those in the major market place over the processing sector for Tasmanian rock lobster. The main reasons for this market dominance over the supply chain are the key weaknesses of the industry described in Table 3-2, such as fragmentation of the industry and the lack of willingness of members to work together. Many processors appear reluctant to seek alternative markets and accept the prices offered in the market place.

> My gut feeling (unless circumstances like SARS occur or the Chinese market changes or collapses) [is that] there is no incentive for processors to doing anything about improving the market or improving the price (Fisheries Manager, pers.comm., 2003).

Industry fragmentation is further reinforced by observations such as the following:

> As people selling apples say, they love buying from the Australians, because you are cheap today but your mate who has got his company up the road will be cheaper tomorrow, as he will undercut you, and that is a major problem for the industry (Industry Development Manager, pers.comm., 2003)

> It is fine when the market is really strong. When we were there (Trade mission in China), they said 'oh we love rock lobster from Tasmania, we want to buy as much as possible', and we would say 'when do you want it?' and they would say 'as soon as possible'. But when the market retracts or is not as strong [due to impacts such as SARS], honestly, with six main buyers, and there are how many exporters from Australia, 70 or 80? They have a smorgasbord of people to buy from in Tasmania. Two brothers own the two major importing companies in China. Obviously the competition is pretty mild. So that is a major issue (Industry Development Manager, pers.comm., 2003).
>
> Since we have got back from China, we have had an increase in problems with the border closing because it is basically an illegal trade. The authorities in central China are likely to say "right the border is closed". Finally you pay a bit more money to get your product through or alternatively you look at holding your product for a while (Industry Development Manager, pers.comm., 2003).

One of the greatest threats to the industry is the loss of quota ownership to offshore investors. The supply chain is increasingly being overtaken by Chinese buyers working up the supply chain to own and control the wholesale functions for and distribution of lobster in China, as well as exporting facilities and eventually the quota. Once the quota has offshore ownership, fishers will lose autonomy. Yet for a high value product catering to a niche market there is little reason for fishers and processors to be price takers.

Once a limited or single and dominant market controls the supply chain there is no leverage for fishers and processors to negotiate on price. They have to accept what is given even if it is not fair or not viable. To avoid such an outcome there is a need to diversify the market to stem the power of controlling interests:

> As 95 per cent of the rock lobster goes to China, you have got to have alternative markets. If it is a short-term thing [like SARS], then obviously just [don't] fish for a period of time. Fortunately, from what I have heard, the industry has recovered. It has been long for some, but for those people

> with a reasonable income level they are able to see it through, but has it caused a great deal of concern for some. They have to look and think about alternative markets, and the focus needs to be on other markets in the world with large populations of Chinese who are very affluent (Industry Development Manager, pers.comm., 2003).

> They do let the importers rule them a bit rather than trying to control the importers, and say "no we need to have the information by this time", but they don't. Because it is such a volatile industry, and there are so many people out there competing with each other, the importers have the power to say "if you do not supply us somebody else will", and you get phone calls at the last minute trying to get product on this flight tonight, because it is got to be there tomorrow. It is all last minute stuff. It has got to be done now (Freight Forwarder, pers.comm., 2003).

The difficulty for fishers is to overcome this control by wholesalers. An opportunity could be to establish an industry cooperative marketing company, which facilitates industry development, supply chain and marketing initiatives.

> You will always get small niche opportunities for small quantities of fish going through niche markets in Australia. However the majority of the live fish is going in to Hong Kong and Chinese markets. That is going to dominate what the processors will do. I do not think the processors have the skills to go out and find new markets. Most of them would be stuffed and would go out of business if the Chinese market collapsed (Fisheries Manager, pers.comm., 2003).

In terms of price formation, many industry participants perceive that the Chinese market is price driven.

> They are hard to deal with and they fight over price. If they can get you down by 20 cents/kg they feel they have got a bargain (Processor, pers.comm. 2003).

Trade Agreements

Trade agreements with (existing and potential) trading partners can have negative affects on the industry. Australia competes on an uneven playing field and products are often subject to high tariffs and importing regulations, making export unviable. For example, the European Union has high tariffs for imported luxury goods such as Australian rock lobster, in addition to quality assurance regulations such as 'proof of origin' on importing goods. Negotiations on reducing the tariffs in the European Union have been undertaken by the Western Australian rock lobster industry, with potential flow-on opportunities for the Southern rock lobster industries in South Australia, Victoria and Tasmania. However the high cost of market entry and potential high price for consumers remains an inhibitor for many exporters and fishers seeking new markets in the European Union.

Free trade agreements can provide opportunities for market diversification with other countries and marketplaces that are yet to be explored. While still under negotiation, a free trade agreement between Australia and the United States may also provide opportunities for some primary industries, including the Australian rock lobster industry. Once again the high cost of market entry is a potential inhibitor for exporters and fishers; however opportunities such as value-adding of rock lobster are already been undertaken by some fishing companies exporting to the United States and the European Union. This strategy assists market diversification and reduces the dominance of one major marketplace.

Free trade agreements can also provide opportunities to diversify market opportunities within a country or marketplace. A free trade agreement between Australia and China is also a possibility, particularly with the April 2004 free trade agreement between New Zealand and China. The flow-on effect of that agreement on the Tasmanian rock lobster industry could provide numerous marketing opportunities such as direct marketing to consumers and hopefully minimise the reliance on the current Chinese wholesale buyers.

Quality management

Quality assurance, cool chain management and risk management during shipment of rock lobster from Tasmanian processing factories to final buyers are all possible areas of weakness for the industry. A key issue that needs to be considered by exporters

using domestic and international freight to export product is the reliability of the freight forwarder to carry out cool chain handling practices. "[I]s it being held up in customs, is it being taken care of, is it being put into a chiller, and once it leaves us and goes to a freight forwarder, are they putting it into a chiller?" (Airline Manager, pers.comm., 2003).

> So by the time it gets to the buyer it could be a combination of things, it has come here on the domestic market, the processors have brought it down, some using refrigerated vehicles and others don't. So straight away as soon as they put it into an unrefrigerated vehicle, and straight away the cold chain has been broken. It comes in here and it is not subject to extreme temperatures at 30,000 ft, because it goes into a heated locker, which is still quite cool in there, and it gets to Melbourne and it is 35°C, who is then taking control of it? Let's say x or y are there to pick it up. It is about 30 minutes from the aircraft to put it into a shed and put it into a chiller or you leave it on a trolley. So that 40-45 minutes could blow out to an hour and half and it is 35°C in Melbourne. So then they pick it up and take it back to their shed are they handling it right? (Airline Manager, pers.comm., 2003).

There are many points along the cool chain where quality management of the product can break down. Air transportation of the product is without exception. "The airfreight industry is a very labour intensive industry and mistakes happen particularly when humans get involved" (Airline Manager, pers.comm., 2003).

Despite the efforts to maintain the cool chain, risk is also apparent at the destination points, which results in buyers reporting of mortalities and seeking compensation.

> Do you know how they get crayfish (rock lobster) into China? You try to do all this cool chain stuff and they put it onto some sampan, and run it across during the night, and there is no refrigeration on that. And we can have 2-3 days bookings and the border guard has not been paid off. It is not a problem in Hong Kong or Taipei, but to go into China, the border guard has not been paid off, so they increase the surveillance and you get 3 days of cancellations just like that, and you are talking about thousands

> of dollars of freight to us that disappears. Then the border opens again and stuff needs to be sent through. It makes a mockery of the system (Airline Manager, pers.comm., 2003).

Lack of transparency of quality and transport status along the supply chain affects the processors because they are held financially responsible for the product until it reaches the buyer.

> If a product cannot be shipped for one reason or another, it means the processor has to foot the cost of employing someone to come and pick up the lobsters and take them back to the factory and re-tank them (Airline Manager, pers.comm., 2003).

Often this financial responsibility is a reflection of the processor's choice to take cheaper transport options. "Processors' level of risk management is such that they are prepared to foot the costs of an offload for the sake of cheaper transport prices" (Airline Manager, pers.comm. 2003).

Consistency of quality is a problem that arises when AQIS export standards are enforced at the Australian end of the supply chain, but there is no assurance or traceability beyond the airport in Hong Kong to prove that these standards are maintained. This inconsistency and lack of transparency affects processors when buyers want compensation because the product has arrived dead. Note that compensation is imposed on the exporter if the mortalities are greater than 10 per cent. For processors, there is no way of knowing where or how mortalities occur and whether the feedback on causality is reliable.

> We have these AQIS requirements in Australia and have very stringent requirements for export. Once the product gets to the destination, it is totally mishandled. The quality goes out of the door once it gets to its destination (Freight Forwarder pers.comm., 2003).

For Australian exporters, incidents of mortality in transit are difficult to prove because of Tasmania's remoteness from the market place, even though exporters and airlines ensure high standards of shipment. "Obviously there are some issues with mortalities,

the price goes up; and all of a sudden the mortality goes up" (Freight Forwarder pers.comm., 2003).

> There are so many risks involved with live shipment such as mortalities, and then the trust at the other end and what they are going to claim for mortalities (Freight Forwarder pers.comm., 2003).

Lack of Consumer Awareness

Due to the business culture and logistics involved in importing rock lobster into China and distributing it to restaurants and hotels throughout the nation, industry stakeholders believe that consumers are unaware of the origins of the rock lobster they are consuming. Some supply chain members feel that consumers are only concerned about price and do not really care where the product comes from. "I don't think consumers in China and Taiwan really care where the product comes from. I think you will find that it is all driven by price" (Freight Forwarder pers.comm., 2003). However this observation partly contradicts the high demand for quality Southern Rock Lobster, which is reflected in market and beach prices. Rock lobsters are a key product in banquets, where high value and a high quality product are considered a reflection of business status.

Freight Logistics

The interview findings highlight that the challenges of freight logistics are not unique to the Tasmanian rock lobster industry alone and are shared by other industries exporting perishable products out of Tasmania. Freight capacity is often inadequate during peak seasons from October to April, since many different industries are competing for export space out of the State. Obtaining domestic flights that coordinate with international services with minimal delay is not easy at any time of year. Two international flights to Hong Kong depart from Melbourne airport each day, one in the morning and the other at night. Perishable products have a limited lifespan and therefore cannot be delayed during shipment, and freight forwarders are often forced to prioritise products according to lifespan and customer relations. As noted in Chapter Two, the airfreight companies use passenger planes, the passengers also take priority and therefore if there is extra luggage, "offload" occurs and all the airfreight is offloaded to make room for the luggage.

> There is only one air freighter, "which flies at the wrong time for everybody as it flies in the middle of the night. That is for the hard freight. Tuna is the only thing we can put on there. The lobsters, abalone, flowers, cherries do not use it because it flies at the wrong time. The product is sitting around for too long and it is no good by the time it gets there" (Freight Forwarder pers.comm., 2003).

> Each industry fights with each other for space, because cherries, abalone, flowers and lobsters go to Taiwan, and as they all come on in their seasons they start to fight with each other (Freight Forwarder pers.comm., 2003).

Freight logistics becomes even more of a juggling act for the rock lobster industry when the custom's border closes between Hong Kong and mainland China. The consequence is that "one of those flights becomes unavailable so you have got the whole volume trying to get out and get the international flight, they cannot carry the capacity and someone has to miss out." (Freight Forwarder pers.comm., 2003).

Another issue is the distance from major market places for Tasmanian rock lobster and the amount of time product is out of the tank. For Tasmanian product, it can take approximately 10 hours before it departs Australia.

> The processor has to bring the product to the airport, we have a cut off time for product to be there at the aircraft, it takes an hour and half to ensure the product is put on the aircraft properly. Then it happens again at the other end, and once again, there is a cut off time (Freight Forwarder pers.comm., 2003).

The distance and time from international markets also becomes an inhibitor for the Tasmanian industry to seek new markets such as the United States and Europe.

> If there was a co-op put forward and a packing/holding facility in Tullamarine, where they can transfer the lobsters and re-tank them for a couple of days, then put them on a long journey. Then I think those other markets would be available and possible (Freight Forwarder, pers.comm., 2003).

The Industry's Long Term Future

Key stakeholders have various concerns about the Tasmanian rock lobster industry's viability and ongoing sustainability. One concern relates to the effects of globalisation on the industry, particularly in terms of the growing influence of global food companies and their accreditation schemes.

> In 10 years time, there will be four major supermarkets in the world ... What they want to do is have global suppliers and supply management systems, and a global retail system. So if you want to sell to them you have to fit in with that (Industry Development Manager, pers.comm., 2003).

Stakeholders anticipate increasing pressure for industry accountability. Accreditation and codes of practices are being actively explored by industry members to address concerns about such matters as the effects of fishing on the environment, food safety, or animal ethics. This exploration is embedded in risk management strategies more generally. One of these risk management strategies is Hazard Analysis and Critical Control Points (HACCP), which is a food safety standard that applies to handling, storing, processing and packaging practices.

> Ultimately the pressure will come on, even on the little rock lobster fisherman down here, but he will have to say "I have a system for food such as HACCP, in place, or we are fishing in a sustainable way, and the oceans are clean and unpolluted" (Industry Development Manager, pers.comm., 2003).

> The rock lobster people are well advanced and are going down that track, because the sustainability of that has already been assessed by Environment Australia, and has been accepted. There has been a lot of work done in this area. The next step is to have a HACCAP based safety system and some environmental system in place (Industry Development Manager, pers.comm., 2003).

"Ultimately the retailer will become the dominant supply chain member (Industry Development Manager, pers.comm., 2003)" as they continue to require higher quality assurance standards and accreditation from producers.

This trend anticipates that supply chain management, traceability and accreditation processes will become increasingly important for researchers, managers and the industry in order to maintain a competitive advantage in a global marketplace. As members of the global community are becoming more aware of the exploitation of fisheries, pressure will increase on industries to justify practices and ensure that harvesting practices do not have long-term detrimental impacts on the sustainability of this resource, commons or on food safety and quality and on the humane treatment of animals.

A researcher at TAFI believes the industry will "need to demonstrate that the fishery is managed sustainably, not just [be] species focused, but with [an] ecosystem approach" (Fisheries Researcher, pers.comm., 2003). This approach will be a major driver for fishers and other supply chain participants to document their processes of operation whether at sea or in the factory.

> [This is] a global responsibility to the community, people are becoming more aware about the environmental issues relating to fishing ... Fishing and management affect the whole community and not just lobsters (Fisheries Researcher, pers.comm., 2003).

Risk management strategies are imperative and enable adoption to change in terms of the supply chain, product quality, and marketing:

> [There is a] need [for supply chain members] to invest money in managing the risks instead of sticking their heads in the sand. They all need to take a little bit less to ensure for the future (Freight Forwarder, pers.comm., 2003).

Among processors there is grave concern for the sustainability of the Tasmanian rock lobster industry, not just in terms of the resource, but also in relation to economics and social well being. With fewer entrants moving into the fishery, there is additional concern that the demographics of the fishery may face dramatic changes with effects

flowing on to processors. "Fishermen are a dying race and the next generation are not taking it over" (Processor, pers.comm., 2003).

Uncertain futures characterize processing, with some feeling that there is not enough volume of rock lobsters going through their factories for operations to remain viable, hence the drive in 2003 for a moratorium on the number of processing licenses. Others feel that the margins are being squeezed at both ends; while exporters are trying to drive down the price paid to fishers, the latter are trying to raise the beach price to cover operating costs, including quota lease price, and to generate profit. At present, fishers who are leasing quota are worst-affected and their futures are particularly uncertain. A factor contributing to costs exceeding returns is the price of quota that is being set by investors who purchased quota when market prices were higher.

> It starts from [an] investor saying "I want this amount of money for my lease", but what if the investor charges ridiculous amount of money that creates controversy right through the chain? (Processor, pers.comm., 2003).

Another concern about the industry's future among processors is the diminishing quality of lobsters harvested, and that is partly attributed to fishers catching what they can to service business loans.

> Certainly [there are fewer] entrants in the fishery due to the costs of entry. Good for the resource, not so good for the industry (Fisheries Researcher, pers.comm., 2003).

> We need a strategic management plan for the whole supply chain. If we do not have a management plan in place we are going to lose the industry (Processor, pers.comm., 2003).

> I think in 5-10 years time if you have a fishing boat you will be operating it for someone else. You will be a manager of that boat. The fisherman owning his boat and going out fishing will be obsolete in 5-10 years time. They will be advertising in the paper for skippers. I can see small bits of it happening now, and fishermen cannot sustain the costs (Processor, pers.comm., 2003).

Processors also feel they have limited representation on industry advisory committees; that fishers run the industry and do not listen to processors; that fishers think of processors as thieves.

> You have got to start with getting the product right, get the flow put right, and the costs right, then you will automatically increase ... There are two things the industry has to look at: economies of scale; and quality assurance. (Processor, pers.comm., 2003).

From a marketing perspective, industry members have failed to undertake marketing initiatives and remain dependent upon a limited market. In the industry, there has been a lack of strategic planning for marketing, and of allied minimal risk management strategies, and a reliance on the "status quo".

Despite these impediments, opportunities for collaboration between fishers and processors exist in relation to initiatives to improve market intelligence, diversification, and consumer education. Through improved supply chain relations, the improved quality and flow of information is possible and should enhance strategic planning and risk management.

Summary

In this chapter I have profiled the Tasmanian Rock Lobster industry, and highlighted current issues and emerging trends relating to the industry. Many of these issues and trends can also be observed at other levels. This insight has been possible because of consultations with key industry stakeholders, participation in seafood industry meetings, forums, and conferences, and analysis of relevant literature. The SWOT analysis of the industry's current and future status has identified significant strengths, however weaknesses and threats dominate, among them industry fragmentation, lack of trust, market dominance, lack of market intelligence, trade agreements, quality management issues, lack of consumer awareness, freight logistic risks, research directions, and costs of doing business. However, a number of opportunities were also identified, such as market diversification and improving supply chain transparency, that could provide solutions to some of the identified weaknesses. The industry profile discussed in this chapter provides a backdrop to a review of the proposed IS/IT solutions presented in the

following chapters. Many of the issues raised in them are interrelated with the issues raised in this chapter and are instrumental in formulating a strategic business plan for the industry in its attempts to address risk and uncertainty by developing business initiatives that will simultaneously enhance the sustainability of the resource and of their own social and economic well-being.

CHAPTER FOUR: IS/IT SOLUTIONS IN SUPPLY CHAIN MANAGEMENT

In this chapter I outline two IS/IT solutions for the Tasmanian rock lobster industry, designed to overcome some of the supply chain weaknesses and threats highlighted in Chapter Three. These solutions have been developed from preliminary observations of the research setting and its participants and peak body, the TRFLA, and from insights gained by analysing literature from Tasmanian Government fisheries management plans and policies about the industry. The solutions are, first, an EC Project (information service website and electronic trading platform) and, second, a Rock Lobster Electronic Management System (business management system and tagging system). To determine their appropriateness for the industry, I used an ethnographic/soft systems methodology, described in Chapter Two, to help understand the supply chain and obtain feedback from key industry stakeholders about the solutions. The following section describes the impetus for selecting the solutions. Primarily the motivation is based on preliminary informal observations that set the scene and problem, and highlight potential opportunities and solutions. Following that discussion, I present both solutions, and then review Solution One, leaving further elaboration of Solution Two until Chapter Five.

Knowing the Industry Supply Chain

Supply chain transparency is particularly important in order for industry members to operate their businesses efficiently and develop trust amongst each other. Uncertainty and poor transparency along a supply chain can lead to distorted information about demand and distrust along the supply chain (Christopher & Lee 2004; Fawcett et al. 2004; Kwon & Suh 2004). These effects may exacerbate the 'bull whip effect' (Lee et al. 2002) which, in supply chains, is caused by variability of ordering patterns between upstream and downstream players due to poor communication and planning. To control such an effect, industry members need to "focus on modifying the chain's infrastructure and related processes rather than the decision maker's behaviour" (Lee et al. 2002: 2). There is also a need to fully appreciate cultural differences between supply and demand functions along the chain (Mentzer & Moon 2004). Lack of transparency along a supply chain motivates Tasmanian rock lobster industry members to try and remove intermediaries without necessarily recognising their roles and significance to the

industry. That motivation stems from a desire to develop closer connections with end buyers, gain more reliable information, and process and market lobster. The removal of intermediaries can, however, create new challenges for fishers. Very few are successful at managing all the supply chain processes within one business. In this respect, members of the industry can learn numerous lessons from fishing company executives who can manage an entire supply chain within a business, and deal with the similar risks and uncertainties faced by those in the Tasmanian Rock Lobster industry. Where an individual fishing company is able successfully to catch, process, transport and market lobster, a team of people may still be required to provide specialist services, advice and support. The complexities of the marketplace and the range of services required (such as supplying bait, and holding, purging, packaging, and shipping lobsters while negotiating with buyers) are major reasons for company executives seeking support services.

The main difference between an individual fishing company and an industry supply chain is the absence of a company director or individual overlooking the entire supply chain operations. In an industry supply chain, no one person has a full overview of how the chain is working, determining inefficiencies, and identifying high risk areas that could be overlooked or avoided, unless an organisation such as an industry association or cooperative is established. Many Tasmanian rock lobster industry members certainly have an understanding of the supply chain and peak bodies, such as the TRLFA and TFIC, and endeavour to assist in managing supply chain issues. However there is a need for an industry body that represents all players in the supply chain, unites a fragmented industry, and has the resources and capacity to have an overview of the industry without having a political and financial bias that favours any one part of the supply chain. Cooperatives may be a possible solution to represent and unite the industry.

Gertler (2001) promotes cooperatives as a vehicle for sustainable development in rural resource-based industries, and defines them as autonomous associations of "persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through joint-owned and democratically-controlled enterprise[s]" (Gertler 2001: 18).

He concludes that the success of cooperatives is subject to democratic membership and autonomy from governmental and other political powers. In the Australian fishing industry, examples of successful cooperatives include the Lakes Entrance Fishermen's Co-Operative Society Limited (LEFCOL) in Victoria (SIV 2004), and Geraldton Fishermen's Cooperative Limited (Brolos 2004) in Western Australia and the Clarence River Fishermen's Cooperative Ltd (CRFC) in northern New South Wales (CRFC 2004). Their success appears to be based on respective cooperative's abilities to represent members democratically, ethically, autonomously, and strategically to ensure they have a viable future. I also suspect that successful fishing cooperatives are based on the characteristics of a certain fishery or fishing port. For example, Lakes Entrance Fishing Cooperative in Victoria is successful primarily because of its central port where fishers unload their catch. However these conditions contrast with Tasmania fisheries where many fishers' homes and unloading ports are geographically dispersed (Bradshaw & Wood 2003).

Kitts and Edwards (2003) describe examples of cooperatives in fisheries for US Pacific whiting, Chignik salmon purse seine, Bering Sea and Aleutian Islands Pollack, and Alaska weathervane scallops. These fisheries have capitalised on the *Fishermen's Collective Marketing Act* (FCMA) of 1934 to better share harvest capacity and/or profits, reduce costs, improve product quality and negotiate prices. In some instances, fishing cooperatives are instigators of resource management strategies, which ultimately contribute to sustainable development of an industry and resource.

Despite the Tasmanian rock lobster industry's geographical profile, a cooperative may be a possible platform for members to unite and manage their supply chain more effectively and strategically.

Gertler (2001) highlights how cooperatives have the capacity to establish trust, accountability, and strategic partnerships and alliances, and improve processes and transparency among supply chain members. These assets can then be marketed to the consumer in terms of demonstrating the industry's environmentally, socially and economically sustainable status.

Why do we need a change?

For approximately five years, the TRLFA has sought to explore potential applications of IS/IT. The motivation for such an inquiry has stemmed from the desire to better understand the supply chain and to identify areas for improvement such as strategic planning, market development (increasing product value in export markets and seeking more marketplaces), industry viability, product flow and feedback, information flow and feedback, and quality and risk management. This trend was becoming apparent in other primary industries, such as beef and wine.

Earlier I described one of the key issues motivating the industry members to explore opportunities for marketing and improvement in supply chain relations and processes. Tasmanian fishers and processors are 'price takers' for a product that has limited supply and high demand. In 2001, I was given the opportunity by the TRLFA to conduct research on this topic and identify applications for IS/IT for the Tasmanian rock lobster industry. The plan was to design and implement an information service website and electronic trading platform. Additional funding for the industry to implement this plan was sought from the TECC. Using participant observation techniques, my role as a researcher was to monitor the uptake and impact of electronic commerce applications on the industry. During that work, it became apparent that there was a shift in the food industry towards SCM, traceability of food products, and quality management using IS/IT. Such change was being attributed to consumer concerns about food quality and safety as a result of health scares such as the bovine spongiform encephalitis (BSE) (Frederiksen & Bremner 2002). The change was evident particularly in the European seafood industry, with the Commission of the Tracefish Project (Denton 2002). The Australian seafood industry also followed this shift with the establishment of a FRDC funded project *Formation Of An Industry Strategic Plan For Development Of A Quality Index For Australian Seafoods*, involving Seafood Services Australia, the Sydney Fish Market, and Western Australian Fisheries, as well as a number of prominent industry associations and service providers (Boulter 2003). In addition, parallel programs were being established in the field of freight logistics. There, collaborative efforts were being undertaken between freight service providers and perishable food processors and exporters in the area of cool chain management, for example, the Tasmania Logistics Online Project, part of the Information Technology Online (ITOL) program funded by NOIE. A common thread among these groups was the desire to improve the quality of products and services along the supply chain, and to develop feedback mechanisms in

quality, marketing and consumption. To achieve improved quality standards along the supply chain, it was recognised that both traceability of the product and transparency of the processes along the supply chain were necessary, and that IS/IT could provide the appropriate tools to achieve these ends.

Another parallel movement within the seafood industry was the development of electronic fisheries management systems such as electronic logbook (e-logbook) systems[10]. I had observed that there were numerous applications of e-logbook systems being developed throughout the world for various purposes such as compliance, fleet management, logistics, quality management and traceability, marketing or, in some cases, a combination of purposes (Denton 2002; Frederiksen et al. 2002; Seafood New Zealand 2002). The commonality of these e-logbook systems was the use of fishers' logbook data as the basis of the system. The information could also be used for fisheries assessment and supply chain purposes, and to deal with topical issues facing the industry such as community perceptions of environmental impacts of fishing practices.

Based on my observations, I determined that there was a need to further develop the e-logbook concept and create an integrated e-logbook system that streamlined and improved the efficiency of collecting regulatory information from industry participants. In addition, the system would provide participants with greater feedback and access to information useful to business and industry managers. The aim was to avoid scenarios experienced by those who supply perishable products to companies such as Coles-Myer Pty Ltd and Woolworths Pty Ltd, where each company has its own quality assurance scheme. The cost of complying with these individual schemes means suppliers can only afford to comply with one system and are therefore locked into supplying one company. An integrated system could minimise costs for an industry required to comply with quality assurance accreditation schemes and obtain export exemptions from Environment Australia. It became apparent that an e-logbook system for the Tasmanian rock lobster industry supply chain might be strategic in terms of managing risk and preserving the industry's competitiveness and sustainability. However, such a system may also have more broadly based applications in other food industries.

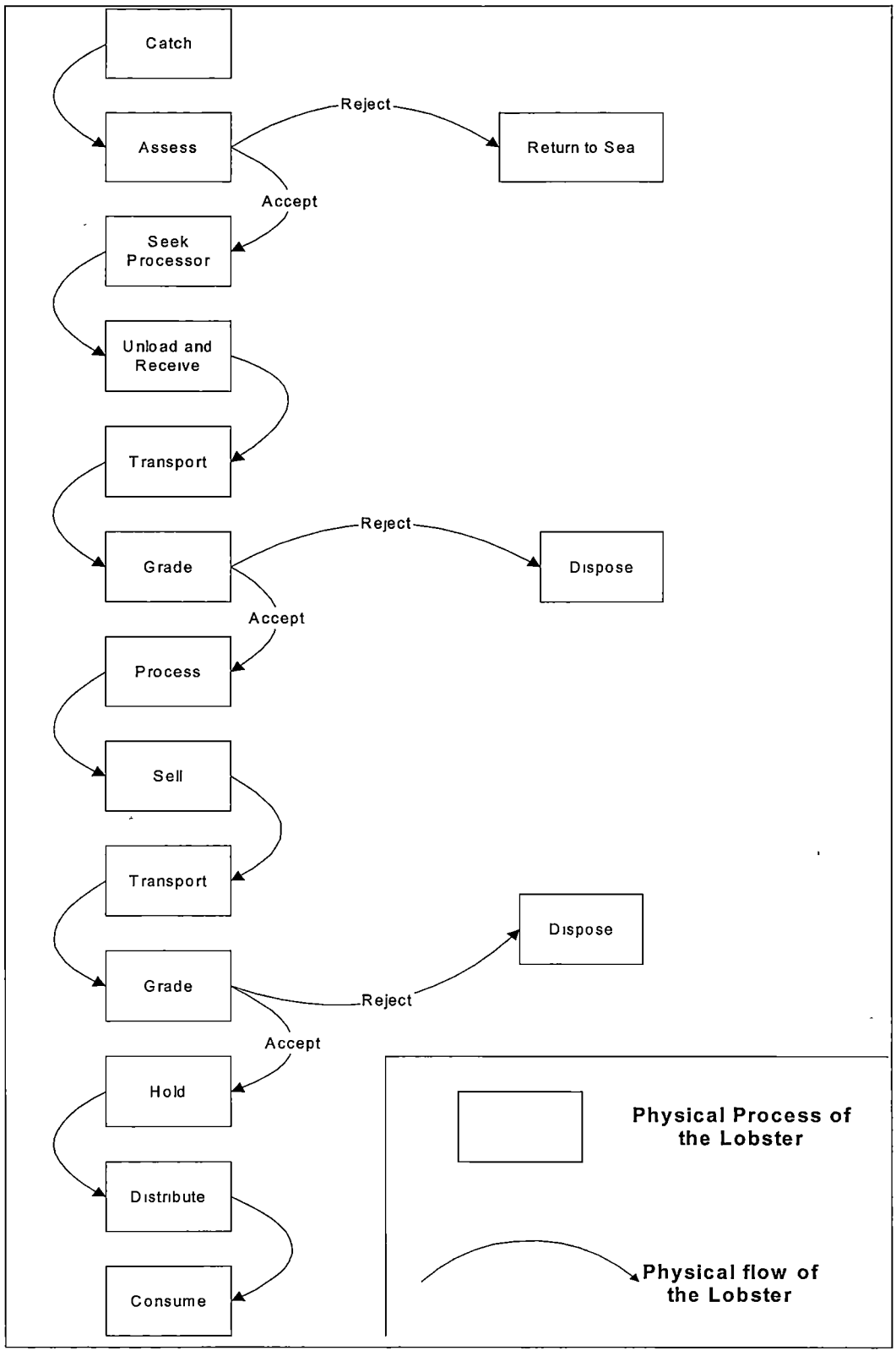
[10] E-logbook systems, such as the E-Boat project commissioned by FRDC with the South East Trawl Fishery, were designed to collect catch and effort data for industry and to fulfil government regulatory requirements.

The Tasmanian Rock Lobster Industry Information System

In Chapter Two, I introduced and described the Tasmanian rock lobster industry supply chain, which consists of multiple participants or actors, business processes and flows, and information processes and flows (see also Figure 4-1). Industry participants include fishers, processors and handlers, agents, brokers, wholesalers, freight forwarders, and restaurant and retail buyers. Business processes, interactions, and relationships among these participants have often been a reluctant necessity to ensure the product reaches the market place and financial gains are achieved. The industry also involves a number of organisations such as industry associations, research institutions, and government agencies that are focused on resource management and, to a lesser extent, industry development and marketing.

Marketplace requirements and Tasmanian Government policies and management plans, including the Quota Management System (QMS), define the business processes and information flows within the Tasmanian rock lobster industry supply chain. The supply chain is largely a manual information system, which relies on word of mouth, anecdotal records, and paper-based records. Current DPIWE data requirements from industry are primarily for compliance and resource management purposes. Some data are used for industry development and statistical reporting at state, national and international levels. Specifically, the QMS requires fishers and processors to conform to a series of regulations for the purpose of resource and quota management, namely quota docket books completed by both fishers and processors, and fishers' logbook information.

Figure 4-1: The Tasmanian Rock Lobster Industry Business Diagram representing the physical movement of the rock lobster from catch to consumption



This manual information system is almost entirely paper-based until the data are entered into the State Government's quota management database, licence management module and integrated catch and effort system. For compliance purposes, DPIWE uses a paging

reference number to uniquely identify fishers and processors and to monitor their movements. Fishers and processors obtain a paging reference number via a DPIWE call centre and make reports that described their movements. Fishers are also required to maintain a quota docket book and logbook that is submitted to DPIWE monthly. Few fishers maintain detailed personal logbooks in hard copy or electronic form either at home or on their vessel. The majority of the information is stored in the fishers' minds as tacit knowledge and becomes part of their intellectual and commercial property.

The marketplace, Australian Quarantine Inspection Service (AQIS) export requirements, and local government health regulations primarily drive food quality and handling standards of fishers and processors. However there appears to be a lack of integration between data requirements and systems of different government authorities. Traceability of the rock lobster beyond the processor appears to be non-existent and feedback from the marketplace appears to be communicated only in terms of demand and price, or if the product arrives in an unsatisfactory condition.

Opportunities to improve this manual Tasmanian rock lobster industry information system provides the motivation to explore alternative solutions to improve the industry supply chain processes for various outcomes elaborated in Chapter One. The following sections present two IS/IT solutions.

IS/IT Solution One: Electronic Trading Project

In January 2000 the TRLFA established an industry project, *Information service website and electronic trading platform*, which was supported financially by the TECC. The project was seen as a long-term strategic investment for the industry and eventually for the whole Tasmanian seafood industry. The project was not just about replacing the traditional supply chain; it was also about using EC as a tool to explore new opportunities in terms of marketing and trading, and to review the current business processes to see if EC could assist in streamlining and improving efficiency along the supply chain. The idea was for fishers to gain up-to-date information, have more control over how their catches were marketed, and encourage a more transparent supply chain in terms of details about physical logistics, feedback from end buyers and mechanisms for price determination. Improving transparency should bolster trust among supply chain participants and address some issues of risk and uncertainty.

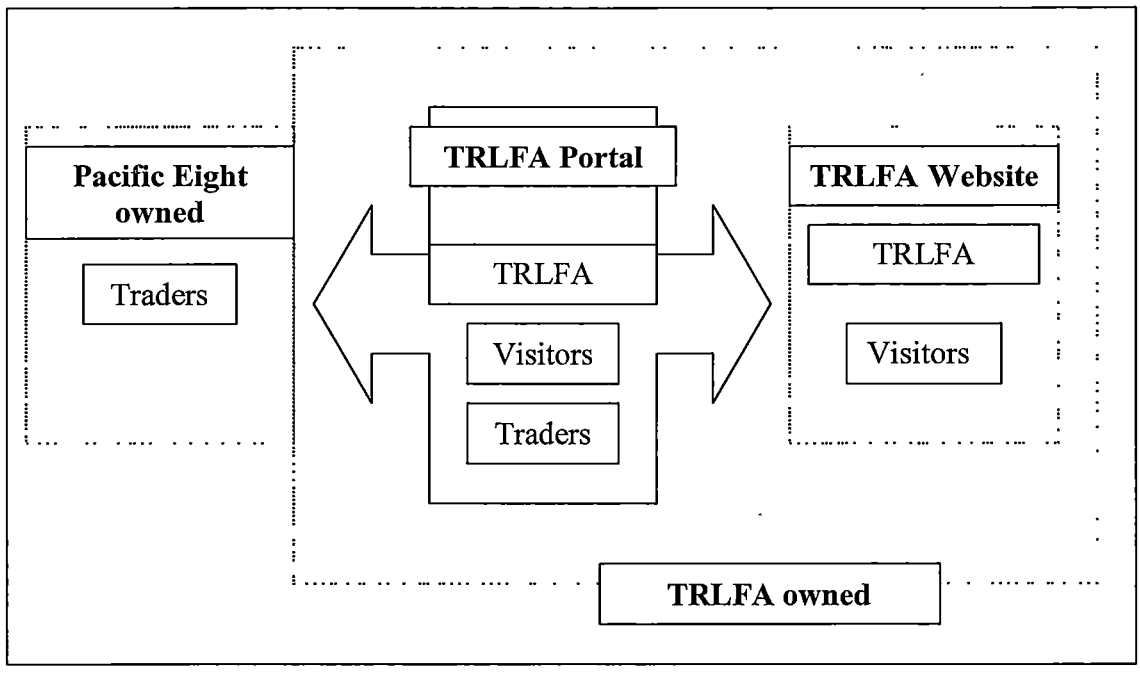
The joint vision that I had with the TRLFA was for it to provide a portal for the Tasmanian rock lobster industry community, which would include an online information service and trading facility. The approach was supported by the study *UK Fisheries e-commerce* (Brown 2001) that recommends a number of steps to achieve quick wins for an industry trying to adopt EC. "The first two steps include fisheries portal and e-trials, which involve establishing an industry website that acts as an Infomediary, and then trials are undertaken to determine the best approach for e-trading" (Brown 2001: 36).

As the project involved the industry association and a third party, Pacific Eight Pty Ltd, events and situations were often beyond my control and therefore I had to be opportunistic in collecting pertinent information about the project's progress. Pacific Eight Pty Ltd would have ownership and responsibility for managing the e-trading part, and the TRLFA would have ownership and responsibility of the information service website.

Proposed Model

The proposed model for the Tasmanian Rock Lobster Industry EC project involved three target groups; public/browsers/potential traders, fisher members and trading members. The public/browsers/potential traders and fisher members would be catered for through an information service website, and the e-trading platform would be just for trading members (Figure 4-2).

Figure 4-2: Proposed layout of the Tasmanian Rock Lobster Industry EC Project



The vision for the proposed e-trading platform was for fishers to explore new markets by posting their catches on a website for prospective buyers to view. In addition, the industry members could foster fisher-buyer relationships based on an agreed price, and product and customer service quality standards. The TRLFA was mindful of the obstacles that would ensue because the industry is subject to seasonal closures, quota allocation, and a highly variable price. The aim was to start this platform at the domestic level and progress to exporting product to overseas destinations. Apart from the logistic advantages of selling product domestically, it was envisaged by the TRLFA, even in 2001, that there were opportunities in the domestic market for Tasmanian rock lobster. If successful, this factor alone would assist with diversifying markets and increasing transparency along the supply chain.

The TRLFA and Pacific Eight Pty Ltd initially agreed to establish a pilot project where trials would be undertaken to test the proposed e-trading model with selected members of the industry. Participants in the trials would include fishers, packers, processors, buyers and Pacific Eight Pty Ltd. Its vision for the project was biased towards international rather than domestic trade, however Pacific Eight did agree to support the TRLFA in establishing a pilot project. The trials aimed to test the business rules, processes and logistics involved in the supply chain, with a view to trade online. It also became apparent that these trials were less about technology and more about the business processes necessary to trade. The trials would focus on a direct selling

method, based on a preference for regular buyers. This approach contrasted with the more opportunistic selling methods of open auctions used by some other platforms, and in particular with other seafood trading sites that commonly used auction-trading methods (Kaplan 2000), for example, World-catch.com. The main reason for the approach was that low volumes were anticipated from a species-specific site. Useful spin-offs were to include the provision of a facility to post product and orders online, and the capacity to foster better relationships between buyers and sellers.

A standard would be established for suppliers wanting to use this system. The criteria would be based on the assurance of supply, quality, and on the understanding of the need to work together as a community, similar to a cooperative. Suppliers who joined the e-trading system would become part of Pacific Eight Pty Ltd and be entitled to B class shares. The arrangement would not vary much from a fisher's cooperative. Payments would be either credit card, cash on delivery or on account, with a preference for credit cards and accounts. Orders could be sent via SMS text messages to fishers and processors. It was suspected that processors would be initially reluctant to participate in this new trading system as it was likely that the new system would be regarded as a threat to their established modes of operation. The processes of operation are described in Figures 4-3 and 4-4.

Figure 4-3: E-trading Supply Chain – Step One

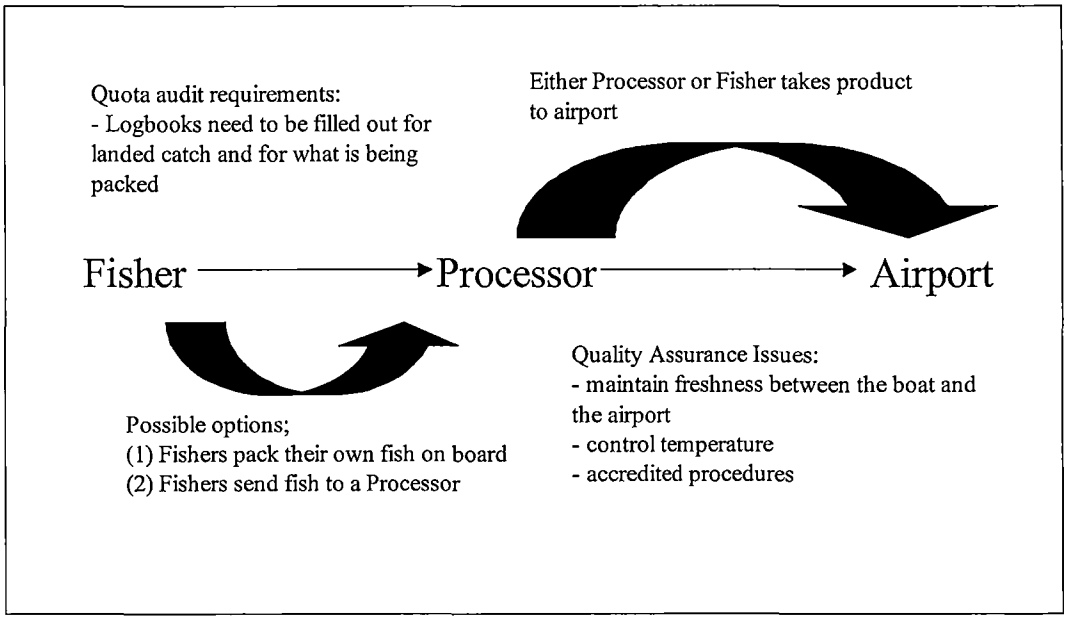
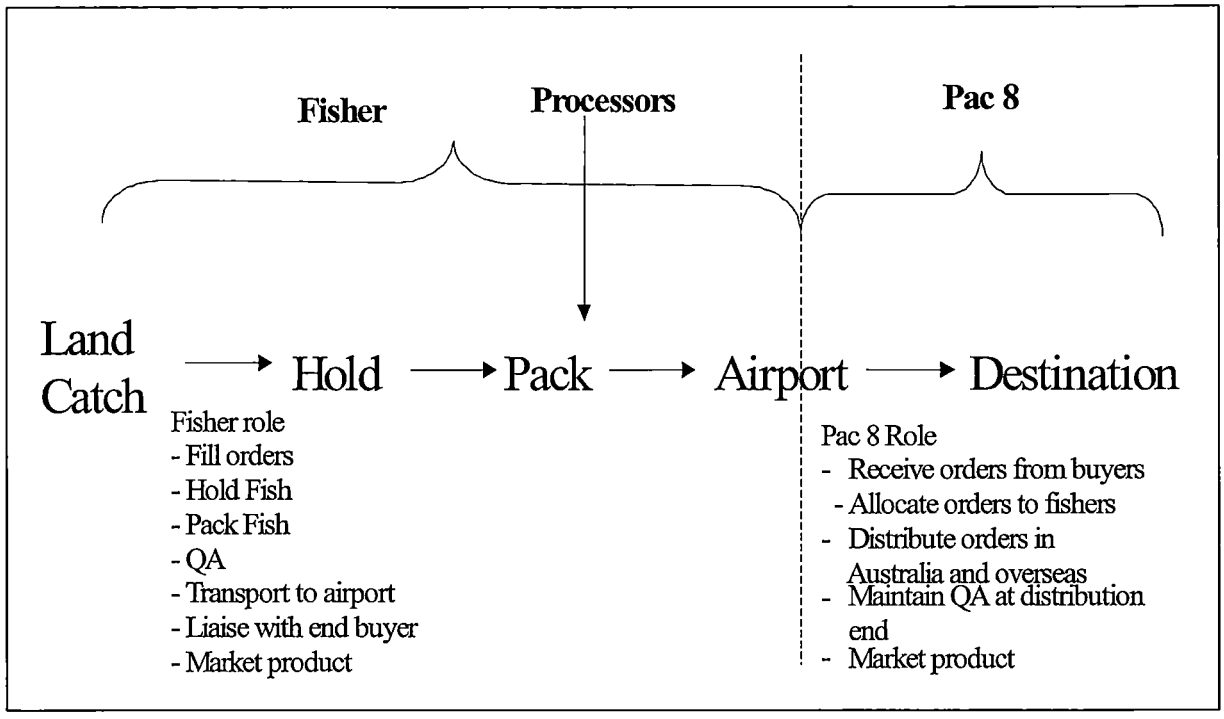


Figure 4-4: E-trading Supply Chain – Step Two



One potential problem that could have affected how fishers and processors used this technology was the low volume that was likely to be shipped. Small shipments could result in increased prices to pack and freight rock lobsters. Availability of freight space and price is related to shipment size and coordination between processors and freight providers. For example, if a large shipment is organised weekly with the airfreight providers there is a greater assurance of space, as priority is made over smaller and irregular shipments. A more coordinated approach between suppliers of rock lobster and airfreight providers would be advantageous to ensure space would be available to transport product from Tasmania to its final destination. Once trials were conducted, and the model accepted by the TRLFA and Pacific Eight Pty Ltd, the project would have been expanded to include the entire Tasmanian rock lobster industry. The following section reviews the efficacy and fate of this IS/IT solution.

IS/IT Solution One: Reviewing an Electronic Trading Project

The Tasmanian rock lobster electronic trading project began in January 2000, and was stage-managed by the TRLFA and funded by the TECC. The project was to establish an information service website and electronic trading (e-trading) platform. Based on the anticipated completion date of the project, it was envisaged that this doctoral project would commence in March 2001 to study its uptake among and impact on the

Tasmanian rock lobster industry. The website was completed and launched in June 2000; however significant delays occurred in relation to the e-trading platform. One condition of TECC funding was that the e-trading platform be built under the umbrella of the Tasmanian Business Online (TBO) initiative, which was to assist Tasmanian businesses and industry associations to adopt an e-commerce model. In theory this condition was fair to the TRLFA, but in reality the TBO project was itself, still being developed when the TRLFA was ready to begin part two of the project, and when TBO did get off the ground, the TECC deemed that the e-trading model that the TRLFA was seeking did not fit the new TBO model.

The TRLFA wanted to establish an e-trading platform for fishers to seek new buyers, have closer fisher-buyer relationships, and have greater transparency in the supply chain in terms of information flows, customer loyalty, and feedback on quality and product requirements and specifications. The initial motive for this project was to by-pass the processors, so that fishers could directly communicate and trade with end buyers, because of ongoing tensions between fishers and processors. To the frustration of the both, lack of trust was the main issue in terms of price formation and product demand. It was suspected by fishers that there was manipulation of demand by processors (for example, prices always seemed higher when fishers went to sea compared to when they returned with a vessel load of rock lobsters).

Independently of poor relations and prior to the onset of events such as SARS and the rising Australian dollar, some fishers were very concerned about the continued reliance on China, on access to a duty free point of entry to that market via Hong Kong, and on the patronage of six major buyers who distribute the lobsters throughout China. To date that method of entry into the marketplace has been accepted by fishers and exporters due to the high returns, which provide little reason to explore new markets. The lack of drive to seek alternative markets has meant that the industry's future has become vulnerable due to poor risk management strategies. The SWOT analysis described in Chapter Four reinforces the observation that Chinese buyers have a better understanding of our business culture than we do of theirs, and thus they have a competitive advantage. That advantage provides opportunities of price manipulation with the gradual trend to push the price down, resulting in greater pressures on the margins for local fishers and processors, who, in turn, experience increased costs to enter and remain in the fishery.

While the TRLFA waited on the TECC in order for the e-trading project to commence, it was also plagued with problems with the information service website. The web developers failed to make the website user-friendly for TRLFA members to update information and for fishers to use. In March 2001, the doctoral project commenced on the basis of assurances by TECC that the e-trading part component of the industry project would begin in 2001; it did not. Fortunately by the middle of 2001, Pacific Eight Pty Ltd, entered the scene and was introduced by the TECC to the TRLFA as a potential e-trading provider. Pacific Eight's interest was to e-trade Tasmanian seafood, including abalone and rock lobsters, in addition to other primary products. For the TRLFA, an attractive feature was the fact that the Sydney-based directors had an existing association with and appreciation of Tasmanian seafood and the Tasmanian fishing industry. The e-trading model being created by the company met the TRLFA's requirements for e-trading: to be able to display their catch online and market rock lobsters to restaurants, hotels and major food outlets in places such as Sydney, Hong Kong and Singapore. Pacific Eight had already conducted research on the supply chain of both abalone and rock lobster industry sectors, particularly from Tasmania to the domestic and foreign markets. Issues such as logistics and distribution were a high priority it and, as a result, it had established a strategic alliance with a Singapore distribution company to handle Tasmanian rock lobster in the Asian region. The company had conducted roadshows to market Tasmanian abalone and rock lobsters to restaurants and hotels in Bangkok, Singapore, Hong Kong and Sydney.

Numerous industry meetings with Pacific Eight were observed and documented, a model for e-trading was devised, and a new information service website was developed. Most participants were also dispersed throughout Tasmania and interstate, and the fishers' availability for project meetings was dependent upon seasons and weather. However the implementation of the e-trading model became a much more complex exercise than the TRLFA had anticipated. The TECC took a dominant project management role and redefined the direction for the industry project and for the doctoral project. Negotiations between the TRLFA and Pacific Eight provided insights into reasons for the numerous pitfalls that both sides experienced, with much of the discussion about business rules rather than technology. In May 2002, an updated industry website was launched at a TRLFA industry meeting. The website was received more favourably by fishers than its predecessor with some volunteering to maintain the

website content. The website was the first step in the uptake of e-commerce for the industry, and provided the necessary platform for fishers to familiarise themselves with the Internet and e-commerce, both requisite for the second step needed to trade lobster online.

Over time, differences in objectives between the TRFLA and Pacific Eight began to emerge. The TRLFA wanted to develop domestic markets for the Tasmanian rock lobster for two reasons. They could see undeveloped market opportunities for rock lobster, and the domestic process was less complex than exporting, particularly when setting up an e- trading platform. As Pacific Eight's focus was predominantly on exporting to new overseas markets, numerous overseas trips by company members to Bangkok, Hong Kong and Singapore occurred. Those commitments reduced contact between Pacific Eight and the TRLFA, making it difficult for industry members to comprehend, adjust to, and meet the needs of Pacific Eight's business model. For members to adopt an e-trading platform, a change in culture was needed, one involving reengineering the supply chain, educating and training industry participants, and finding time for adjustment. The pressure to supply export markets also meant that fishers had to gain cooperation and support from sceptical processors. Nevertheless, in August 2002, the TRLFA and Pacific Eight agreed on the business rules required to establish an e-trading platform for the online trading of rock lobsters. However, initial market enquiries resulted in lower than established beach prices.

In October 2002, Pacific Eight secured a large order in Hong Kong for Tasmanian rock lobster, but the industry was far from ready to meet this requirement using the new system. Unable to supply, Pacific Eight ended up losing face with contacts, and relationships between the TRLFA and Pacific Eight deteriorated. Fishers refused to accept a beach price lower than they were getting from the Chinese marketplace for the purpose of establishing new markets. This attitude was significantly different from that held by representatives of the TRLFA who could see that beach prices (particularly for the short term) needed to be lower than traditional market prices to establish new markets for the industry to diversify markets and minimise risk. Pacific Eight also had financial pressures to acquire business quickly, which meant its directors were impatient with the industry, whose members were trying to adjust to change.

The failed project highlighted the points that the adoption of e-commerce applications is more about business processes than technology; that all supply chain members play an important role in the industry; and that better relationships, between fishers and processors should be fostered to achieve greater transparency and management of the supply chain. Ultimately it is about utilising information to mitigating supply chain risk and uncertainty through improved confidence along the chain (Christopher & Lee 2004). These observations were also partly reinforced during a joint trade Mission to China in May 2002:

> A lot of the fishers and exporters went on that trade mission really to see and meet some of the customers and establish, particularly for fishers, whether they were really getting a fair proportion of the total return. I think everyone was amazed that how little mark up there was from the exporter to the final customer in China. That was brought out in some of the restaurants where the abalone and rock lobster were selling something about AUD 120 per kilogram, and that time it was basically double what the fishers was being paid. Relative to what the cost of abalone or rock lobster was getting in an Australian restaurant, it was very cheap (Industry Development Manager, pers.comm., 2003).

> Now given the fish has to be taken across the border into China and distributed around a huge country and the logistics of getting it around, and maintaining the live fish right through to the restaurant, it was surprisingly little mark up and that was confident feedback for some people (Industry Development Manager, pers.comm., 2003).

By improving the understanding about the business processes and price formation along supply chain, buyer-seller relationships can improve. In this instance, the modest margins challenge the perception that Tasmanian rock lobster fishers and processors are price takers because of price formation. But in fact, the industry's reliance on these markets are what makes Tasmanian industry members price-takers.

Problems associated with the e-trading project were also related to timing. The industry was rushed into adopting a model that they were still adjusting to, and the lack of ready face-to-face contact with Pacific Eight personnel led to suspicion by members of the

TRLFA. At the time, the upstream supply chain members enjoyed high beach prices and, apart from a few, they could see little reason to change and adopt costly risk management strategies such as diversifying the target markets. No one could envisage that within less than 12 months, the fishers' position of relative comfort would change.

By the end of 2002, I had observed some emerging trends that were relevant to the four main themes of my thesis topic. Through my connections with TFIC, Tasmanian Freight Logistics Council (TRLC), Trade and Marketing Division, Western Australian Fisheries, and national bodies such as Seafood Services Australia, I was able to participate in state and national workshops and meetings relating to seafood industry supply chains with a particular focus on traceability, quality chain management (cool chain logistics), and e-logbook systems. I became privy to emerging trends and work in Europe, US and Australia that used IS/EC as a tool for traceability and quality management of supply chains. Based on these observations, I felt a need to develop one e-logbook system that integrated the purposes and therefore streamlined the requirements of industry supply chain participants, while providing participants with greater feedback about and access to useful information for their business. There was also a need for the industry members and myself to learn and build upon from past experiences and knowledge. Examples of these requirements among industry participants included the need to maintain a quality management, logistics, or quota management systems.

It was very timely for me to identify these trends and to see an opportunity to explore this area using the Tasmanian rock lobster industry setting. The industry's use of paper-based logbook and quota docket systems for DPIWE's resource and quota management requirements made it a suitable industry to undertake such research. The TRLFA was supportive of this change in direction as it appreciated these emerging trends, and understood that I wished to modify the thrust of my research. It also became apparent that my development of such a system for the industry supply chain could be strategically beneficial in terms of risk management, competitive advantage and sustainability outcomes. More broadly, such a system could also apply to the food industry in general.

My objective at that stage was to refine my research plan such that it was more independent of the industry and to minimise external risks to the thesis, and develop a

clearly structured path to successfully complete the work. I established a new set of objectives and a research plan and tapped into other skill sets such as systems analysis and data modelling. It should be noted that the emphasis of my research also shifted to sustainability, security, and risk management. From these adjustments came Solution Two.

IS/IT Solution Two: Rock Lobster Electronic Management System

The major difference between Solution One and Two is that the latter takes a broader approach to the application of IS/IT in its approach to the industry supply chain. Solution Two takes an integrative industry supply chain approach and focuses on using IS/IT to improve information flows, business processes and information management among supply chain members. Its objectives are to convert the manual information system currently operating in the industry supply chain to a computer-based information system; to use fishers' logbook and quota data as the basis of the system; to provide traceability of product and be able to monitor quality, logistics, compliance, and customer satisfaction from the end market place; to differentiate the product from competitors by use of brand names, codes of practice, and accreditation; and to provide feedback to supply chain members.

My vision for this information system is that it will be an industry supply chain tool for both vessel-based and land-based information recording. The objective is to use fishers' logbook and quota docket book information as a basis to establish a system, which consists of two components: a fisheries business management system and a tagging system designed to track product from catch to consumption. The aim is to assist with industry SCM and to include all key supply chain members including fishers, processors, government, researchers, freight logistics, wholesalers, and end buyers. I envisage that the new system will improve communication links among all supply chain members, including end-buyers. The system will be for compliance and resource management purposes, and for gathering information to assist with traceability, accreditation schemes, industry development, and trade and marketing. Ideally, the new system may provide regularly updated information on allocated quota balances, average beach and sale prices, capital and operating costs, and product quality and destination.

Experiences in other seafood and agricultural industries world-wide, such as those in the New Zealand rock lobster industry's catch and effort information system (Seafood New Zealand 2002) and or in European fish chains in the Tracefish project (Denton 2002) suggest the following. Information systems can assist industries in terms of SCM, decision support, knowledge management, strategic planning, sustainability outcomes and competitiveness for rural industries in the global market place. The ability to record and share specific information enhances the potential to manage the supply chain effectively and strategically, particularly in terms of risk management relating to the environmental impact issues and product quality, and industry and market development. These effects may have significant positive flow on effects for economic and social outcomes that advance the principles of sustainability in practice. In this regard, Mentzer and Moon (2004: 45) supports the role of SCM in terms of providing benefits to supply chain participants by "building relationships, support systems, and processes both between and within participating companies". All parties can share benefits if information is made available across organisational boundaries, and plans are coordinated. However Mentzer and Moon (2004) argues that to achieve these benefits there is a need for supply chain managers to understand demand and the cultural divides that often separate the communities of supply and demand.

In light of the foregoing, my IS/IT model focuses primarily on understanding and developing the supply side so demand information can be captured and managed better from an upstream perspective. This emphasis does not remove the importance of the demand side, which has been deemed out of the scope of this dissertation, but provide research opportunities for others to explore the perspectives of those in the market place seeking Tasmanian rock lobster.

To fully test Solution Two, it was necessary to describe the Tasmanian rock lobster industry supply chain in both its current and proposed states using data models; describe the data requirements for the proposed system; and outline how the proposed system would then be assessed in terms of industry acceptance. Using the data modelling software tool, Microsoft Visio 2000 Professional Edition, data models such as business process diagrams, IFDs, and ERDs allow the industry supply chain to be represented diagrammatically in terms of its physical business processes, decisions and information flows. I constructed preliminary data models of the supply chain based on available information obtained from government and participant observations of industry

operations. In-depth interviews and an industry forum were used to consult key industry stakeholders of the industry supply chain and included interactions with fishers, processors, freight providers, buyers, resource managers, fisheries research scientists, compliance, trade and market development representatives, and members of industry associations and councils.

The industry forum provided an opportunity for me to propose a Rock Lobster Electronic Management System to key stakeholders of the Tasmanian rock lobster industry. The proposal included a prototype developed by a third party electronic fisheries management system developer, Ocean and Land Resource Consultants (OLRAC) Pty Ltd. The aim of the prototype was to assist in communicating the concept to the Tasmanian rock lobster industry, and to gain constructive feedback from industry members about the proposed concept and its appropriateness for the Tasmanian rock lobster industry and other fishing industry sectors. The forum also provided an opportunity to consult with industry and gain feedback on the proposed system from interview participants.

Proposed Rock Lobster Electronic Management System

The proposed Rock Lobster Electronic Management System has two components: a business management system and a tagging system.

1) The business management system (BMS) is a stand-alone database on office/vessel PC for fishers and processors that can be integrated into freight providers' tracking systems. The BMS is designed to apply to all supply chain participants, particularly fishers, processors, freight providers, and wholesale buyers (Table 4-1).

2) The tagging system (TS) involves tagging rock lobsters, and tracing them from fishers to end buyers. A tag includes a barcode or GPS transponder/microchip that stores key information about the product and the industry supply chain. The information includes: market reports about the lobster provided by fishers, processors, and freight providers; market feedback reports from buyers, freight providers and processors; GPS location and temperature readings during transit; catch unloaded or dispatch orders; and branding information to uniquely identify the product in the market place. The level of detail to which the product is tagged depends on time and cost of operating the system. The following options were considered by me: uniquely identify

individual fish onboard the vessel by using a tag; uniquely identify individual fish upon arrival at the processing factory by using a tag; and uniquely identify boxes upon dispatch from processing plants. These options were based on the level of detailed information collected and transferred along the supply chain. The more detailed information collected and transferred, the greater the cost in time and money.

Table 4-1: Tasmanian rock lobster business management system

Supply Chain Member	Information Collected	Reports Generated
Fishers	trip and catch details (date, time), GPS lat/long, numbers, weights, depth, quality descriptors, beach price, purchaser details (processor name), paging reference number, product identification, environmental observations, operating and capital costs	• logbook and quota docket book reports for DPIWE • fisher market reports such as name of fisher and vessel, catch details, quality description
Processors	• fisher market report • quality/catch description upon arrival, beach price, sale price, buyer details, destination details, freight provider details, and consignment number	• quota docket book report for DPIWE • processor market report • fisher market report, buyer and freight details • feedback report including sale price and product status upon arrival at processing plant and at buyer
Freight Providers	• fisher market report • processor market report • destination details, consignment number, freight cost and product quality during transit	• freight provider market report • fisher market report • processor market report • tariffs, freight duration and product quality during transit • feedback report including departure and arrival dates, freight duration, freight cost and product quality during transit
Wholesale Buyer	• freight providers market report • product status upon arrival, retail destination, retail price	• market feedback report • product status upon arrival, retail destination, retail price

Key Information Requirements

The key data requirements of the system described in this section are based on the assumption that each lobster can be uniquely identified. This assumption is subject to acceptance by members of the industry, but in an ideal world the exercise would allow each product flow to be mapped. Key data requirements for the system are the logbook and quota docket book requirements specified by DPIWE (see Appendix 4) and these are sourced from DPIWE's *Rock lobster fishery policy document (1997)* and *Rock lobster fishery management plans*; *Fisheries (Rock Lobster and Giant Crab) Rules 2001*; and *Fisheries (Processing and Handling) Rules 2001*. The primary reason for obtaining such information is for compliance and resource management. Other key data requirements that would be useful for quality management, SCM and marketing

include: lobster identification; quality recording of rock lobsters (colour, size, condition, legs lost such as soft shell); freight details (consignment number and destination); and buyer and market information (batch and beach and sale price). Codes of practice to minimise the environmental impact of fishing, processing and handling operations, and quality and food safety may also be included.

If the feasibility and practicalities of tagging each rock lobster were accepted by fishers, unique identification could be mapped against catch, trip, and vessel, and stored electronically. Associated with the rock lobster would be attributes such as weight, size, colour, and physical condition. One option would be to tag each rock lobster as it is caught and determined suitable for sale. The catch details recorded in the system would then be compared against constraints such as a fishers' allocated quota. Each catch would be mapped against each trip, which may have multiple catches and attributes defining the trip. At that point, the first feedback mechanism would take place in the system, and includes quota, quality, and price checks.

Once rock lobsters are tagged and details recorded, the fisher searches for a processor to buy the catch. After selecting a processor, securing an agreed beach price and an unloading port, the fisher would then request a paging reference number from DPIWE. This number would be received electronically via email. The beach price, processor reference number, and paging reference number, would be assigned to the catch and entered into the system. The fisher would then proceed to a pre-arranged port facility for unloading. The catch also has a beach price attribute, which would be added into the business management system, so the fisher could obtain calculations on total returns for the quota year. This process would allow fishers to extrapolate potential earnings for the quota year and compare these with others from previous years, allowing them to predict potential risks of not covering capital and operating costs. The process would also assist fishers to assess their banking arrangements and tax returns.

During unloading, further weighing and counting would be required, in addition to recording information for the Tasmanian Government's management and monitoring of the resource. At that point, there would be another check on the quality of the lobster. If the catch were accepted, then the transport provider would take the catch to the processor. At the end of each trip, reports from the system would be run for State Government quota and logbook requirements, as well as for research. The reports

would only contain that information from fishers' personal logbooks needed to meet the data requirements of the regulators. The rock lobster, catch, fisher, and vessel details would then be passed onto a processor along with all the necessary attributes to meet their regulatory requirements. The collection of this information could either be done by storing information on a microchip on the tag and/or in a database on a secure website. The attributes also would include quality of the catch at the point of departure from fisher, beach price, catch details, vessel and fisher details. Another report would then generated from the system based on numbers and weight associated with the catch, and that is sent to DPIWE.

Transportation of live rock lobster to the buyer's destinations often involves significant risks such as damage or mortality, so quality monitoring measures need to be undertaken by the processor and the freight service provider. Processors may also have to hold rock lobsters while waiting for buyers to purchase the product or arrange freight space, and therefore they need to consider the impact of delays on the rock lobster and monitor its condition.

The catch is then mapped against a batch. The batch can include multiple catches from multiple fishers. This step allows processors to make up orders to meet buyer requirements in terms of size and colour of the product. However at the same time, if the origin of the rock lobsters was required then processors would have a record of the location in which the lobsters are harvested from. Each batch would have processor details, weight, product description, destination, buyer, consignment number, and sale price. Each buyer also would have associated attributes such as region, address, product requirements, and sale price history. When processing lobsters under the current system, processors assess lobster quality, particularly in terms of export requirements. Under the new system, this information would be recorded on the system prior to shipment to the buyer. Each batch would have a consignment number, which would be used to track the product during transport. The batch would also have buyer, processor, destination, arrival and departure date, and quality at point of departure from processor. As the batch would be linked to product, catch, lobster and vessel, the buyer would have the ability to track the product back to its origin. The attributes at the buyer's end would include the consignment number, processor, quality upon arrival, arrival date, destination, whole buyer details, retail buyer details and quality on departure.

To establish a Rock Lobster Electronic Management System, non-functional and functional requirements need to be identified, and then verified by the industry stakeholders. The functional requirements of a system are generally associated with specific requirements that a software application should achieve, such as output reports and displays, services provided by system functions; and security and access controls. In contrast with functional requirements, those, which are non-functional, are associated with the business needs of the system such as processes, operational objectives such as performance standards, and user needs. Table 4-2 lists some of the functional and non-functional systems requirements for the Tasmanian Rock Lobster Electronic Management System.

Table 4-2: System requirements of the Tasmanian Rock Lobster Electronic Management System

Non-functional	Functional
To have a user friendly system for fishers and processors operating, at times, in adverse working conditions	To ensure minimal data entry is required and minimal impact on day-to-day fishing operations, while being able to record useful and good quality data
To ensure security, confidentiality and privacy policies and conditions are established to ensure the data are used legally and appropriately to avoid harm to individual fishers, industry or government	To ensure scalability of the system to fit in with fishing businesses of different sizes
To ensure data integrity and quality during collection, storage, and extraction of data	To ensure adequate space on vessels to have the system installed (depends on vessel size and layout) • Is there enough space to secure a laptop computer?
To ensure a scalable system so industry participants can afford to participate in the system, even at a basic level; this requirement can also be achieved through sponsorship from government and industry	To ensure the system meets fishers' requirements to access information pertinent to business
To improve transparency of supply chain	To use catch information to determine how much quota is left
To improve understanding of price formation of product along the supply chain	To use recorded beach prices gained from catch to extrapolate the overall income for the quota year and determine if predicted income for the year can cover the operational and capital costs to run the business
To identify which marketplace has the best returns at any given time	To have feedback mechanisms and control points
To gain feedback from the marketplace on quality and product specification	To track product from the day it is caught to the day it is served to a consumer
To have efficient methods of recording data for the purpose of quota and government compliance	
To have the capacity to undertake environmental, biological and economic research projects with government and research institutes	

Although the proposed system is yet to be reviewed by members of the industry via consultation with key stakeholders, some benefits and issues have already been identified though preliminary observations (Table 4-3), which highlight my appreciation and awareness of the benefits and issues when developing a solution.

Table 4-3: Identified System Benefits and Issues for The Tasmanian Rock Lobster Industry

Benefits	Issues
Business and industry management tool for fishers and processors	Industry participation and recognition of benefits
Traceability • Tracking product beyond the processor • Proving origin of product	Tagging technology • cost • compliance issues • transferability • needs to be easy for fishers or processors to attach on lobsters whilst at sea or in factory • needs to be durable, malleable and able to withstand travelling with the lobster throughout the supply chain without causing stress to it, and • able to store information and be read by a scanner; for example microchips • needs to be accepted by airlines if tracked during transit
Information feedback and feed-forward along the supply chain	System reliability and security • potential loss of vital evidence if system fails and the paper-based system no longer exists
Processors are able to identify and avoid problems with freight	Resource management potential loss of records if system fails and the paper-based system no longer exists, and • no perceived savings in terms of staffing; cheaper to have five data entry clerks than three quality assurance data analysts
Encourage good practice and highlight poor practice in industry	Custodianship of information
Greater understanding of market requirements by all chain participants • Fish with market requirements in mind	Confidentiality and security of information
Improve new market opportunities • Niche markets requiring quality and environmental traceability of food products • Matching markets with quality status i.e. US tail market and domestic market live and cooked market	Funding, sponsorship, leadership and regulation
Consumer education • Tasmanian Rock Lobster versus Competitors	

Summary

In this chapter I have highlighted the significance of IS/IT as a possible solution to some of the issues that characterise the current and future status of the industry as described in Chapter Three. I then outline two IS/IT solutions for the Tasmanian rock lobster industry. The IS/IT solutions drew from preliminary background research, the literature and general observations about trends in IS/IT in the seafood industry. IS/IT Solution One began as an industry project before the thesis commenced. Its fate was documented and reviewed, and the lessons gained contributed to the formation of IS/IT Solution Two. The analysis and review of that second solution, including the mapping

of the supply chain and modelling the concept, is undertaken in the following two chapters.

CHAPTER FIVE: MAPPING THE INDUSTRY SUPPLY CHAIN

The Tasmanian rock lobster industry supply chain is *ad hoc*, informal, untraceable, and not transparent. The main drivers regulating the supply chain are the State's quota management system, AQIS export regulations and the market place. Fishers' logbooks and records, DPIWE's quota docket books and quota management system, and the very industry participants are considered key data stores holding vital product information. The knowledge stored in participants' minds is referred to as tacit knowledge (Dampney et al. 2002) and it is composed of and influenced by their skills and experiences acquired during their fishing or processing careers. Frustrations among supply chain members indicate that flows of information about prices, market trends, and product specifications are restricted, and that decisions are being made on incomplete information. To overcome this problem, tacit knowledge or "neuro data stores" about business operations and product knowledge need to be shared among industry participants to ensure a more balanced perception about the industry and the resource.

A computer-based information system for the supply chain would be advantageous in such circumstances, by providing the facilities to store information electronically. Whether it is related to the fishing or processing operations, product, shipping, or purchase, information can be shared electronically across the industry. This enhanced service delivery assists in improving knowledge and understanding of what constitutes a highly valued product, how this changes over time, and how the market influences the exploitation of the resource. An inter-organisational and inter-business approach is supported by Giannakis and Croom (2004) and Kalakota and Whinston (1997: 293) who define the supply chain concept and reinforce my approach to understand and manage the industry supply chain:

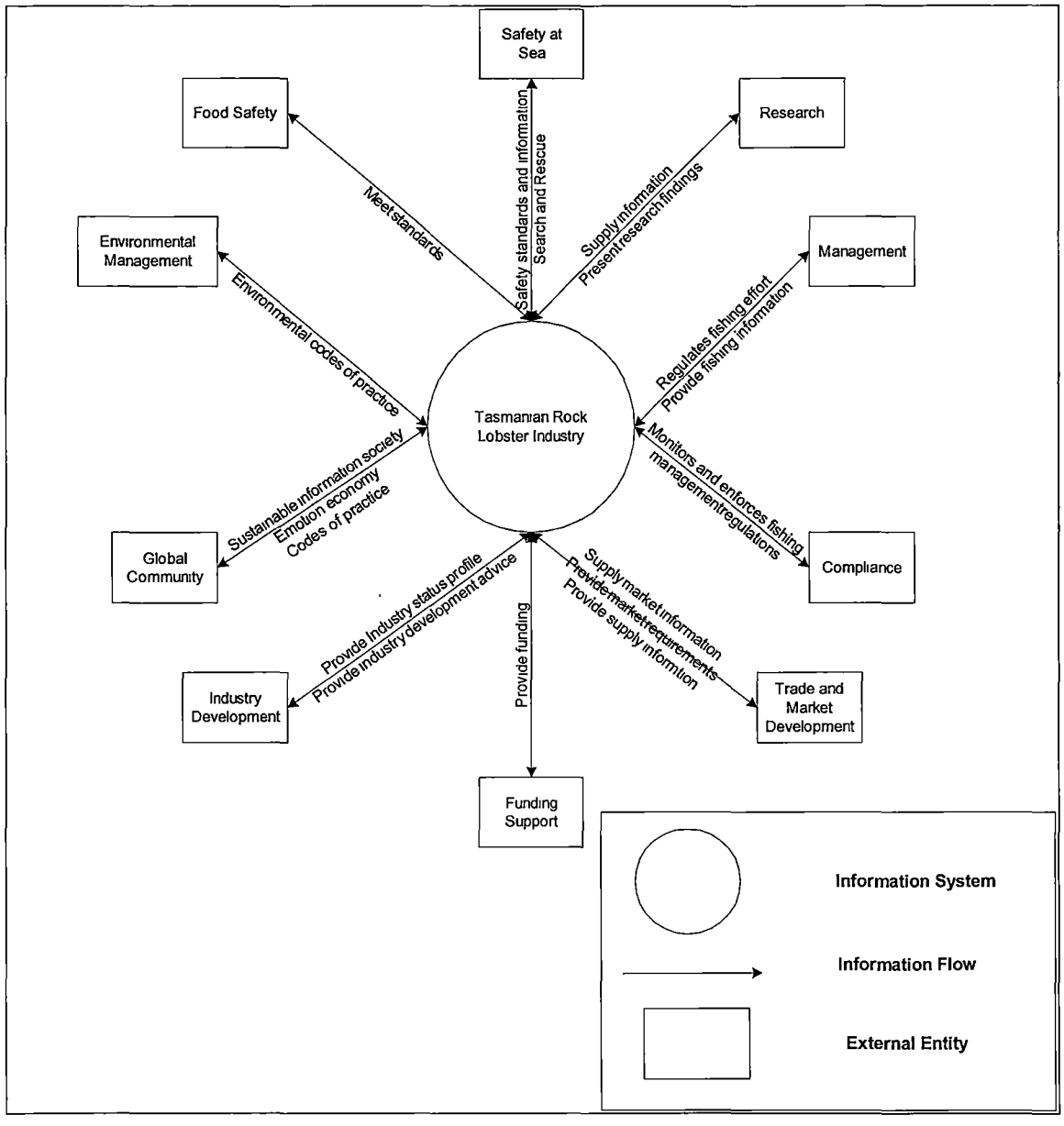
> The key functions in supply-chain management are to manage information about demand to enable a better understanding of the markets and customer needs.

Based on these supply chain definitions, and before I ventured to develop a computer-based information system for the Tasmanian rock lobster industry, it was important to model the current industry supply chain system. The three types of modelling

techniques used to map the industry supply chain are physical business sequence process diagrams, IFDs, and ERDs. The physical business sequence process diagram maps the physical flow of the rock lobster, and the physical processes associated with it. The IFDs represent the information processes, data stores and information flows along the supply chain. To place the Tasmanian rock lobster industry in relation to external entities, a context diagram is used (Figure 5-1). In this diagram I describe at a conceptual level the external entities which are the key players in the industry that interact with the current supply chain information system, and I trace the information flows and relationships (networks) between and among these external entities and the system (Hawryszkiewycz 1994). In Figure 5-1, external entities are represented using themes such as the global community, research, funding support, management, compliance, trade and market development, industry development, environmental management, and sea safety operations. As one example, the global community external entity represents the general public, consumers, and other users of the resource. The relationship between this entity and the industry system is the industry's accountability to the broader community or, in reverse, the communities' requirement for probity. The management and sustainability of resources is a global concern, and gaining permission to access and harvest these resources is carefully managed by international, national, and state jurisdictions. In addition to demanding that harvesting is managed sustainably, the global community is increasingly concerned with public health issues relating to food safety and quality, and the ethics of environmental care, including animals, plants and habitats. Codes of practice for harvesting, processing, packaging and transporting are becoming equally important to the global community and industry is responding to the need to be accountable and provide information about its conduct.

As a second example, in relation to the environmental management entity, in Australia the need for industry accountability in relation to environmental practices is demonstrated by the Environment Australia's requirements of businesses that they undertake environmentally sustainable practices to gain export exemptions, which is in accordance with the *Environment Protection and Biodiversity Conservation Act 1999*. In Tasmanian fishing industries, these practices are also regulated under the *Living Marine Resources Management Act 1995*.

Figure 5-1: Level 0: Tasmanian Rock Lobster Industry Context Diagram representing the key players (external entities) and their relationships with the industry



The third example is the research entity which represents all key players involved in fisheries-related research findings, of which the Tasmanian rock lobster industry is a key beneficiary and supply information. Players such as the Marine Laboratories at TAFI and CSIRO, Hobart, University of Tasmania, Australian Bureau of Agricultural Research and Economics (ABARE), Australian Bureau of Statistics (ABS), and Bureau of Rural Sciences (BRS) are implicated. The fourth example is the funding support entity, which represents the key funding bodies that facilitate research whether it be pre- or post-harvest research on the Tasmanian rock lobster industry. Examples of funding bodies include DPIWE, FRDC, NFIS, and the Australian Research Council (ARC).

Management and compliance entities represent key players involved in managing the industry and the exploitation of the resource. These entities include DPIWE, DPPS, and AFMA. The key relationship between these players and the industry is the legislated requirements for the industry to harvest the resource, process and sell. DPIWE and DPPS are involved in the management, compliance, and enforcement of fisheries under state jurisdiction, whereas AFMA is a Commonwealth fisheries agency. Fishers who have been allocated access rights to the resource are required to supply catch information in fisheries logbooks and record volumes and movements of catch in quote docket books and make telephone reports. Processors or fish handlers who process and on-sell on the catch are also required to supply management bodies with movements of catch in quote docket books.

The trade and market development and industry development entity represents State and Commonwealth government agencies such as DPIWE, DED, Austrade, and DFAT. The industry development entity also includes national seafood industry bodies such as SSA. These agencies assist the industry is seeking new market opportunities and managing fluctuations in existing markets. Their joint mission is to improve economic growth and sustainability for the industry and the communities that depend on the industry's revenue.

The current Tasmanian rock lobster industry information system consists of two sub-systems, which involve key entities such as the fishers, processors, government, transporters and buyers; Figure 5-2 is a lower level diagram and describes each system. The main differences between the two sub-systems is that, first, the Tasmanian government regulates the quota/logbook system for the purposes of managing the resource, whereas the supply chain information system is an informal industry information system that ensures the objectives of trading rock lobster are achieved. Second, one system includes the entire supply chain and the other system only includes operational information about fishers and processors. These two sub-systems are connected by the legal requirements of fishers and processors to supply information for the State Government's quota/logbook system.

Figure 5-2: Level 1: Tasmanian Rock Lobster Industry Diagram

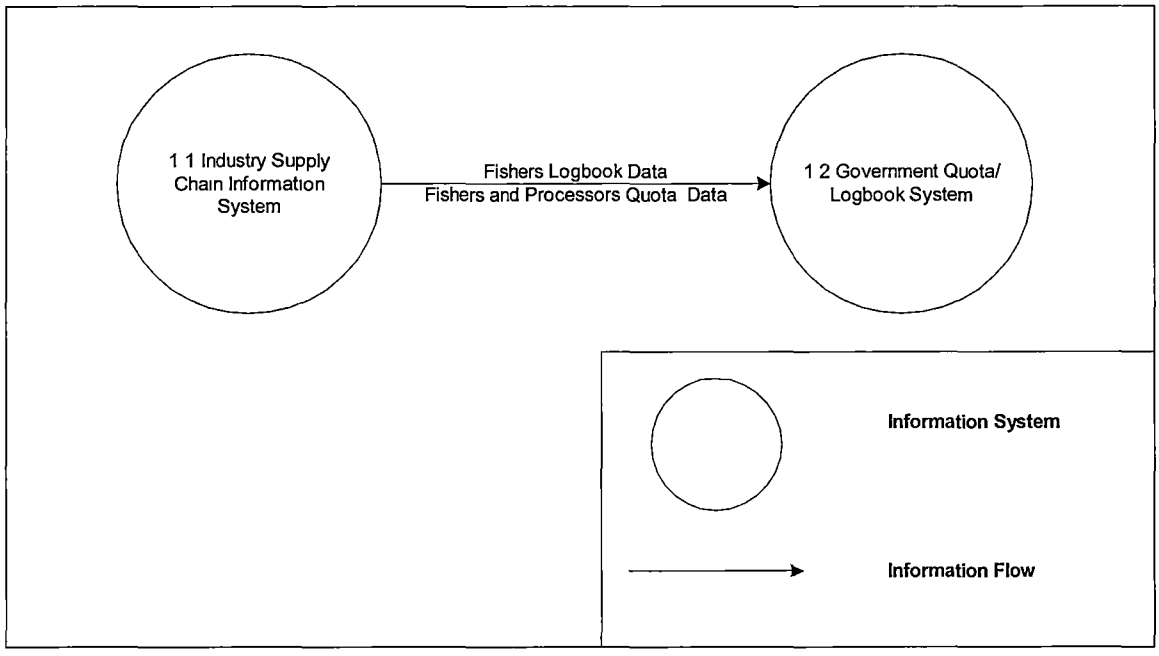


Figure 5-3 presents the industry's manual supply chain information system using an IFD. The IFD represents the key information processes and information flows associated with trading, assessing, handling and transporting rock lobster. Each process involves assessments of information, which determines a decision output. For example, *Assess Trip Viability* represents a number of information flows from data sources such as fishers' knowledge banks, weather databases, and GPS plotters, to determine whether it is viable to go fishing. This decision process triggers another physical process of steaming to fishing grounds, catching rock lobster, and sorting and recording the catch. The *Assess Lobster* process produces information about lobster attributes, in addition to trip and catch attributes such as fishing location, bottom type, numbers and weights. After sorting and assessing the catch and obtaining lobster attribute information, fishers select processors. The process is both physical and informational. That decision process is based on key information such as lobster attributes, date and time of unloading, beach price offered and the personal relationships with the processors. In some instances, processors could be leasing or selling quota to fishers on the condition that the lobsters are sold to that processor.

Figure 5-3: Level 2: IFD 1.1 Tasmanian Rock Lobster Manual Supply Chain Information System

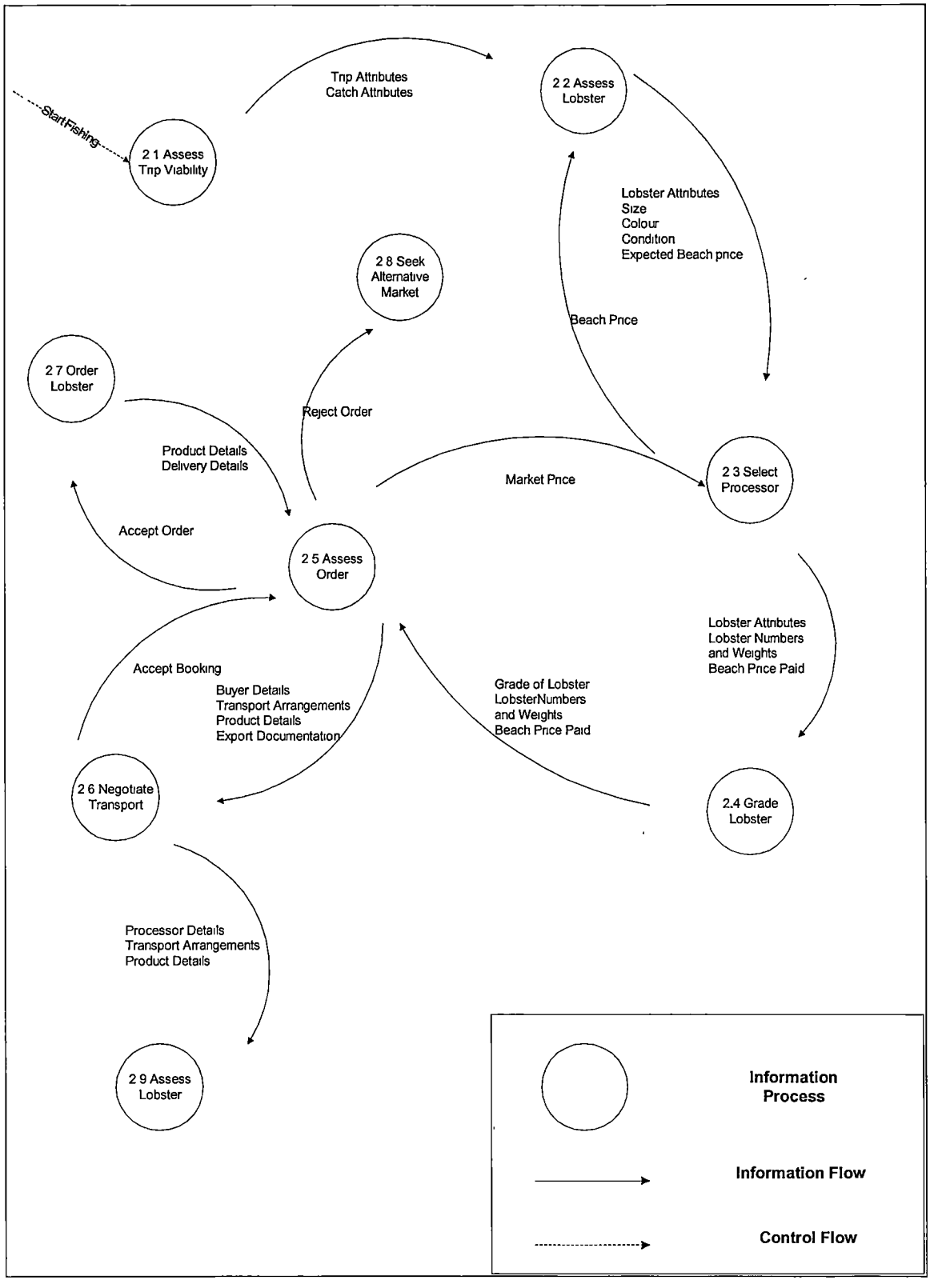
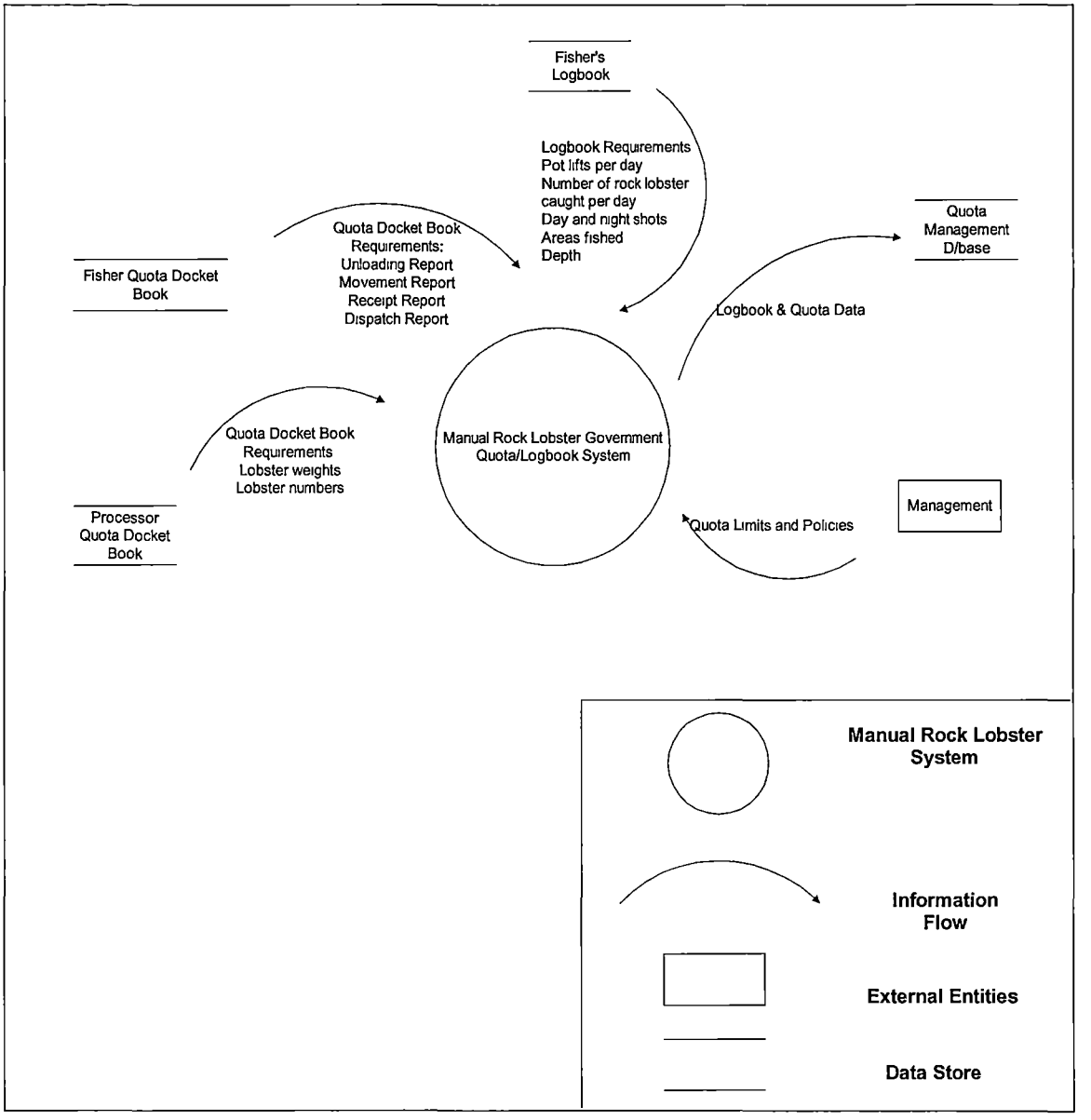


Figure 5-4 represents the Tasmanian Government's quota/logbook system, including the key entities involved such as fishers, processors and handlers, and key agencies

involved in the management of the resource. These entities are all suppliers and users of the manual logbook and quota management system.

Figure 5-4: Level 2: IFD 1.2 Tasmanian Rock Lobster Manual Logbook System



This system is mostly manual and the majority of the information supplied is paper-based, entered by DPIWE staff into a computer-based system, and includes quota docket books, telephone reports, fisher logbooks, and quota limits, management plans and rules. The information is extracted by DPIWE, whose staff use it for monitoring the quota in terms of compliance and resource management, and, to supply TAFI with data to undertake stock assessments. Very little information, such as monthly quota balances, is fed back to fishers and processors. The only feedback fishers or processors get from DPIWE is when an error has been found in their paperwork. In contrast to the

industry supply chain information system (Figure 5-3); the quota/logbook system only includes entities, processes and information flows associated with quota management and logbook systems, which are requirements for fishers and processors. Entities such as freight providers and buyers, and other supply chain participants, are not required by the State Government to provide information and participate in the system and therefore are not represented in this diagram. The primary focus of DPIWE and Tasmania Police is to monitor, manage and enforce the quota management system and manage the resource. Other supply chain information is regarded by these agencies as outside their jurisdiction. It should noted that the physical flow of the rock lobster along the supply chain is described in Figure 4-1 and highlights the key physical processes needed to ensure the rock lobster is traded successfully and meets the requirements of the logbook and quota system. The diagram also provides a useful reference for describing in more detail the physical and informational processes involved in the manual industry information system.

The Catching Process

Processes related to fishing operations are mostly determined by State and Commonwealth Government regulation and market requirements. However they vary somewhat due to fishing behaviour (preferred fishing grounds), characteristics and preferences (home port, inshore fishers, day fishers, size of vessel), and fishers' personal interest in their catch and business (market requirements). With reference to Figure 4-1, the first major physical process involved in the industry supply chain is *Catch* lobster. This physical process involves numerous information flows and processes, which determine the decision (control process) to go to sea and harvest rock lobster. The information process that underpins the *Catch* process is represented in an IFD (Figure 5.5), which is Level 3: IFD 2.1. This diagram is the next level down from the manual industry supply chain information system, Level 2: IFD 1.1 (Figure 5-3), and represents the information process *Assess Trip Viability*.

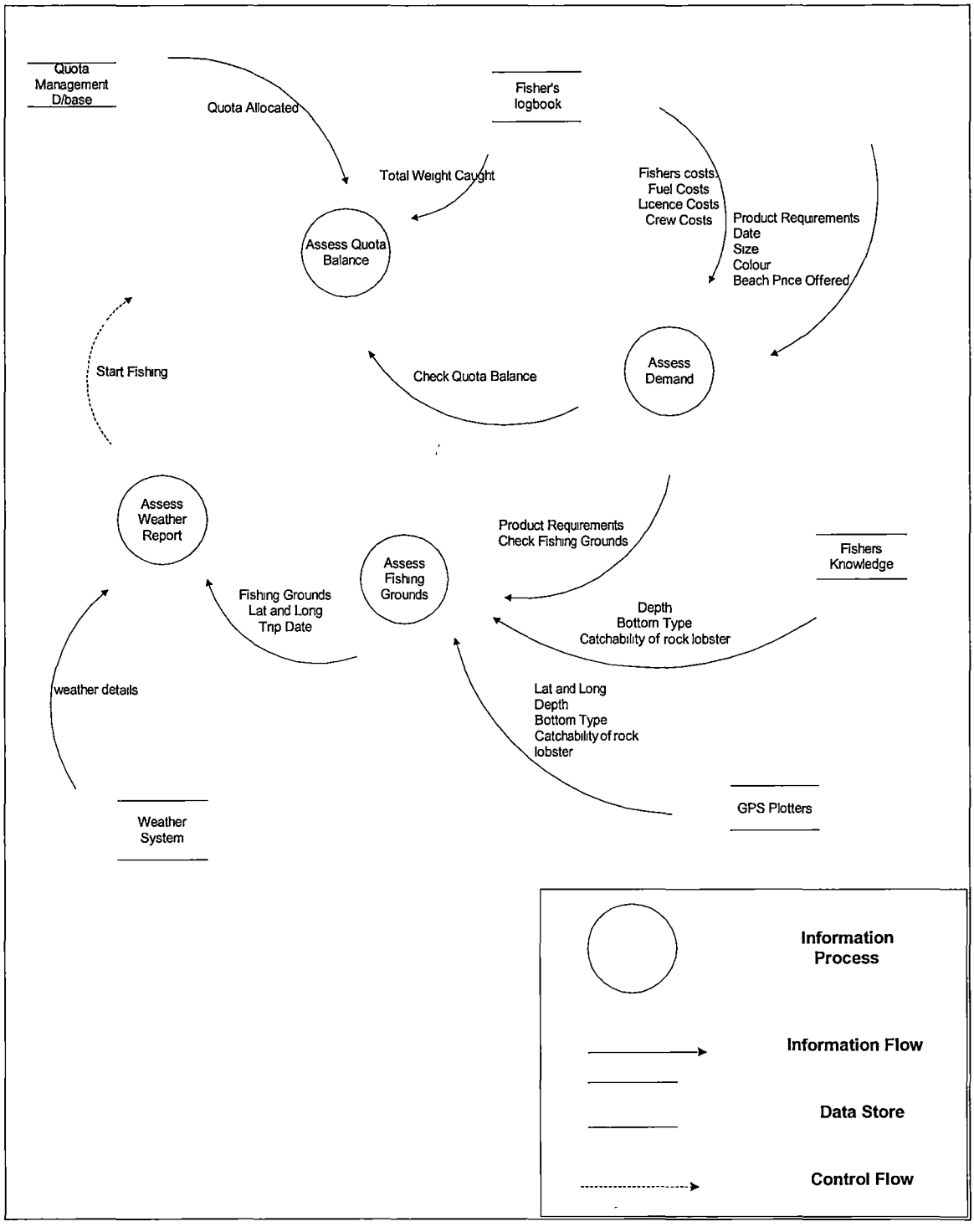
The physical process is decided upon by fishers on that basis of key information from a variety of sources such as knowledge and experience, paper-based records such as logbooks, electronic data records such as catch and bathymetric data stored on GPS plotters, weather forecasts through a telephone or internet service, verbal information such as market requirements from processors, and fishing season, licence and quota information provided by DPIWE. Informal information such as beach price, lobster

colour, and size sought in the marketplace can come from supply chain members such as processors and buyers. Lobster condition can be influenced by water temperature, salinity, location, depth and time of year. Colour is influenced by depth. Beach price can be influenced by supply and demand, and the condition of rock lobster catch. Fishers' tacit knowledge allows them to make very accurate estimates of weight against numbers, lobster condition and preferred fishing grounds.

Pots (also known as traps) are used to catch lobster, and a shot involves setting the entire fleet of pots at a specific time and location. The shot details are recorded for future reference by some fishers on GPS plotters. When deploying pots, the fisher marks the first pot on the plotter and then proceeds to the next location and records that location on the plotter and so on. The information recorded generally includes latitude and longitude, depth, bottom type and catch details. Some fishers go to the length of recording catch against each pot to determine the 'catchability' of their pots. Detailed bathymetry can be recorded, since each marker can record fish size, colour and bottom type. The degree of detailed information recorded on GPS plotters varies according to how much fishers want to know about the catch and the skipper's capability and knowledge of how the technology works. Some fishers are able to store these data on CDs; however this capacity depends on the age and sophistication of their plotter.

The data collected provide fishers with information about pot catchability and catch rates at different fishing locations. The information is carefully guarded and regarded as the intellectual property of fishers, for whom it provides a competitive advantage. The information is also kept separate from the daily DPIWE logbook, which is completed by fishers and submitted to DPIWE monthly. Information such as number of pot lifts per day, number of rock lobsters caught per day, day and night shots, areas fished (grids) and depth, is transferred to logbooks. As each pot is hauled, deckhands sort the catch by sex, quality such as "ocy fish" (rock lobsters that have been attacked by octopus), and size (each fish is measured against a gauge). The degree of sorting is variable and dependent upon individual fishers. Some skippers measure their fish twice, while most measure 'close to the size limit'. Once the sorting has been done, the pot is re-baited and returned to sea. Each night, the skipper completes the daily logbook. Some fishers who keep detailed records of their fishing operations also record the logbook details electronically on home computers for future reference.

Figure 5-5: Level 3: IFD 2.1 *Assess Trip Viability*

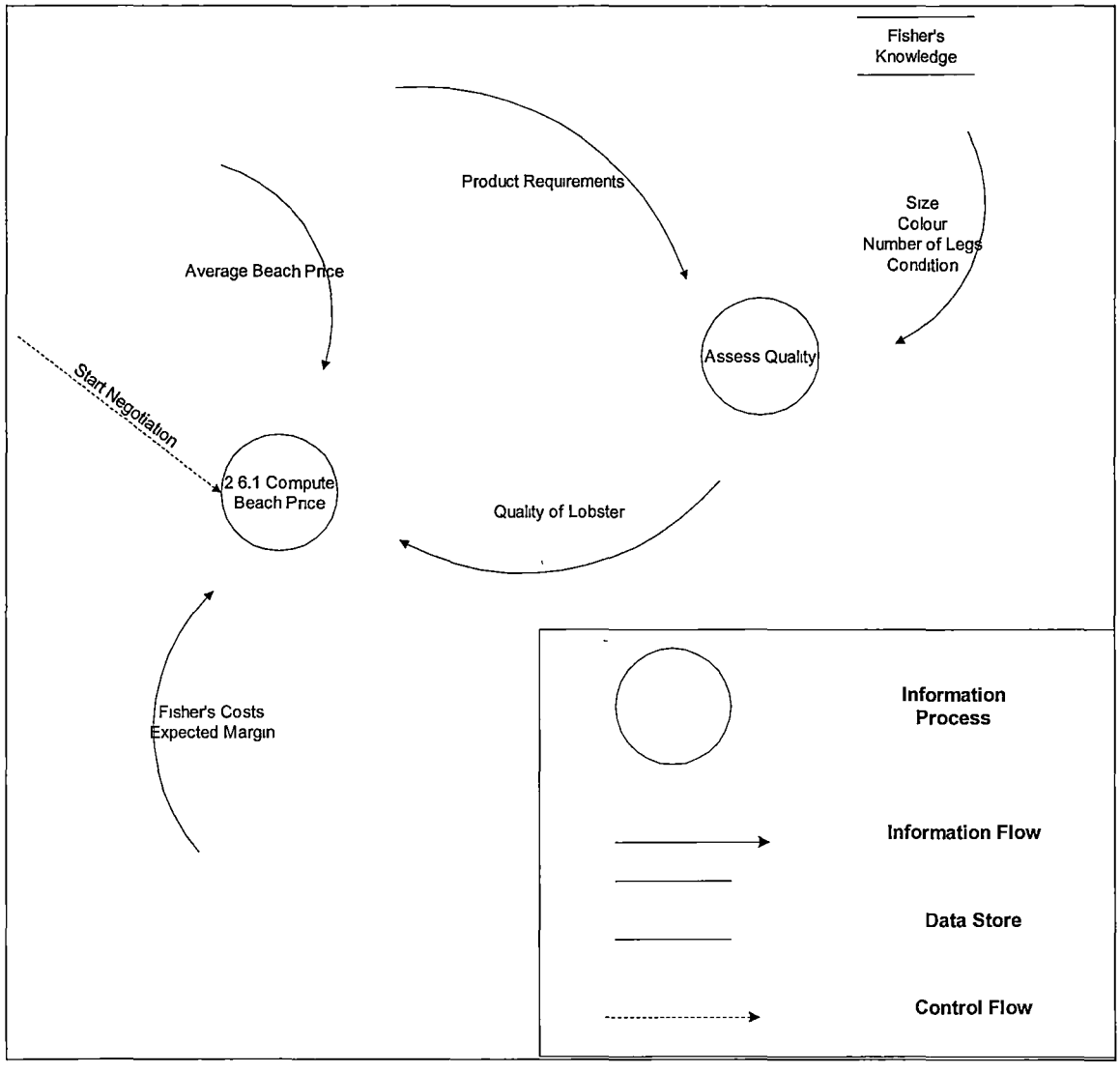


The Assess Process

The next physical process is *Assess* (Figure 4-1) and it occurs once fishers have caught the rock lobster. This physical process requires a number of physical processes, decisions, and information flows to occur. After sorting, if a lobster is accepted, the lobster is then counted as part of the quota, which is reported to DPIWE. If rejected, the lobster is returned to the sea and is not counted as part of the quota. In some instances, the lobster may be kept for personal consumption (five permitted on any trip). The

information processes and flows and data stores associated with the *Assess* process are represented in Level 3: IFD 2.2 *Assess Landed Lobster* in Figure 5-6.

Figure 5-6: Level 3: IFD 2.2 *Assess Landed Lobster*



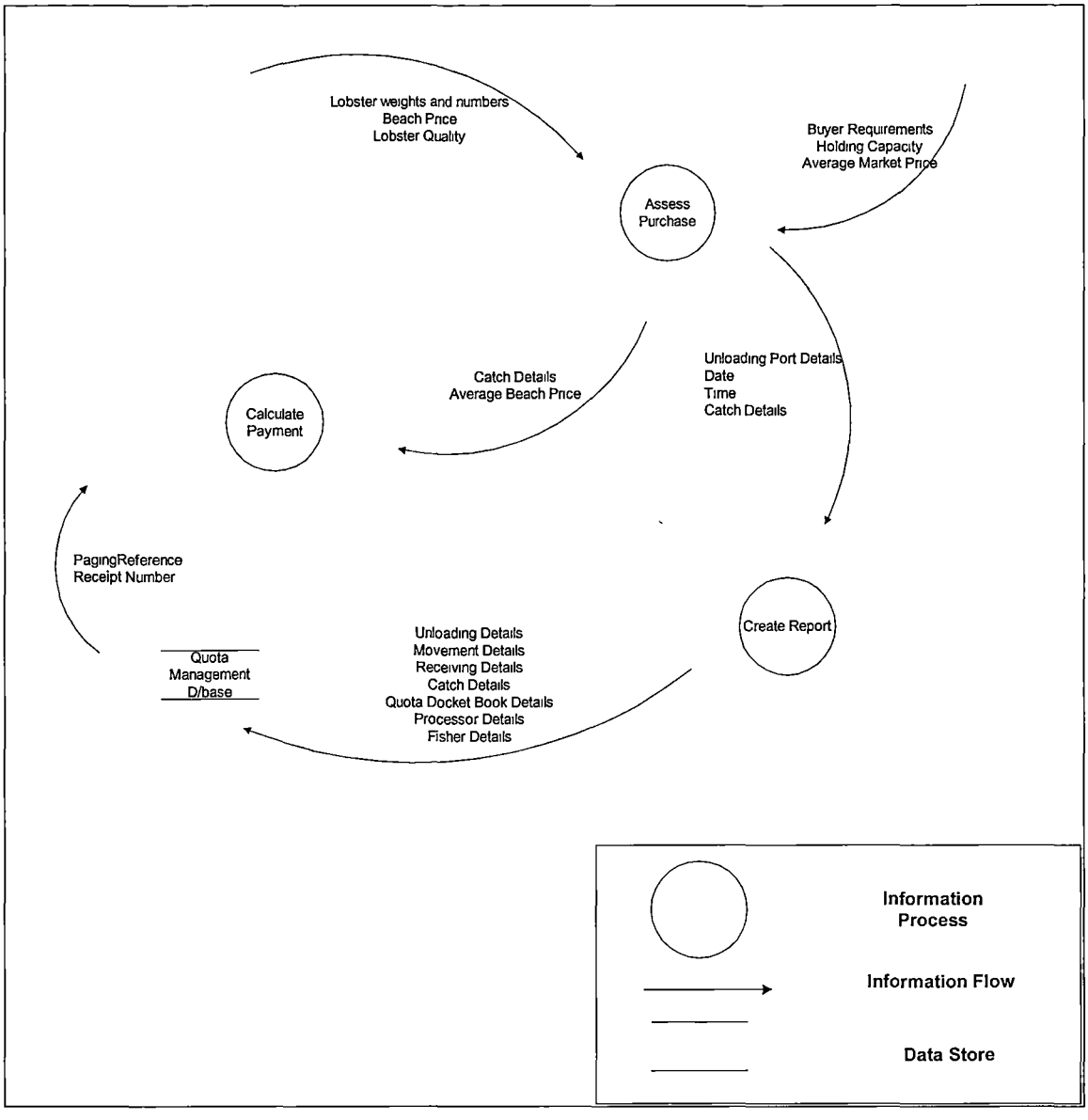
The assessment process of the lobster is based on physical appearance. In addition, the quantity caught is also recorded and checked against quota allocated to that fisher and licence entitlement. Finally these factors are checked against beach price, and operational and capital costs, which also determine whether to reject (return to sea), hold the lobster or sell it that point in time. If the rock lobster is accepted, it is recorded on a quota docket book and a logbook, which is a State Government requirement. The assessment process determines the fisher's expected beach price, and therefore permits the selling process to begin.

The Select Processor

The next physical process is *Select Processor* lobster (Figure 4-1). Once a fisher is ready to unload a catch, preferred buyer(s) are notified to determine the beach price offered. The fisher normally provides a descriptor of the catch such as estimated weight, numbers, sizes, colour and quality. Depending on the relationship with the fisher, the processor generally has an idea of the fishing behaviours of fishers based on their trading histories. Weather and time of year can also indicate fishing behaviour and therefore indicate the type of catch that will be unloaded. Such information allows processors to validate the fisher's description of the catch (assess purchase) and to offer a fairly accurate price (calculate payment). Sometimes if a fisher is not satisfied with the beach price offered for the catch or part of the catch, for example, a particular size range, then the fisher may choose to hold onto the fish in holding tanks until a better price is obtained. Holding rock lobsters is only possible for fishers who have holding capacity on their vessel or at home. It is particularly important for fishers who have vessels with a holding tank to avoid ports where there is warm and/or fresh water, as this will cause mortalities in the catch. Fishers who use ports such as Hobart and Strahan, need to unload everything and therefore have to accept the best price offered.

Once a price has been agreed between fisher and processor, an unloading port, date and time of unloading is also agreed (create report). The fisher then makes a "prior-unloading report" to DPIWE two hours before arriving at the port. The fisher generally uses a mobile to contact DPIWE's call center to notify staff of estimated weight of catch, date and time of unloading, and the processor receiving the catch. The fisher is provided with a paging reference number as a receipt to confirm the report. The prior unloading report is then paged to DPIWE fisheries officers and Tasmanian Marine police who make random port inspections to ensure compliance of quota. The information processes and flows involved in seeking a processor, selling, notifying authorities and arranging for unloading is presented in Figure 5-7 Level 3: IFD 2.3 *Select Processor*.

Figure 5-7: Level 3: IFD 2.3 *Select Processor*



The Unload, Receive, and Transport Processes

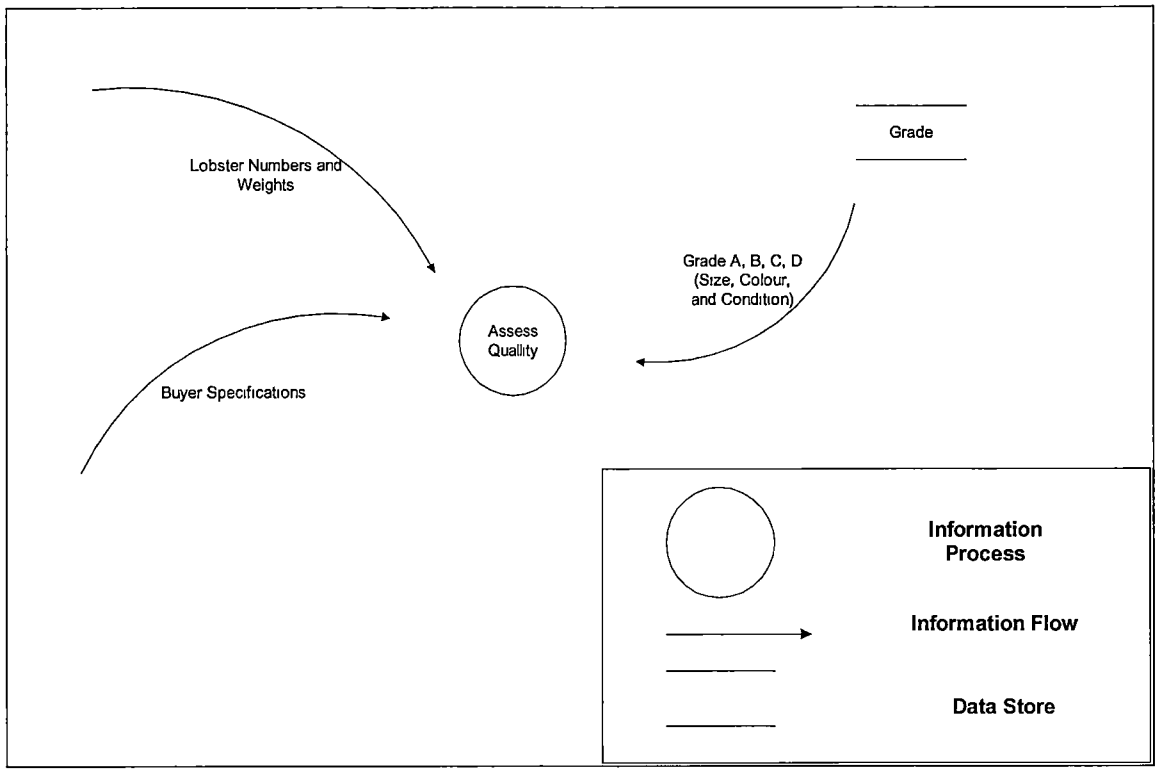
The next two physical processes (Figure 4-1) involve the process of "unload and receive" lobster at the wharf and "transport" lobster to processing factory. At the wharf, the fisher is met by the processor's transport and the lobsters are unloaded into bins and weighed by the processor. The weight and count is recorded in the fisher's (unloading report) quota docket book and the processor's (movement report) quota docket book (Figure 5-7). The bins are drained of water and the weight of the bin is deducted. The bins, filled with lobster, are then loaded onto a refrigerated truck. The movement report (long distance) applies to the transport of lobster to the processing plant that is greater than 1km distance from the unloading location. If the processing plant is less then 1km, a movement report (short distance) applies. Upon receiving the lobster at the processing plant, a receipt report is required.

The Grade Process

Once at the factory, fishers' catches are kept separate for sorting and grading into size and quality (export and domestic quality) (Figure 4-1). The information processes, flows and data stores are presented in Figure 5-8 Level 3: IFD 2.4 *Grade Lobster*. Within 30 minutes of receiving the catch, DPIWE's receipt report is required to be completed by the licensed processor. Processors generally know fishers and the quality of the catch they tend to supply. The quality of the live product is determined by the export market's product requirements in terms of colour, size, and condition (number of legs, soft shell, liveliness). The emphasis on any of these three categories is variable and it is difficult for processors to understand the rationale behind why buyers change their preferences. The inability to predict demand is one of the difficulties in dealing with such a complex and culturally different market place such as China.

The *Grade* data store in Figure 5-8 stores size, colour, and condition categories. The colour categories are: deep red; brindle (red/white); and white. The export colour is a deep red. Size categories of lobster are a) 600-800g, b) 800-1000g, c) 1-2kg, and d) 2kg and more. Generally 1-1.5kg lobsters receive the premium export price as they suit the market. However these product specifications can change on a regular basis. Export conditions require that the rock lobster has less than 3 to 4 legs missing, is lively, and has a hard shell. However these standards vary somewhat among processors, as they are subject to interpretation of what buyers want and what standard of lobsters they can export. Determining quality is a subjective process, particularly when shell hardness is determined by squeezing the lobster's carapace. To the detriment of the industry's reputation overseas, some processors have been known to export soft-shelled lobsters, dead lobster and lobsters with few legs. Processors who have high standards try and influence fishers, and reward those who supply them with a quality export product. Some fishers even choose not to go to sea if they know they cannot catch high quality product. However some processors feel the standards are dropping and that there is less 'export quality' rock lobster available.

Figure 5-8: Level 3: IFD 2.4 *Grade Lobster*



In terms of stock management in factories, the degree of sophistication of stock management systems used by processors is variable. Like fishers, processors store much of the processing activities in their heads, unless there is a regulatory requirement to document key information. The stock flow sheet is kept for the purpose of providing information to DPIWE, and processors can present the s if required. Information collected includes record date, book invoice, where fish were bought, the sell out book number, the name of the fisher lobsters were bought from, and reported numbers. Some processors rely on paper-based systems such as stock flow sheets, while others use computer-based systems such as accounting packages to record rock lobster size, quality, and numbers coming in and out of the factory and fisher. The computer-based systems also have hard copies to back up the information. The stock flow systems allow processors to know how much rock lobster they have in the tank and the quality of the stock for when a buyer wants to place an order. Whether it is computer-based or paper-based, processors have historical catch records for each fisher they buy from. So over time a database of fishers is created, and processors know their reputation for quality of catch. Generally, processors also know the regions in which their fishers operate and this is often reflected in catch quality and composition of sizes and colour.

Traceability within a processing plant is virtually non-existent, mainly due to the lack of regulatory requirements. Apart from what information is stored in processors' minds about the product flow throughout the factory, there is no other way of knowing where a particular fisher's catch or lobster will end up. When the catches arrive at the processing plant, each is sorted by colour, size and quality, and is counted and weighed to determine price paid to fisher. The fish are then placed in tanks with other fishers' catches. Sorting is based on colour, size, quality, and condition. For example, export quality would be separated from cooking quality fish. Then when an overseas order needs to be filled, the best rock lobsters are selected first. There is also a degree of stock rotation, so the oldest stock also goes first. An order can consist of lobsters from different fishers' catches.

The Process Lobster Process

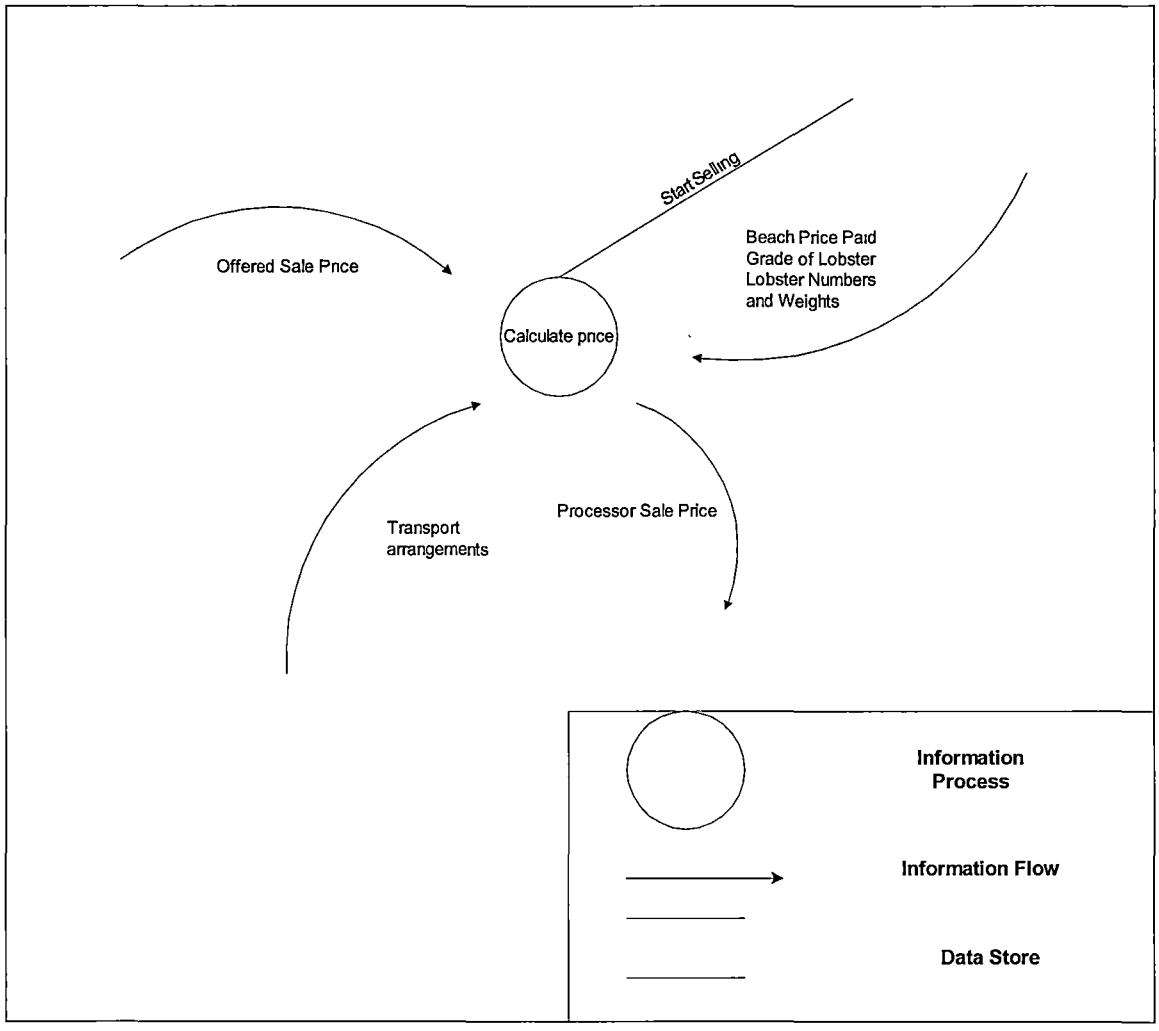
Rock lobsters are generally held in tanks for two days to allow for purging before packing and sending. Twenty-four hours before packing and sending, the temperature of the tanks is reduced to 3°C to "slow" the lobsters' metabolic rate. Packing involves placing these lobsters into a polystyrene box with freezer bags and timber wool to maintain the temperature. The next step is the *process/handle* of the lobster (Figure 4-1) which also involves a number of steps such as complying to quota management requirements, managing supply and demand, and covering operating and capital costs. The information process 2.5 *Assess Order* represented in Figure 5-3, depends upon factors such as the number of orders, the requirements of the orders, transport availability, the selling price offered, the beach price being accepted, and supply. These factors are all subject to seasons, weather, and competition with other processors. The quota requirements of processors are undertaken with the information process 2.3 *Select Processor* (Figure 5-7).

The Sell Process

The *Sell* process (Figure 4-1) occurs once lobsters have been sorted by size, colour and condition, and it depends on marketplace and business culture. The majority of Tasmanian rock lobster is exported live to China and other Asian countries. Lobsters not suitable for live export are sold on the domestic market in Sydney, Brisbane, Melbourne, and Tasmania. For both export and domestic markets, when a buyer calls and places an order (Figure 5-3 and 5-11), it is necessary for the processor to check flight availability before accepting the order (Figure 5-3, 5-9 and 5-10). The processor

needs to check with the freight forwarders (export) or airlines (domestic) to ensure the product can be shipped so the buyer is able to receive the product by a specified date and time (*Assess Transport Availability*). In addition, price also needs to be negotiated and this depends on the estimated average sale and beach price.

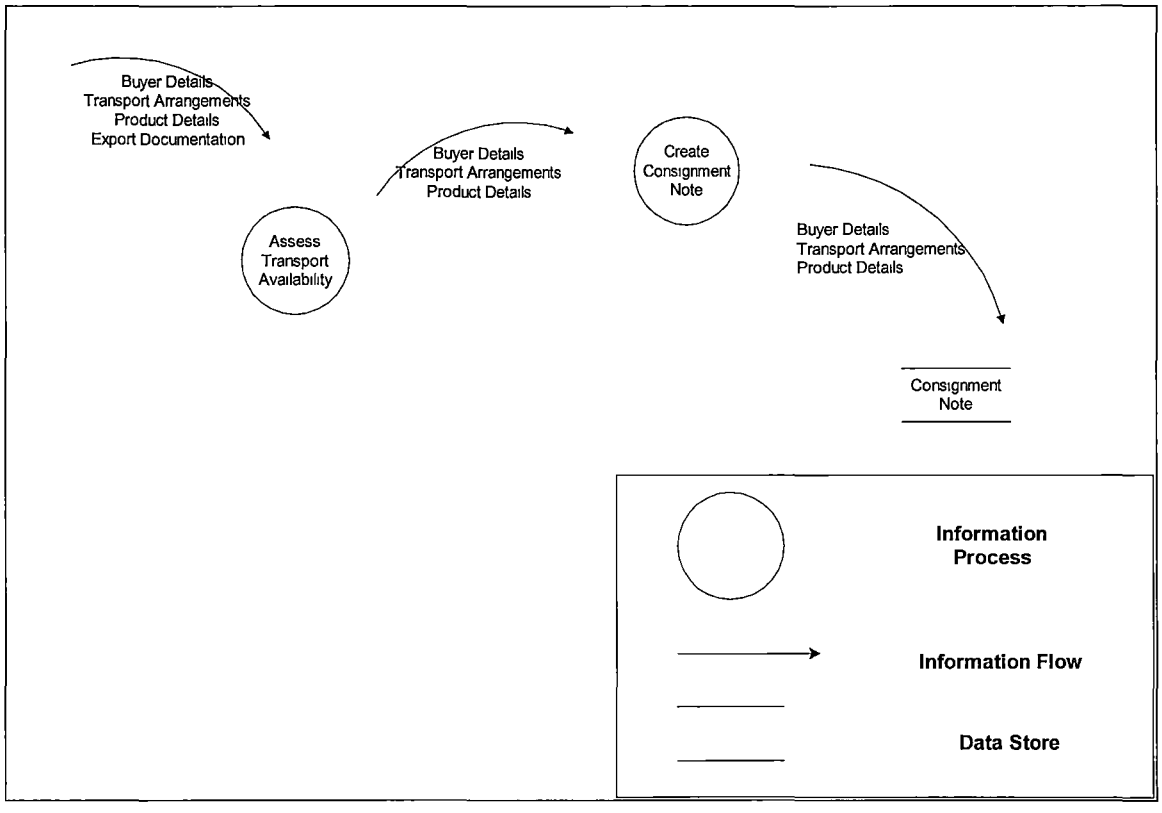
Figure 5-9: Level 3: IFD 2.5 *Assess Order*



Processors need to keep the beach price competitive to ensure supply of export quality product from fishers, while at the same time ensuring there is enough margin to cover processing, packaging and shipping costs (generally a minimum of $10/kg is required). Buyers (export and domestic) generally have a good idea of the current average beach price and sale price. They often do a "ring around" of Australian processors selling the same species to get an indication of the average beach and sale price. This process is subject to supply and demand and often the processor has to negotiate with the buyer over a series of days before a price is agreed on. Once the price and shipping is arranged and agreed to, the processor then fills the order subject to specifications of the buyer. Product specifications are variable (size range) and are not always easy for a

processor to predict or understand. The effects of these specifications are fed along the supply chain to fishers via the beach price. Whatever the specification, processors need to sort the lobsters in their holding tanks accordingly. Figure 5-3, 5-9, 5-10and 5-11 represents the information required from the supply chain to make the decision to sell lobster. The information includes the beach price paid to fishers by processors, supply (number of lobsters available to be sold), transport availability, the offer and buying conditions.

Figure 5-10: Level 3: IFD 2.6 *Negotiate Transport*



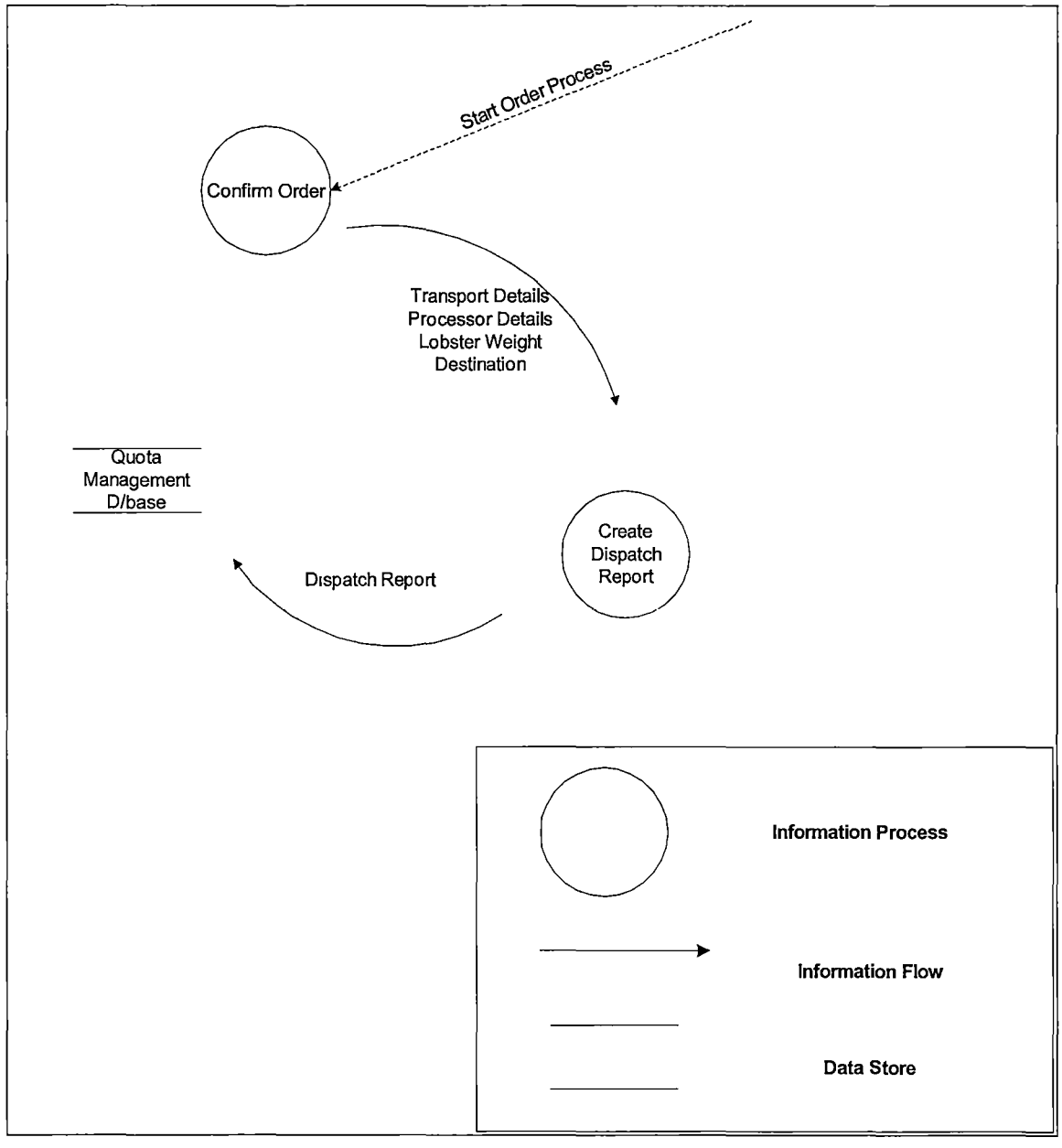
The Transport Sold Process

Once the Tasmanian processor has a buyer for rock lobster (agreed price and transport delivery arrangements), a number of processes need to follow (Figure 4-1). First, the processor needs to make formal arrangements with the transport provider. When sending the product to an international destination, the processor has to complete export documentation for AQIS, book the flights through a freight forwarder who then arranges both the domestic and international flights and handles the boxes at the airports, and finally delivers the product to the airport (domestic terminal).

If sending the product to other parts of Australia, processors do not have to deal with freight forwarders and can contact the airlines directly. Costs, flight availability, and

reliability are contentious issues between some processors and airline providers. Some processors seek airfreight services from charter airlines. No documentation is required by AQIS for domestic freight transportation. The domestic air carrier used will determine what stickers are to be placed on the polystyrene boxes. However, all carriers do require the processor's name, contact details, the number of boxes and the receiver.

Figure 5-11: Level 3: IFD 2.7 *Submit Lobster Order*



Product that is sent by non-export accredited processors to an exporter in Sydney or Melbourne is then tanked again before being sent to China. An exporter may have many shipments of rock lobster coming into the factory, and again the shipments remain separate until sorted and graded.

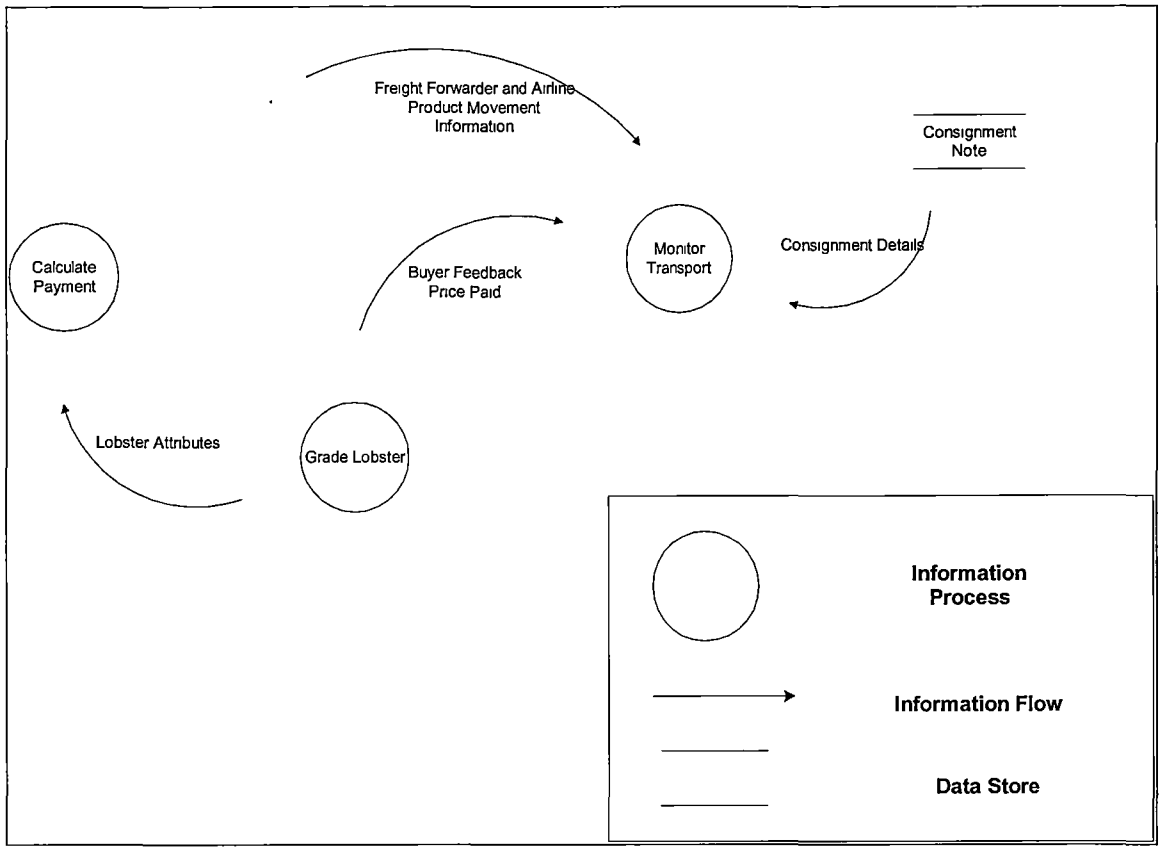
Second, prior to shipping the product, a dispatch report needs to be made by the processor to DPIWE. This stage of the supply chain appears to be particularly vulnerable in terms of managing product quality and ensuring it successfully reaches its 10,000km destination alive and well. If problems occur at this end, and buyers and consumers are not satisfied, processors "foot the bill" for any mortality, and future orders can be affected along with the reputation of the Tasmanian product. The information processes, flows and data stores required to arrange transport of rock lobster is presented in Figure 5-10 Level 3: IFD 2.6 *Negotiate Transport.*

The Grade, Hold, and Distribute Process

The physical process of *Grade, Hold and Distribute* lobster (Figure 4-1) occurs upon receipt of the rock lobster buyer (export or domestic). Feedback or information flow from buyers to processors about the degree of success of the shipment only occurs if product does not arrive, is late, or the product arrives dead. The issue of "claim" is an issue between buyers and processors, and the credibility of the claim in determined by the strength of the relationship between the buyer and processors. Upon receiving the product, buyers will generally grade and, re-tank the lobsters, and then distribute them to restaurants and hotels throughout China, or domestically in Sydney, Brisbane or Melbourne.

Figure 5-12, Level 3: IFD 2.9 *Assess Sold Lobster*, represents the assessment process of the sold rock lobster at the buyers' end of the supply chain. The assessment process involves information processes such as grading lobster, monitoring transport conditions during transit, and calculating payment at the buyer's end. The information flows include the consignment note and details that travel with the shipment of rock lobsters, product movement information from airlines and freight forwarders, lobster attributes graded by the buyers, and the buyer feedback, which is the price paid.

Figure 5-12: Level 3: IFD 2.9 *Assess Sold Lobster*



In summary, this section maps out the business and information processes and flows associated with the Tasmanian rock lobster industry supply chain. Each figure summarises the complex web of information transactions and processes at three levels of detail. Decision/information processes are informed by information flows, which in turn, trigger physical processes, which then provide information for further decisions and physical processes to be undertaken. The mapping process provides a foundation for me to explore the potential application of IS/IT to assist in advancing supply chain management strategies to obtain sustainable outcomes for the industry.

Rock Lobster Electronic Management System – A Proposed Industry Supply Chain

The proposed Rock Lobster Electronic Management System is a computer-based information system, which aims to reflect the physical and informational processes and flows currently occurring in industry supply chain. However it is different from the current information system, being able to electronically capture, store, process and disseminate information to support business decisions. The proposed system is based on feedback from informal and formal consultation with industry stakeholders through

interviews and forums, and on insights from Tasmanian government literature detailing rules and legislation that define supply chain processes. The proposed system also aims to involve all industry supply chain participants. Given that participation is a central tenet of sustainability principles, this is significant.

Solution Two

The Rock Lobster Electronic Management System uses fishers' logbook and quota docket book information as its foundation. Building upon such information are personal electronic catch records stored on GPS plotters, personal and private logbooks, budgets, and observations about environments and catch. The knowledge is stored in fishers' "stand alone" business management system on their PC based plotters. By having the system located on a PC based plotter, integration with other software applications such as the plotter and email, is possible. Privacy, security and confidentiality of information are assured as the registered user of the system (licensed skipper) determines what information is transmitted to DPIWE or other supply chain members. When transmitting data, the security of the system is ensured using a security encryption and digital signatures. Under the Commonwealth *Electronic Transactions Act 1999*, digital signatures are regarded as valid and as secure as a hand written signature. Likewise with the processors: key information about buying, receiving, grading, selling and transporting rock lobsters is stored in "stand alone" business management systems, which sit on office PCs. The sharing of information and tracking of product is facilitated by the use of a tagging system. The aim is to track the product from the day it is caught to the day it lands on a consumer's plate, and to establish feedback mechanisms for supply chain members, such as having regularly updated output information at hand on allocated quota left for the year, average beach price, sale price, capital and operating costs, product quality and product destination. In the current system, these outputs are present but are not formally captured, stored and used in a computer-based information management system. Figure 5-13 presents a new Level 1 context diagram of the system. It replaces the old Level 1 diagram (Figure 5-2), which represents the current manual information system, the industry supply chain and the quota/logbook system.

Figure 5-13: Level 1: Context *The future Tasmanian Rock Lobster Electronic Management System*

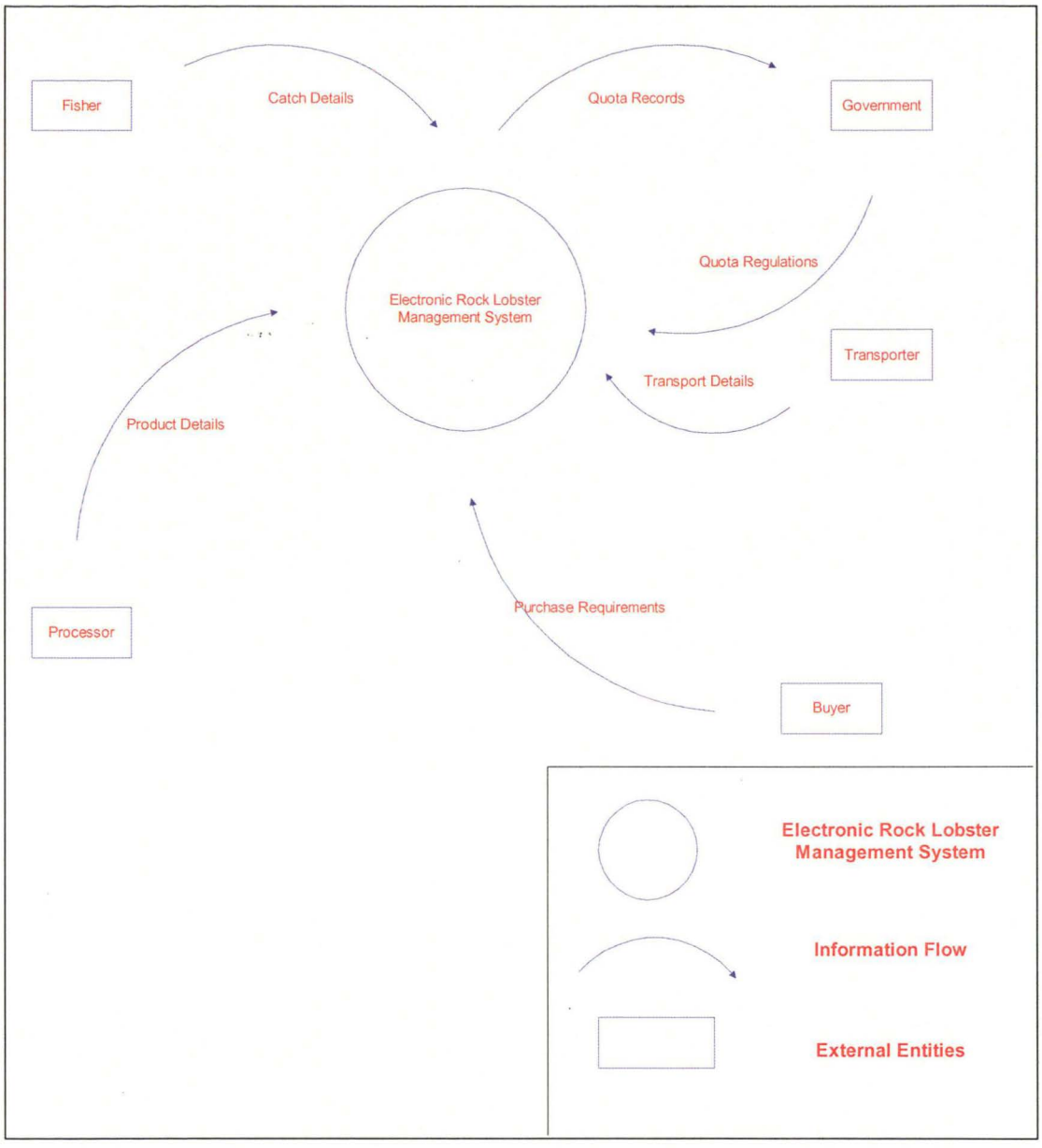
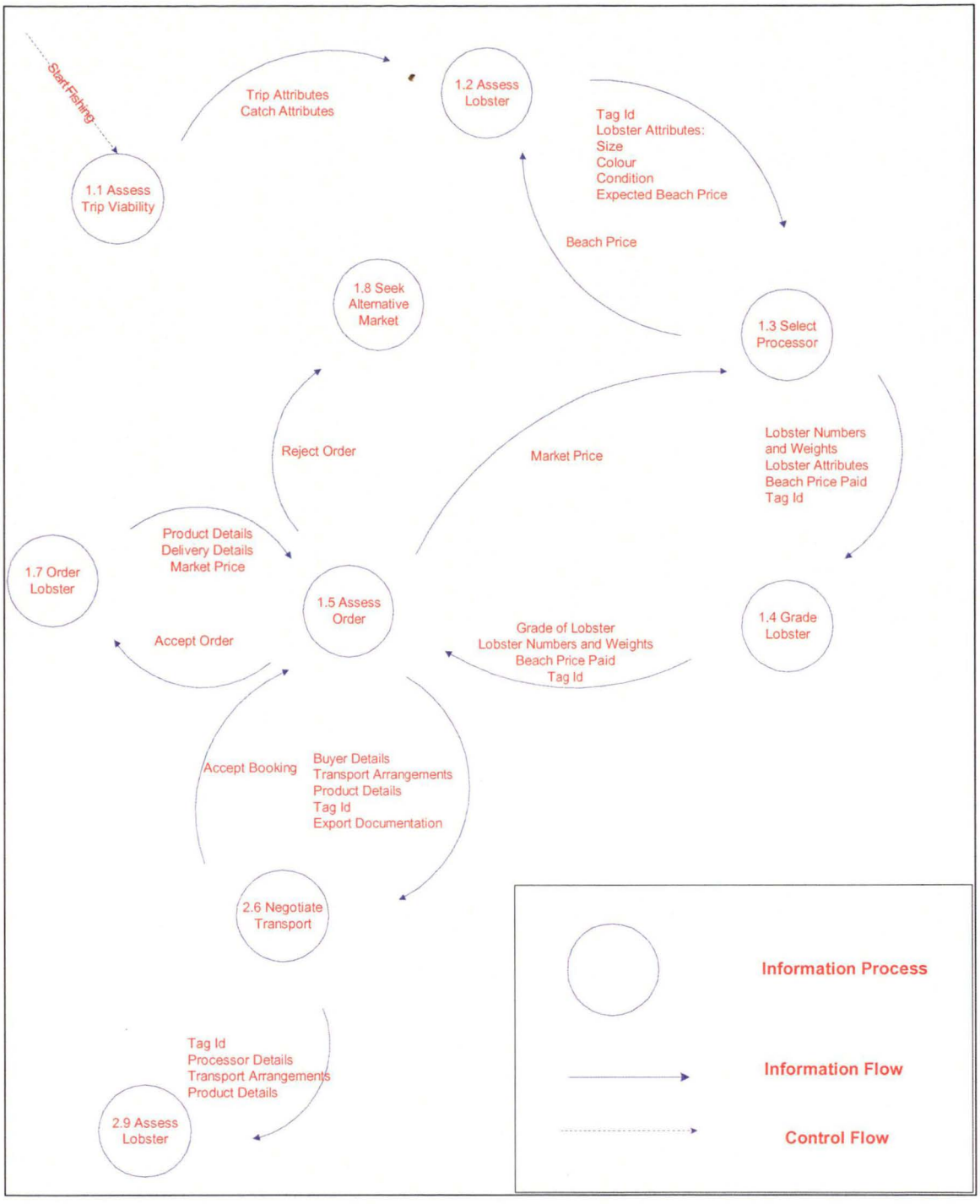


Figure 5-14 shows the next level down, Level 2 IFD, of the Tasmanian Rock Lobster Electronic Management System, which is an electronic version of the Level 2. IFD 1.1 (Figure 5-4). The red and blue colours represent the computer-based electronic information processes and flows. The key difference between Figure 5-4 and 5-14 is the introduction of the tag information process and information flows in Figure 5-13.

Figure 5-14. Level 2: IFD *Tasmanian Rock Lobster Electronic Management System*



The following sections repeat the walk-through of the physical processes described in Figure 4-1, but this time describing the information processes and flows and the entities and relationships involved in the proposed electronic information system with reference to Figure 5-14.

The Catch Process

The proposed business management system begins with the physical process *Catch* lobster. The new system includes a business management system and a tagging system. The business management system aims to be a decision support system that integrates information from different sources including catch history and electronically recorded observations from fishers. As the quota management system, catch and effort and licensing databases are already computer-based, DPIWE will be able to provide profile for each fisher informing them of their fishing access permits, allocated quota, and quota balance to date. GPS plotters already store catch information and most late model plotters can be integrated with PC based software. The business management system will also have the capacity for fishers to record observations such as changes in the environment, pot catchability and catch history, and feedback from the marketplace. Processors will also be able to provide information on current market requirements of products by email.

Market requirements, fisheries access permits such as quota and season, weather, fishers knowledge and experience, and catch history are all factors that will be electronically integrated to assist fishers in making a decision on whether to go to sea and catch lobsters. Other information such as fishing budgets could be included. This information is all about ensuring fishers are able to gain a viable return on their effort, ensuring that the fishing industry remains economically sustainable and that the harvested resource is not undervalued and wasted. Figure 5-15 presents an IFD of the information process, *Assess Trip Viability*, and highlights the key information processes and flow within this process that are computer-based.

Figure 5-15: Level 3. IFD 2.1 *Assess Trip Viability*

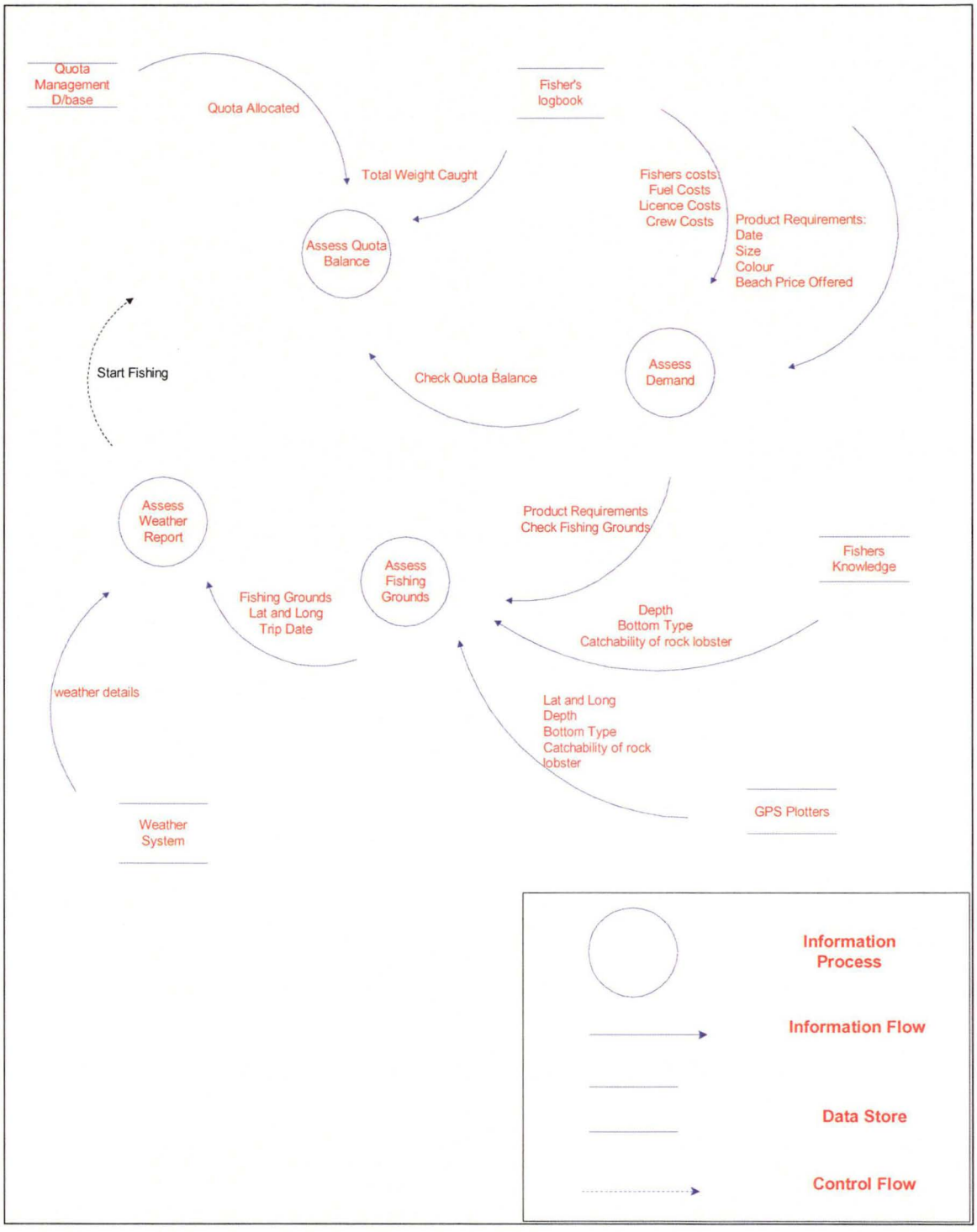
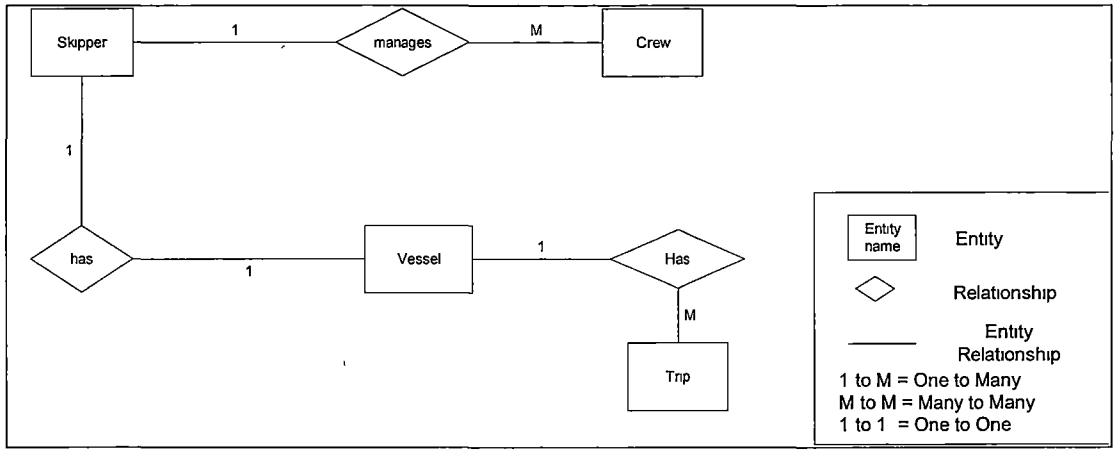


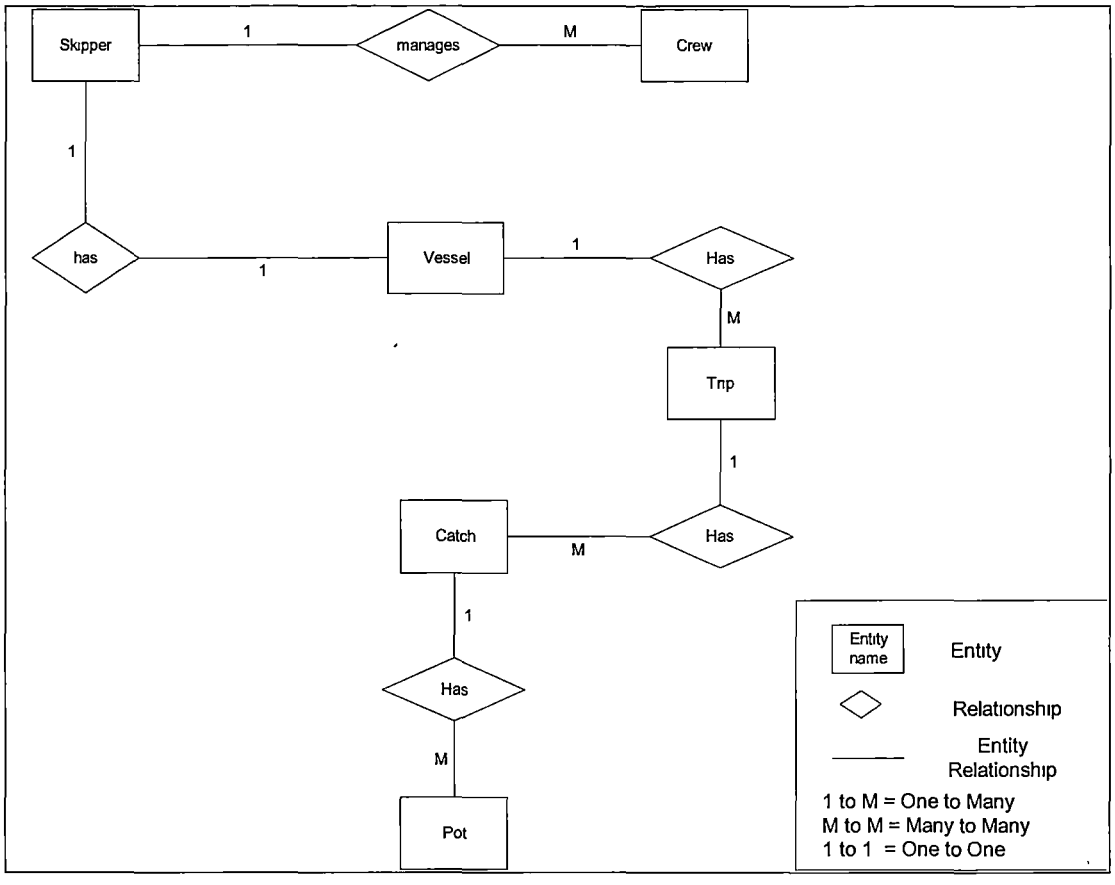
Figure 5-16 also describes the decision of going to sea using an entity relationship diagram. This diagram includes the key entities, namely the vessel, trip, skipper and crew, and their relationships.

Figure 5-16:Vessel – Trip Entity Relationship diagram



Information associated with the trip entity includes start and end dates and times, vessel name, and skipper and crew details. When the pots are set in a location, unique catch identification will be generated, which includes information from the GPS plotter such as date, time, latitude, longitude, temperature and salinity and depth. Mapped against the catch is pot entity (Figure 5-17). Each unique pot has a descriptor, which will later provide information to fishers about pot catchability and their material and vintage characteristics. The relationship between vessel and trip, trip and catch, and catch and to pot is "one to many". In real terms, a vessel can have many trips associated with it, and each trip can have many catches (number of pots set).

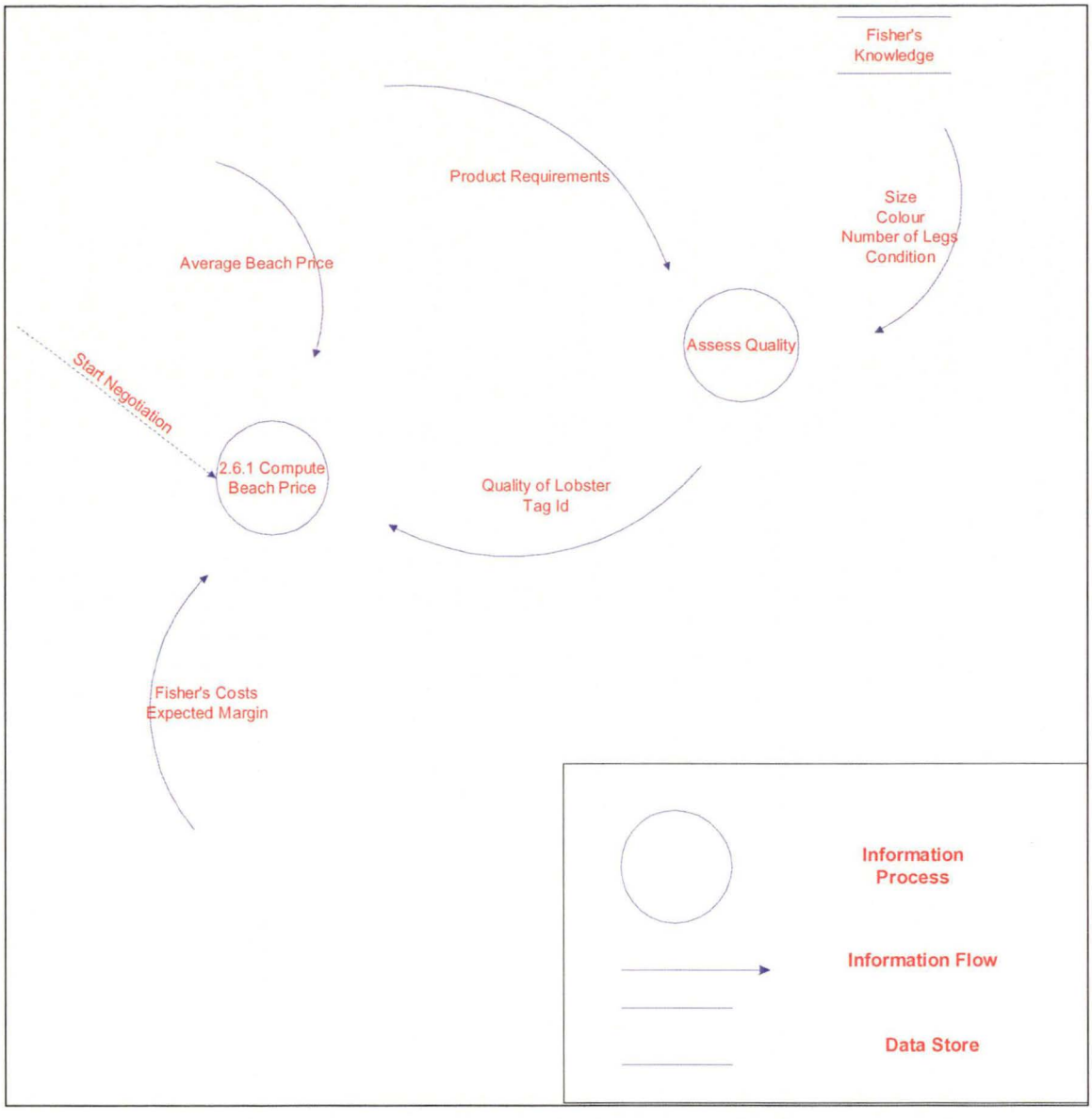
Figure 5-17:Vessel, Trip, Catch and Pot Entity relationship diagram



The Assess Process

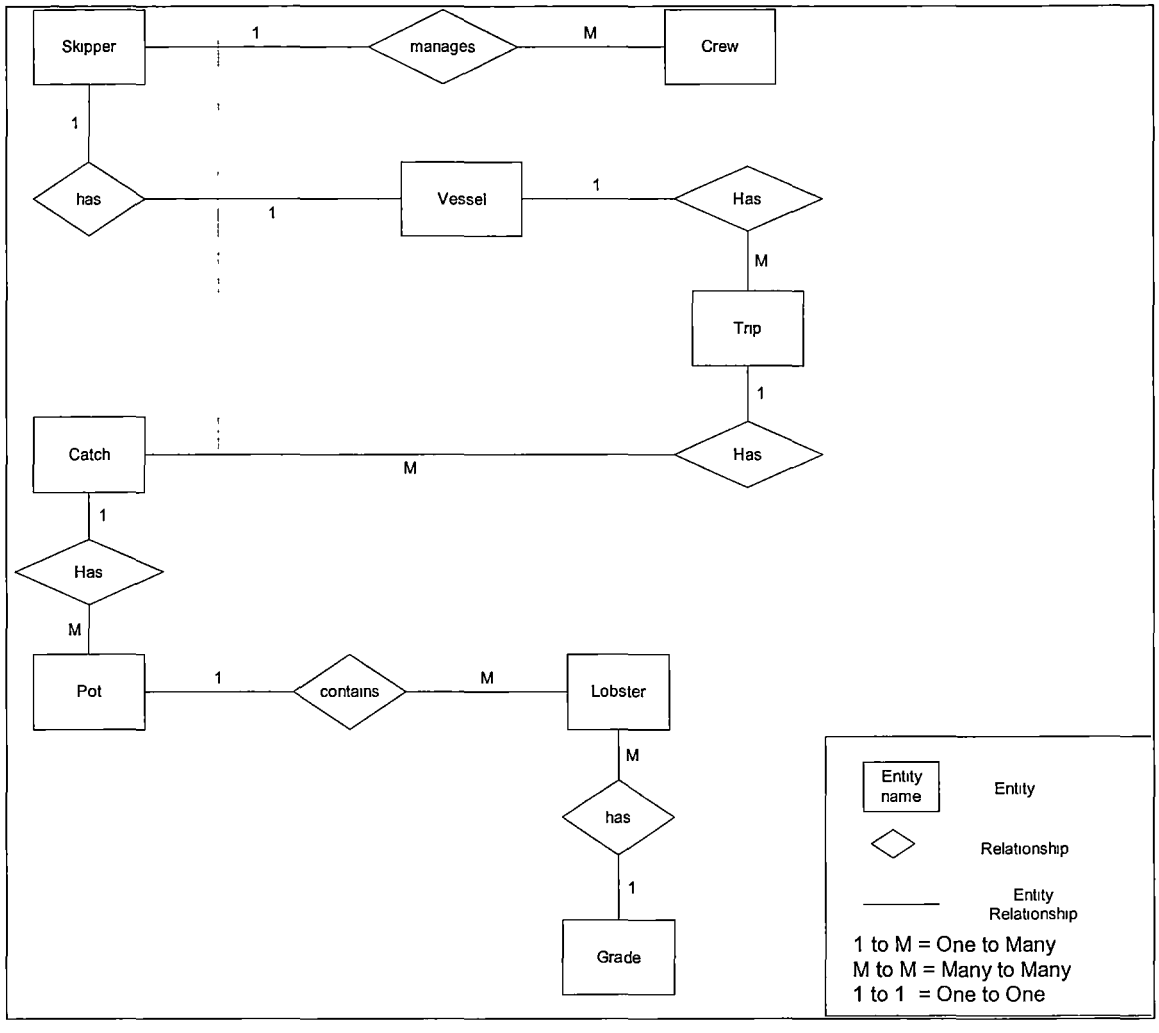
The next physical process (Figure 4-1) is *Assess* lobster, which has similar information processes and flows to the current state (Figure 5-6). However a number of data stores such as the tacit knowledge of fishers, information flows and decisions are computer-based and will be stored on the business management system. Figure 5-14 highlights the main change to the current information system, which involves each lobster having a unique identification (id) if accepted by the fisher. Figure 5-18 presents the next level down the information process, Level 3. IFD 2.2 *Assess Landed Lobster.* In Figure 5-19, the lobster is mapped against the pot, catch, trip, and vessel entities. Lobster attributes include weight, size, colour, and physical condition of the individual lobster. Each lobster will be tagged with a smart microchip containing this identification. As with current processes, rejected lobsters are returned to the sea.

Figure 5-18: Level 3. IFD 2.2 *Assess Landed Lobster*



The tag contains key information that links the lobster with the catch, trip and vessel. So at the other end of the supply chain, if a buyer wishes the industry to demonstrate its traceability of the product back to the origin, the identification numbers will make this possible. Against the information collected about the lobster, catch, trip, and vessel, feedback mechanisms such as quota check, quality check and price check, and regulatory and personal business reports will be possible.

Figure 5-19: Vessel, Trip, Catch, Pot and Lobster Entity Relationship diagram

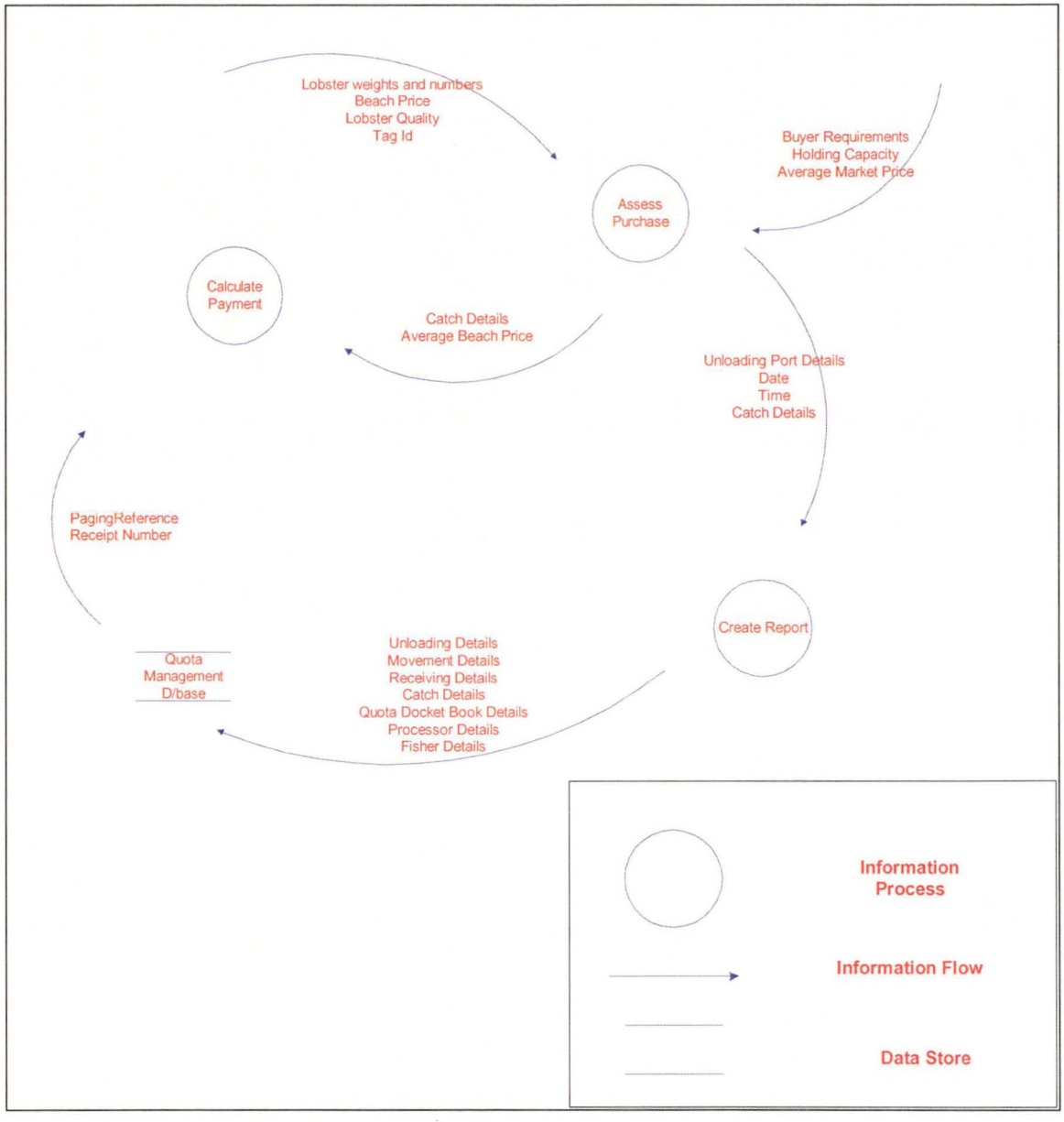


The Sell Process

The *Sell* process (Figure 4-1) will be the same as the current system (Figure 5-8), however the buyer (processor) details will be added to the fisher's business management system against the catch entity. Other information will include beach price, agreed port of unloading, and product description. In some cases the catch may not necessarily be sold all at once because the fisher may not choose to except the beach price for a certain size range or colour. This is only the case for fishers who are able to hold their catch. Many fishers are forced to unload all their catch to one processor, regardless of the beach price split between the size and colour categories. This process allows for a vital piece of information to be added to the fishers' business management system. The beach price is added into the system against the sold catch, so calculations on total returns for the quota year can be calculated. This allows fishers to extrapolate potential earnings for the quota year and compare with previous years, and potentially predict risks associated with cost recovery. Figure 5-20 presents the next information

process, Level 3. IFD 2.3 *Select Processor*, which highlights the electronic information processes and flows involved within the system.

Figure 5-20: Level 3: IFD 2.3 *Select Processor*



The Land Process

Once a sale has been agreed to between fisher and processor, a port of unloading will be arranged. Quota regulation will require the fisher to make an unloading report and obtain a paging reference number from the DPIWE call centre within a specified time period. In addition to making a telephone report, the proposed system could also provide the facility to email details to a central database, which could then automatically generate a reply email containing the receipt number. The beach price, processor and paging reference number are entered into the business management system against the

catch entity. The fisher then proceeds to the wharf for unloading. During unloading, further weighing and counting will be required, along with the recording of information for quota requirements. This information will be entered against the catch entity. At the end of each trip, reports from the business management system will be generated for Government quota and logbook requirements, as well as research. The reports will only contain specific information from the fishers' business management system that would be necessary to meet the data requirements of the regulatory bodies.

The Process Lobster Process

Upon arrival at the processing plant, the catch will be immediately sorted by condition and size, and a receipt report would be made to DPIWE including the weights and numbers received by the processor from the fisher. From the tag and quota documentation, the catch and vessel entities would be passed onto a processor. Information such as vessel name, skipper, location fished, and catch details would be entered into the processor's "stand alone" business management system. Lobster condition at point of arrival at factory and beach price could also be entered into the system under the catch, lobster and grade entities. A report would then generated from the system containing numbers and weights of fisher's catch from the catch entity, and electronically transmitted to DPIWE. Once the fisher's catch is sorted and placed in tanks for purging, orders will then be made up. An order can contain a mix of fishers' catches that are held in the tanks. The orders have specific requirements depending on the buyer, and include colour and size range. Therefore to fill these orders, processors have to handpick the lobsters regardless of their origin. In the processor's business management system, an order contains lobsters, and each lobster has a grade, which includes size category, colour, and condition. Figure 5-21 represents the next information process, Level 3: IFD 2.4 *Grade Lobster* and Figure 5-22 represents the lobster, processor and order entity relation diagram. The lobster entity stores the lobster weight, which is important for the quota reporting requirements. The order entity (Figure 5-15) has attributes such as dispatch weight, product description, destination, buyer, consignment number, sale price, and cost of processing/handling/freight. The buyer also has associated attributes such as region, address, and product requirements and sale price history.

Figure 5-21: Level 3: IFD 2.4 *Grade Lobster*

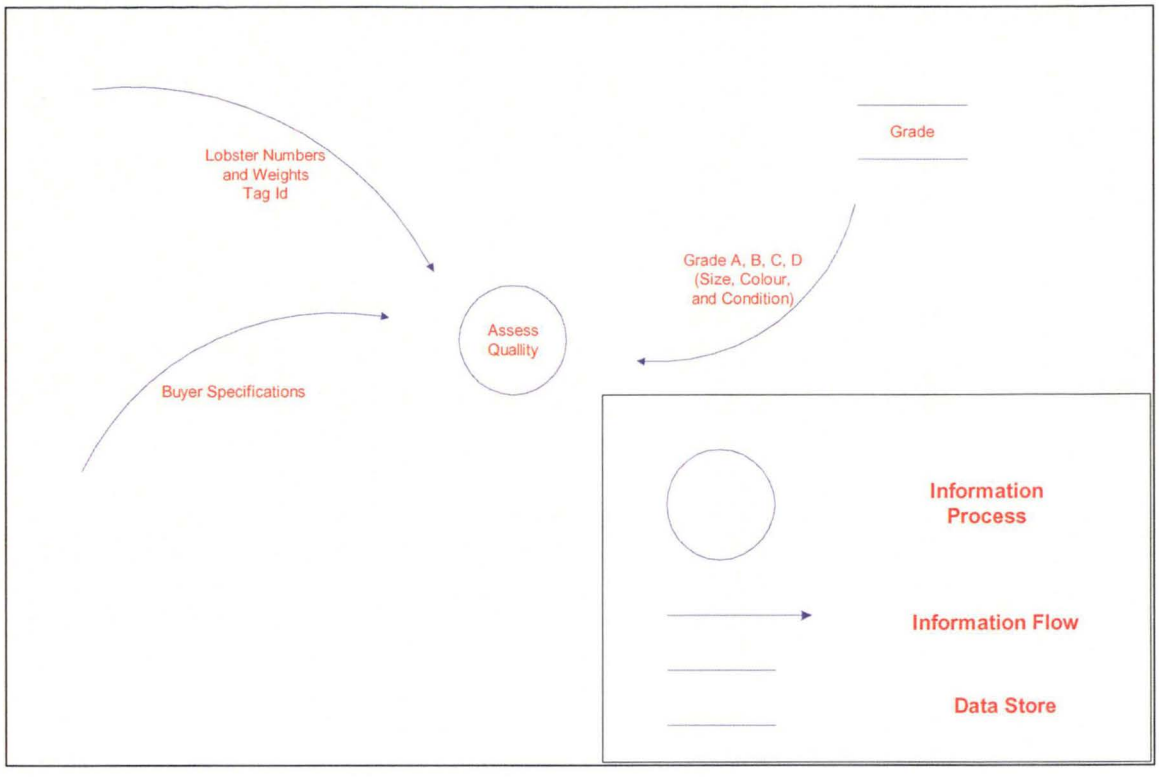
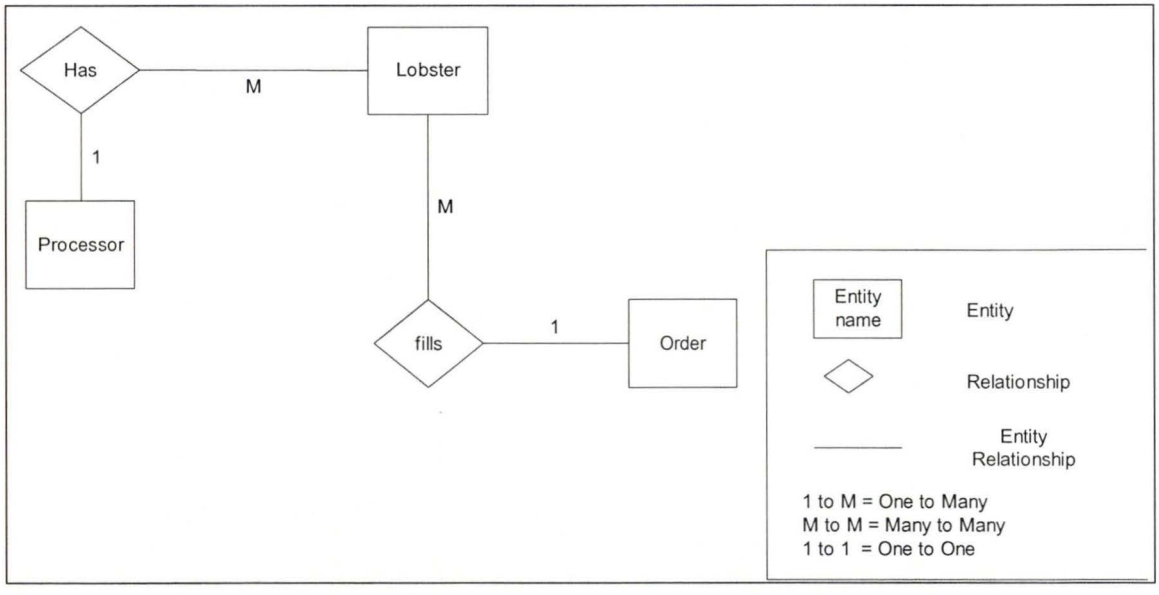


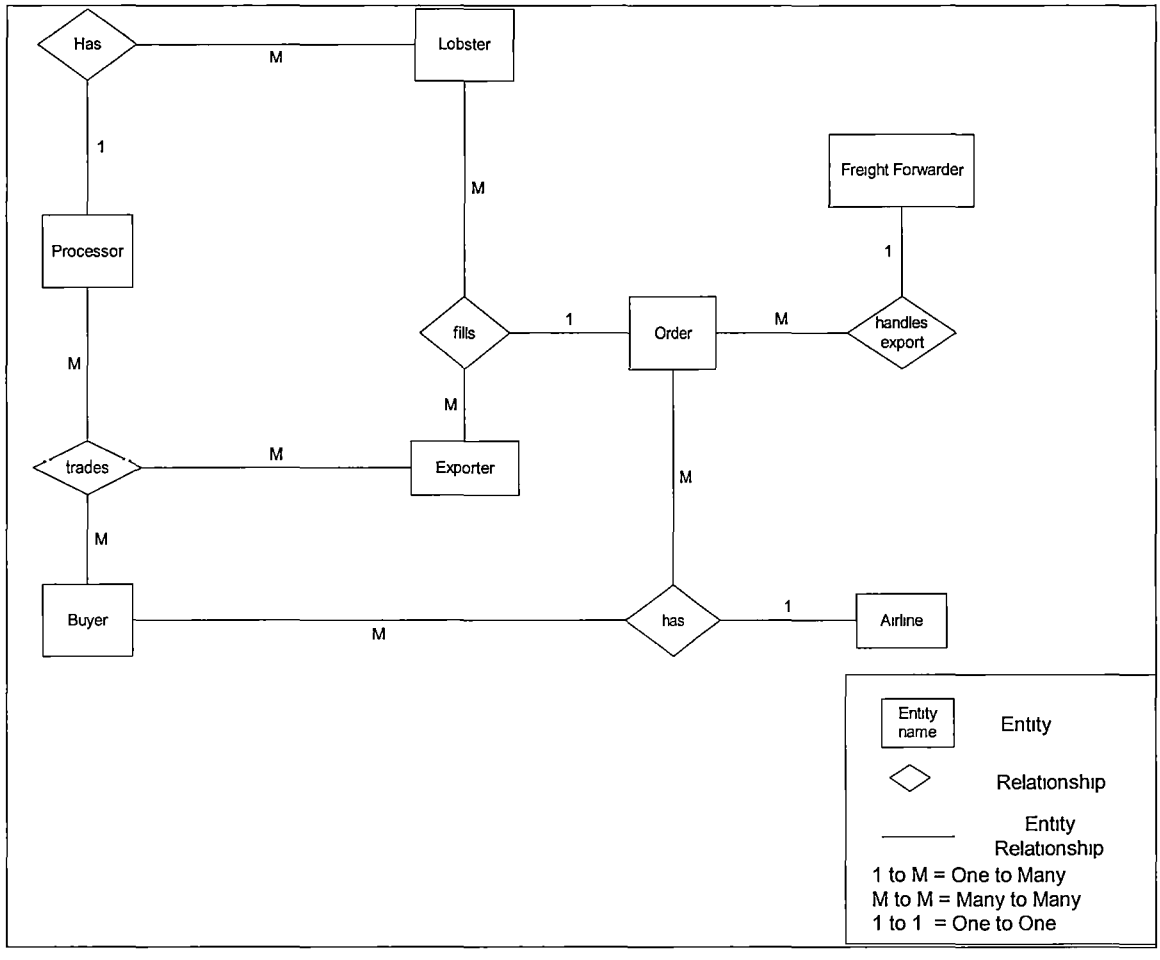
Figure 5-22: Lobster, Processor and Order Entity Relationship diagram



It should be noted that processors may not necessarily be AQIS certified exporters, and therefore cannot directly export lobsters to buyers from marketplaces such as China. These processors generally send live export-quality lobsters to an AQIS certified exporter located interstate, for example in Melbourne or Sydney, where they re-tank and assess the lobster before shipping to the wholesale buyer in China. Non-export accredited processors will deal directly with the domestic airlines for transporting sold lobster, whereas exporters will need to deal with freight forwarders to transport orders

internationally. For an AQIS certified exporter, there is a direct relationship between the processor and the wholesale buyer (say in China). However, non-certified processors deal directly with exporters (Figure 5-23).

Figure 5-23: Lobster, Processor, Order, Transport and Buyer Entity Relationship diagram



The Sell Process

The *Sell* process (export) (Figure 4-1) between the processor/exporter and buyer can be complex because of the business cultural differences between the Australian rock lobster processors and those in Chinese marketplace. Price formation is a complex process of negotiations between processors and buyers. From a processor's perspective, the primary objectives are to maintain a good sale price that ensures a comfortable margin between the beach price and sale price to cover costs, and ensure a sale is achieved to prevent being stuck with tanks full of lobster and increasing overheads. When an order is placed, the processor will need to check flight availability via the domestic airlines or freight forwarder, and then checks supply and price. Once these

checks are made and accepted, the order can be accepted. Figure 5-24 presents the information process, Level 3. IFD 2.5 *Assess Order*.

Figure 5-24: Level 3. IFD 2.5 *Assess Order*

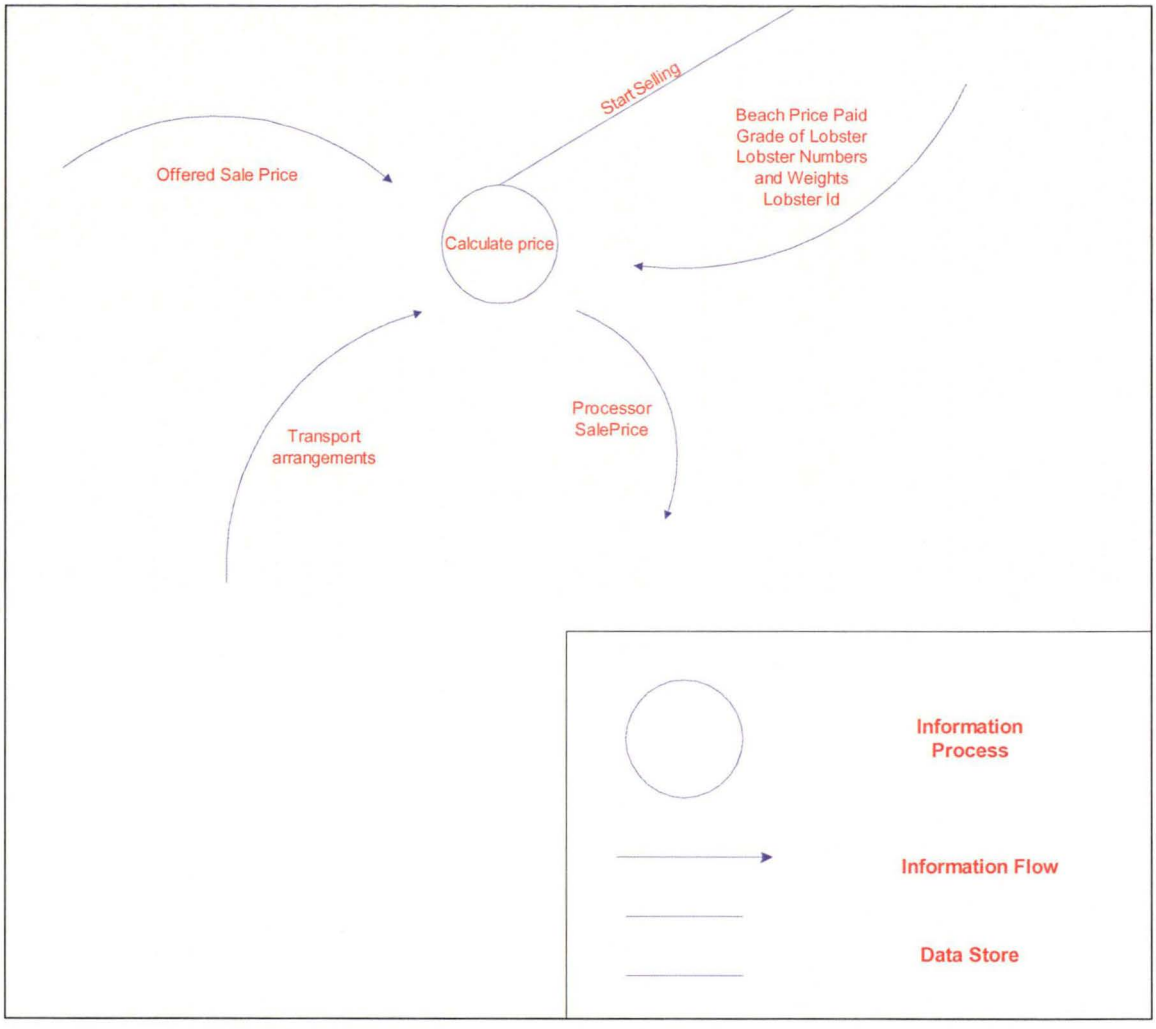


Figure 5-25 presents the next information process, Level 3. IFD 2.6 *Negotiate Transport*.

Figure 5-25: Level 3. IFD 2.6 *Negotiate Transport*

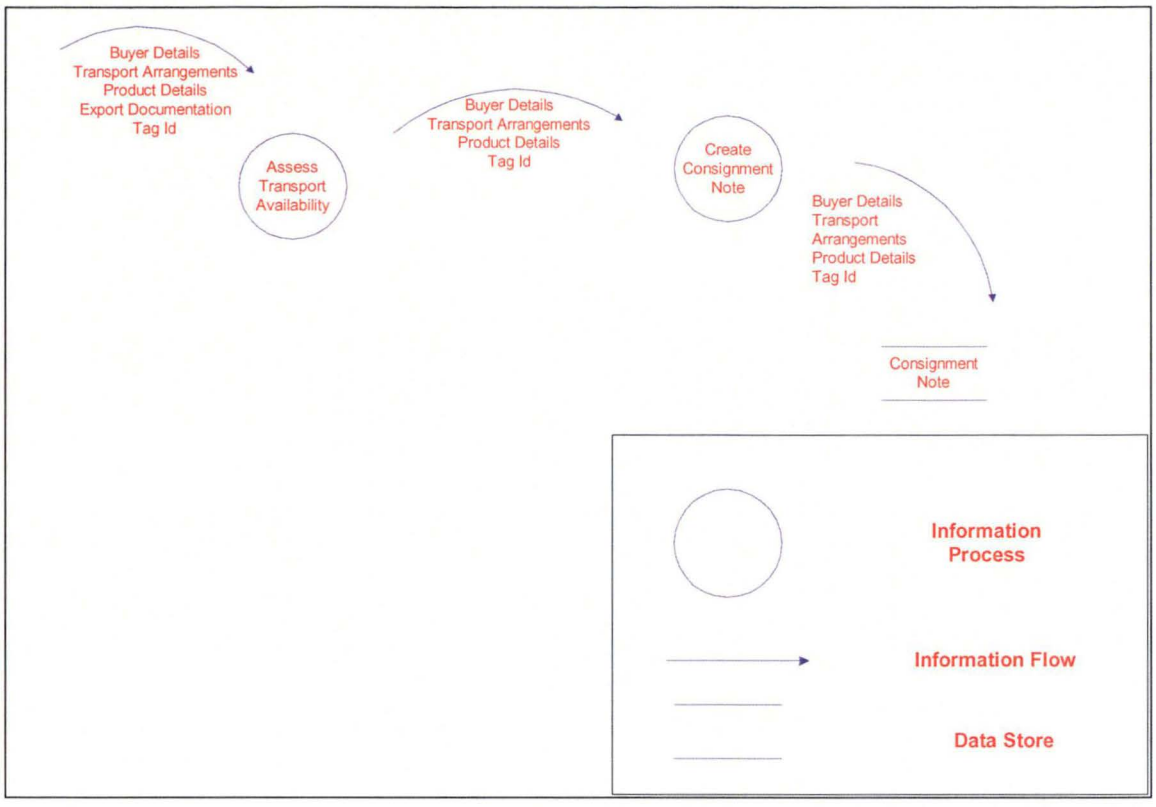
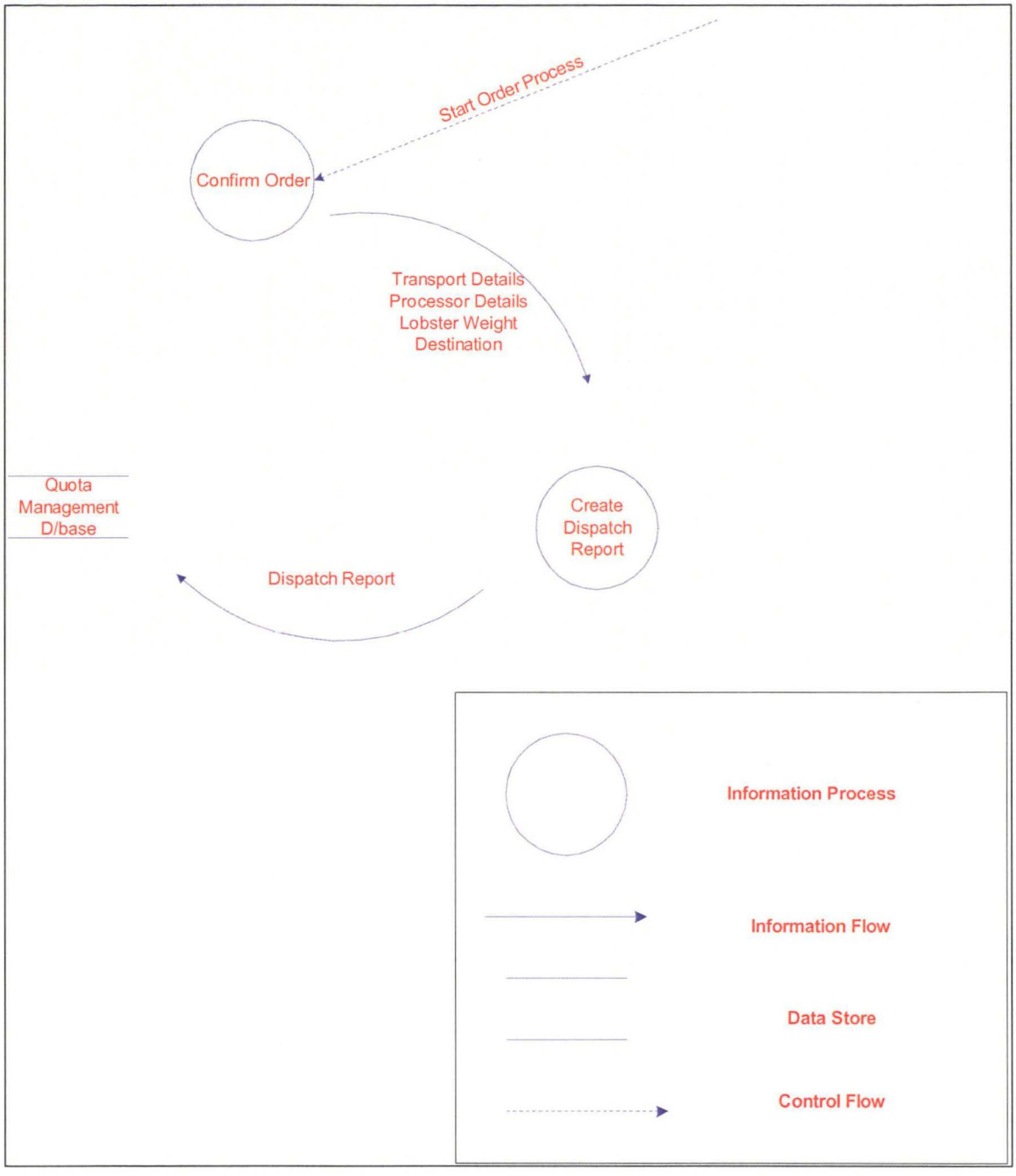


Figure 5-26 presents the next information process, Level 3. IFD 2.7 *Submit Lobster Order.*

Figure 5-26: Level 3. IFD 2.7 *Submit Lobster Order*



The Transport Sold Process

There is a high risk of lobster mortality and loss of condition, and product loss during transportation of lobsters to the buyer's destination, so quality monitoring measures need to be undertaken by both the processor and the freight service provider. Tagging is a possible method to monitor the quality of product along the supply chain. The tag, based on a radio frequency identification device (RFID), has key information that uniquely identifies each lobster such as *Lobster_id*. Similar to a data logger, it also captures key information such as temperature, GPS location and time. In addition, at key points along the chain between the processor and buyer, the processor or freight

forwarder can dial in to the GPS transponder via the web and download key information about the product's condition and location onto the processor's business management system. This information then corresponds to the information in the business management system, which hopefully provides a full picture of the lobster's journey from the fishing deck to the consumer's plate.

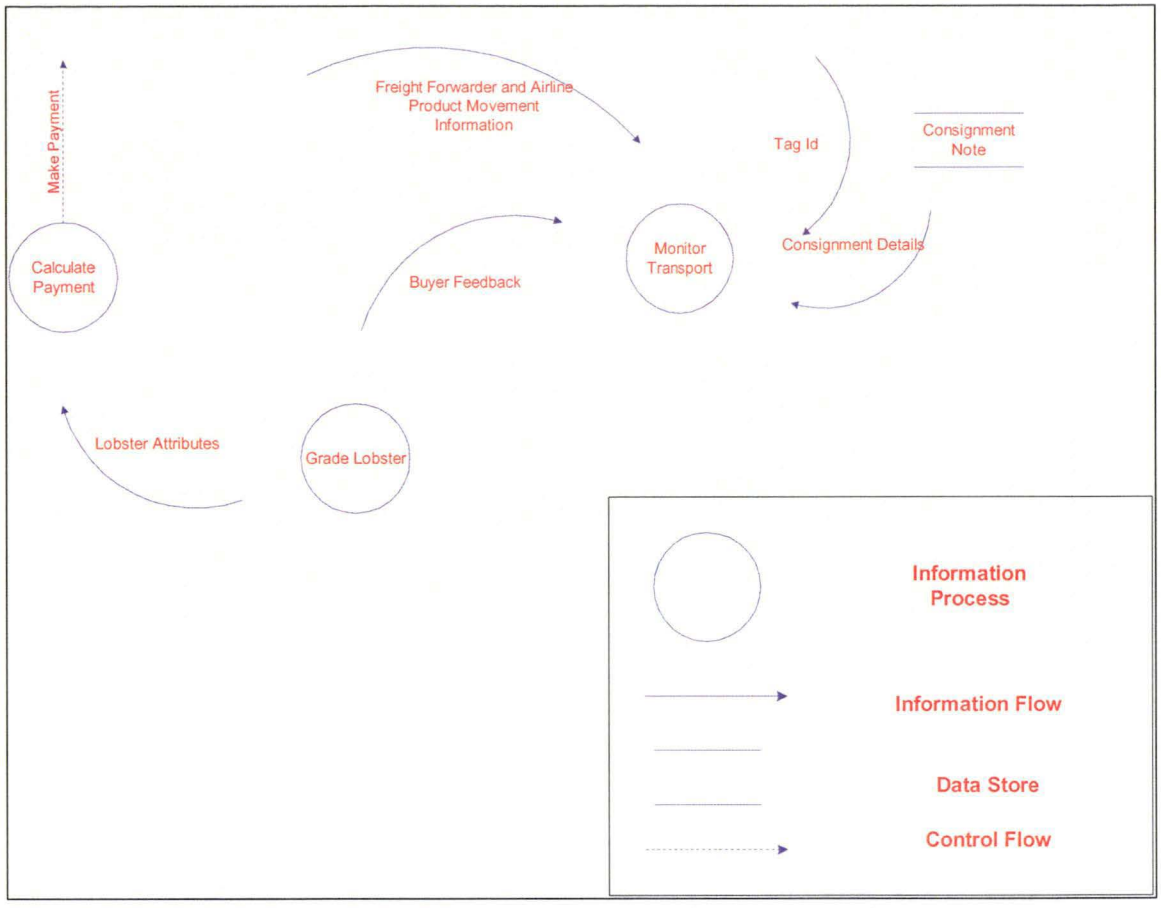
Freight forwarders can assist with product tracking during transport through the unique identification of the order, called the consignment number and/or airline bill number. The order also has buyer and processor identification and details, destination, arrival and departure date, and quality at point of departure from processor. As the order entity is linked to the processor and lobster entity, the buyer can track a specific lobster back to its catch, fisher, vessel, trip and pot. The buyer entity contains the attributes: buyer identification and details, consignment number, airline bill number, processor identification, quality upon arrival, arrival date, destination (other buyers such as restaurant), and quality at point of departure. At that end of the chain, quality is based on consumer expectation. There is a high risk of lobster mortality and loss of condition, and product loss identified during transportation of the lobsters to the buyer's destination, so the quality monitoring measures need to be undertaken by both the processor and freight service provider. Each order has a consignment number and/or airline bill number, which is used to track the product during transport. The order also has buyer and processor identification and details, destination, arrival and departure date, and quality at point of departure from processor.

The Grade, Hold, and Distribute Process

The process of *Grade, Hold and Distribute* lobster occurs when the buyers receive the lobster order from the airport (Figure 4-1). In contrast with the current supply chain processes, it is anticipated that feedback mechanisms will be established to provide processors with information about the condition of the lobster upon arrival. This information would assist processors in improving handling practices and understanding consumers and the marketplace. These mechanisms may also be indicators of change in the marketplace. As the order entity is linked to the processor and lobster entity, the buyer could track a specific lobster back to its catch, fisher, vessel, trip and pot. The buyer entity contains the attributes: buyer identification and details, consignment number, airline bill number, processor identification, quality upon arrival, arrival date,

destination (other buyers such as restaurant), and quality on departure. Figure 5-27 presents the related information process, Level 3. IFD 2.9 *Assess Sold Lobster*.

Figure 5-27: Level 3. IFD 2.9 *Assess Sold Lobster*



Entity-Relationship Model

Figure 5-28 presents the entity-relationship model for the proposed Rock Lobster Electronic Management System. The model represents the key entities and relationships associated with the system. This model provides the foundation for designing a database to support the system. A logical record structure data model is defined in the next section and describes the database design and specification in more detail.

Logical Relation Data Model

Figure 5-29 presents the logical relational data model for the Rock Lobster Electronic Management System. The model represents the key entities, supporting entities, attributes and relationships associated with system. The model also represents the key information collected and stored in the database management system and other datastores such as RFIDs, whether it is on a vessel, in a processing factory, freight depot

or at the buyers warehouse. The information collected will provide the foundation to track product and monitor quality along the supply chain.

To fully develop this database management system, further information is required to define the database specification and structure, such as the volume of information to be stored and access requirements. Then the final step before implementation would be the conversion from the logical to the physical design of the database management system. As my focus is on the conceptual modelling of the Tasmanian rock lobster industry supply chain and the Rock Lobster Electronic Management System, these steps are considered beyond the scope of this research.

Figure 5-28: Proposed Rock Lobster Electronic Management System entity-relationship model for the Tasmanian Rock Lobster Industry supply chain

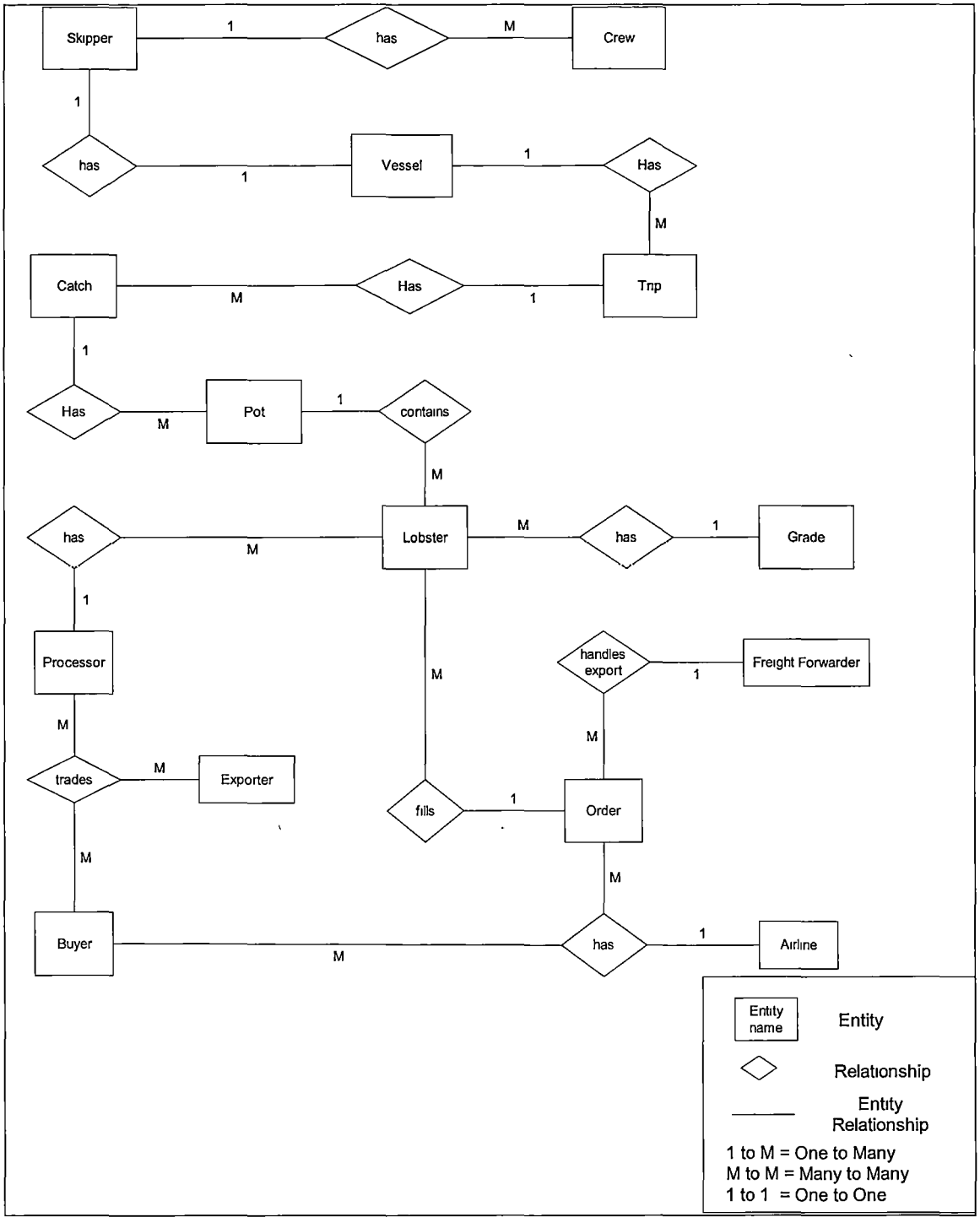
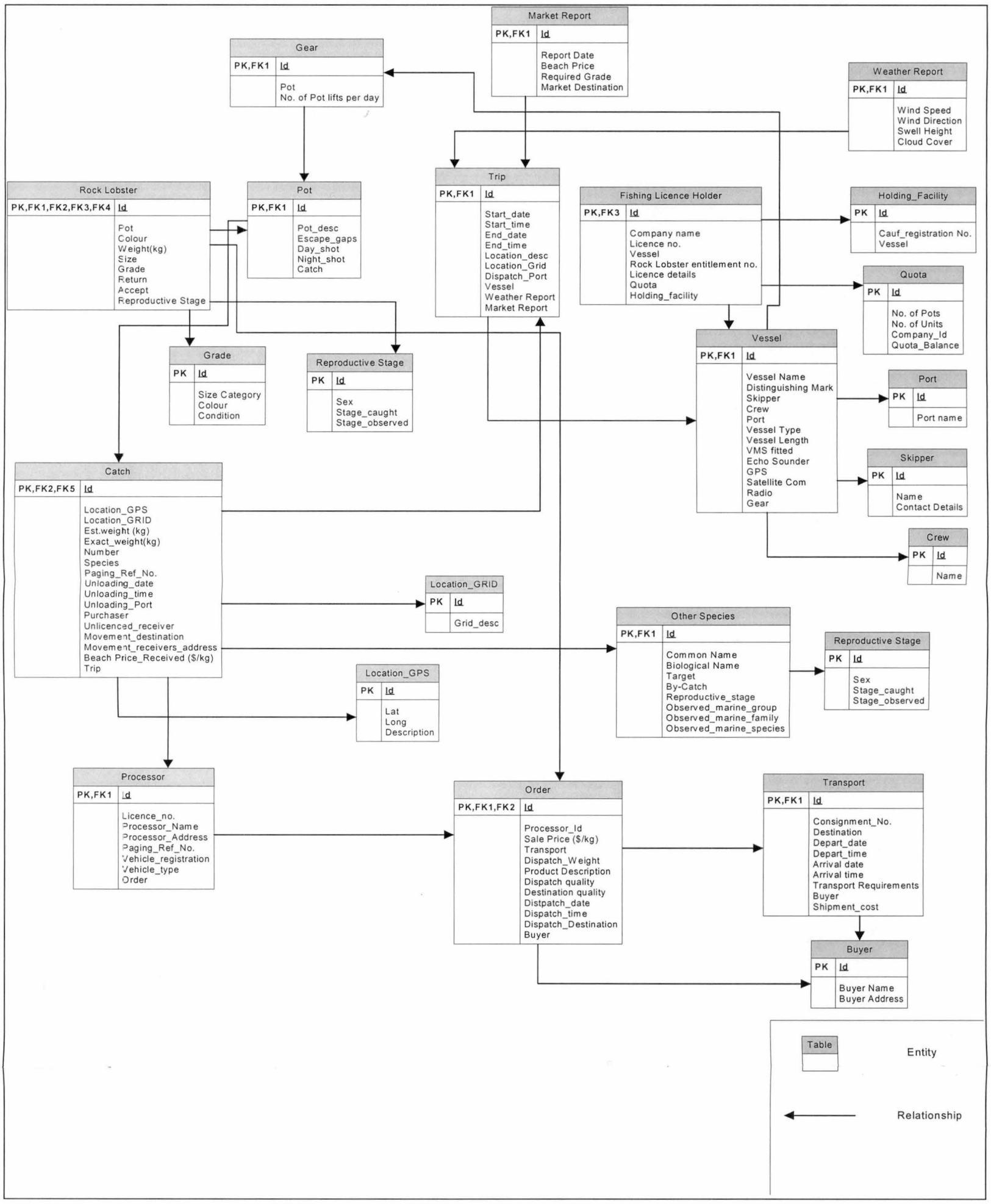


Figure 5-29: Proposed Rock Lobster Electronic Management System logical relational data model for the Tasmanian Rock Lobster Industry supply chain



Summary

Based on information gathered through Tasmanian government literature, and informal and formal consultation with industry stakeholders, in this chapter I took an interpretive systematic approach to map the current and proposed Tasmanian industry supply chain. The proposed Tasmanian industry supply chain is based on the requirements from IS/IT Solution Two, which is to develop a Rock Lobster Electronic Management System for the industry. The mapping process highlighted the industry's information system(s) in its current and future forms, and included key business (physical) processes and flows, information processes and flows, data stores, control processes, entities and relationships. The following chapter reviews IS/IT Solution Two against real life issues and obstacles raised from feedback from industry stakeholders. This feedback will then assist in producing a recommended and tested IS/IT solution that the industry could trial.

CHAPTER SIX: REVIEWING IS/IT SOLUTION TWO

In this chapter I review IS/IT Solution Two, the Rock Lobster Electronic Management System, proposed in Chapter Five. Based on the current and predicted future economic and social climate, the purpose of reviewing the proposed IS/IT solution and strategic plan is to identify and highlight critical success factors to be achieved if the system is to be successfully implemented by the industry. The review process involves incorporating the SWOT analysis findings of the industry profile undertaken in Chapter Four and the lessons learnt from IS/IT Solution One, also described in Chapter Four. A multi-disciplinary approach has been required to understand the effects the system may have on the current industry supply chain, and includes the use of ethnographic participant observations and IS/IT strategic analysis techniques that highlight the benefits and issues associated with each IS/IT solution.

IS/IT Solution Two: Rock Lobster Electronic Management System

As described in Chapter Five, the business management system is a "stand alone" database on fishers' or processors' PCs whether at sea or in the office. The system aims to collect key information about each supply chain member's operations to improve the knowledge base and decision-making processes in the business. The system also aims to facilitate information sharing among supply chain members and industry peak bodies for the purpose of industry supply chain management. The tagging system is designed to work in parallel with the business management system and aims to uniquely identify each lobster against the catch, vessel, fisher, processor, order, transport provider and buyer for the purpose of tracking product along the supply chain. The tag undertakes two roles: it is a branding system and it is a tracing system for both upstream and downstream supply chain members to monitor and gain feedback on quality relating to customer service, handling practices and product description.

Data models such as IFD and ERDs allowed the industry supply chain to be represented diagrammatically in terms of the physical processes and flows, and decisions and information processes and flows. The process was then replicated to model the effects of IS/IT Solution Two on the supply chain. Based on that work, I was able to communicate the concept to key industry stakeholders and gain feedback from interviews. The following section summarises that feedback.

Industry Feedback

In Table 6-1, I have summarised the constructive feedback gained from key industry stakeholders using participant observations. The table summarises data by grouping the benefits and issues against each industry supply chain member. The benefits and issues raised about IS/IT Solution Two also reflect many of the issues and trends that were presented earlier in the SWOT analysis of the Tasmanian rock lobster industry (Table 3-1, 3-2, 3-3 & 3-4). Confidentiality, the perceived loss of control over the data, financial and time investments in the system, technology accessibility, and the constraints of being price takers are some of the main issues identified.

Table 6-1: Industry feedback using participant observation data collection techniques

Supply Chain Member	Benefits	Issues
Fishers	• Web technology – greater access to information such as weather and communication with processors and family • Safety benefits while at sea • Better understanding of downstream supply chain such as markets • Improve handling practices • Promote product and industry attributes • Greater control over their future • More feedback from DPIWE in regard to quota balances and fishing license profiles	• Confidentiality concerns – threats to intellectual property and competitive advantage • Time consuming to tag each lobster • Lack of business application of available technology • Variable standards of handling practices and quality criteria • Lack of trust with processors • Lack of transparency along supply chain • Concerns for future industry viability • Investor influences on costs of operations

Supply Chain Member	Benefits	Issues
Processors	• Stock flow management system • Traceability within factory would be useful • Some Tasmanian owned exporters see the benefits of seeking alternative markets to China	• "Claim" by buyers • "Offload" periods by airlines • High risk between processor and buyer. • Price takers • Dependent on the marketplace • Differences in business culture between export processors and buyers • Variable standards of handling practices and quality criteria • Lack of motivation to seek new markets • Most exporters are owned by Chinese and very few are located in Tasmania • Concerns for future industry viability • Investor influences on costs of operations • Unsophisticated marketplace • Price driven marketplace • Processors individualistic in nature and tend to undercut each other • Stock management systems – variable standards
Fisheries Managers	Electronic transfer of monthly information from processors to DPIWE	• Technology costs – costs and reliability of transmitting data • Lack of coverage • Fishers reluctant to collect more information than they have to • Supply chain issues beyond agency charter • Require fishers to have computers on board (extra expenses) and larger size vessel
Fisheries Scientists	• Provide economic data for the fishery • Changing research focus – taking a more holistic approach • Greater resolution of data	• Fishers reluctant to collect more information than they have to • Volunteer data collection – poor integrity and quality
Trade and Market Development Managers	Potential change based on global trends for quality assurance of food	• Unsophisticated marketplace • Price driven • Industry vulnerable on relying on a major market place
Industry Development Managers	• Providing economic data and performance indicators of growth • Potential change based on global trends for quality assurance of food	• Need performance indicators of growth • Processors individualistic in nature and tend to undercut each other

Supply Chain Member	Benefits	Issues
Licensing and compliance	Electronic collection of catch and effort data	• Potential loss of control over quota management system • Loss of customer service • Potential loss of data due to no hard copy back up • Operation costs outweigh benefits • Concerns of electronic data not accepted as evidence by a court of law • Only interested in weights, not traceability of individual lobsters along the supply chain • Lack of understanding about digital signatures and *Electronic Transactions Act 1999* • Cannot see tagging to assist in the marketplace, because people will remove the tags • Technology – lack of coverage
Freight Forwarders	• Improved customer services with export processors • Integrate with tracking systems	• Cancellations of bookings due to the closure of the Chinese-Hong Kong borders • QA efforts by Australia cannot be guaranteed to continue once in the hands of the buyer • New market access constrained by airfreight costs
Airlines	• Improved customer services with export processors • Integrate with tracking systems.	• Tagging system – transmitting devices not permitted on airlines in Australia • Increasing levels of security, even at a domestic level
AQIS	EU requires proof of origin	
Buyer	Potential change	• China - Cartel wholesale buyers that control demand and supply to consumers • China- Lack of transparency to the consumers • China - Unsophisticated marketplace • China - Price driven • China- Free trade agreement may be occur due to "vested interests" • EU – Need for traceability • US – *Bioterrorism Act*

Analysis of IS/IT Solution Two

Using CSF analysis against the business objectives, a modified system is now recommended. CSF analysis is about determining through industry stakeholder consultation what activities are necessary for the success of a Rock Lobster Electronic

Management System for the industry. Table 6-2 identifies key critical success factors for industry members to achieve before adopting a system against industry objectives.

Table 6-2: Critical success factors for the industry to adopt the Rock Lobster Electronic Management System

Objectives	CSF
Up to date information for upstream industry participants	Need good seller- buyer relationship Understand business culture Market intelligence – industry agents in the marketplace
Shift from price makers to price takers for upstream industry participants	Diversify markets Re-engineer the supply chain to enable upstream participants to drive the supply chain through the use of a fisher's cooperative marketing company
Increasing supply chain transparency	Commitment from supply chain members
Convert manual information system into a computer-based information system	Commitment from supply chain members to enter this data into the business management system Main data integrity
Use fisher's logbook and quota data as the basis of the system	Commitment from supply chain members to enter this data into the business management system
Differentiate the product through value-adding and branding	Establish traceability system Record handling practices and quality of product in business management system

The underlying issue relating to the proposed system is what degree of traceability the marketplace and consumers might accept. The level of traceability depends on the reasons for having traceability. As part of an emerging emotion economy (Todd 2000) where the 'through-chain approach' of 'pot to plate' is reversed and is driven by the consumer, issues such as traceability, animal welfare, good environmental management, freedom from genetically modified (GM) foods, and quality attributes such as taste, freshness, convenience, nutrition, health, and value for money, are at the forefront of consumers purchasing decisions (Todd 2000). Most marketplaces that require or value traceability of food want to have assurances in regard to the integrity of food at every link along the supply chain. Under AQIS's specifications for seafood exporting to the European Union, traceability is required back to the origin of the product such as the vessel (mother-ship) or farm. An example is oysters, where the origin is the farm, and region and/or area grown and harvested. For the purpose of food safety, if an incident of food poisoning occurs with a batch of oysters, there is traceability back to the water source to determine if algal blooms or pesticide and herbicide residue in river run-off are the cause.

The problem is that each marketplace has different standards or requirements. Also known as mass individualization, the relative importance of issues and attributes that consumers consider as influential in their buying decisions are variable between countries, regions and individuals (Todd 2000). Industry supply chains need to recognise that consumers belong to different market segments and should endeavour to customise the product to fit that market segment. Sengupta (2004) supports this argument by highlighting the importance of focusing on the customers and consumers in SCM. The three examples that relate to the Tasmanian rock lobster industry stem from the United States, the European Union and China. The US marketplace is mostly focused on the potential deliberate contamination of imported foods into the US and therefore has introduced the *Bioterrorism Act* to combat this issue. In contrast, the European Union is more concerned with the importation and consumption of undisclosed diseased and genetically modified foods, and foods that come from environmentally unsustainable industries. These concerns are reflected in the AQIS requirements for proof of origin of seafood exported to Europe. The Chinese also have different standards of quality and requirements for food importation compared with other countries and marketplaces. Many exporting processors regard China as predominantly price orientated rather than quality. However, it could be argued that consumers in China are interested in quality and traceability attributes to enhance the prestige of consuming a particular meal.

> The reality is that we are selling into the top 2 % of the Chinese echelon in terms of wealth, those Chinese will start to pick up on what is happening else where, and the Chinese in time will become more highly critical of their high value imports (Fisheries Manager, DPIWE, pers.comm., 2003).

Focusing on the upper echelon in China, the business culture is about displaying wealth at expensive and exclusive restaurants and consuming expensive products. Business deals are made in these environments and therefore highlight the significance of these restaurants for the industry to supply and prove their product's high quality status. The promotion of Tasmanian or southern rock lobster in these restaurants is not fully exploited and is controlled by powerful Chinese wholesale importers. Understanding this business culture is important for future development of the Chinese marketplace for the Tasmanian rock lobster industry. In addition to the business culture of China potentially driving traceability, there is an increasing consumer concern and awareness

driving food safety and disease free food based on the advent of SARS and the Avian Bird flu. If a free trade agreement is achieved between China and Australia, consumer driven traceability of rock lobster may become a marketing requirement and a competitive advantage for the Tasmanian rock lobster industry. From a marketplace perspective, the implication of this movement for the Tasmanian rock lobster industry is the varying degree of traceability requirements of marketplaces. To achieve this, the industry needs to have a good understanding of the business culture and consumer requirements for each target market.

The degree of traceability for the industry is also defined by the practicality of undertaking this task. An underlying issue raised in IS/IT Solution Two is the concern by industry respondents relating to tagging of rock lobster at the point of capture. For the purposes of traceability from the pot to the plate, the system proposes that a unique identification of lobster is established and undertaken by fishers at sea. This "id" is reflected in the business management system and on the tag. The concern is that the task to tag each lobster and record the "id" into the system would be very consuming for a fisher whilst at sea. Although fishers can see the benefits, the time required to undertake this task at this level would outweigh the benefits. However it was suggested by fishers and fisheries managers, that the tagging of individual lobsters could occur at port during unloading or upon arrival at the processing factory. "From our point of view we would be actually targeting the industry through the processing sector in terms of electronic logbooks" (Fisheries Manager, DPIWE, pers.comm., 2003).

Tagging at the port or processing plant stage would mean that lobsters would have an "id" against the trip, but not against the pot and specific location. If a processor tags lobster upon arrival at the factory, the information provided from the fisher would include trip number and details, skipper, and vessel. If a processor tags each fisher's catch upon arrival at the factory, internal traceability and improved stock management within the factory would be a key benefit for the processor. The tagging process would also assist in matching the stock against market specifications and feedback, and therefore ensuring red lobsters are sent to the Chinese marketplace, while brindles are sent to other market places.

From a consumer perspective and for the purpose of AQIS' European Union requirement of "proof of origin", traceability to the vessel and trip may be sufficient,

and would allow the region fished to be provided at a consumer level, for example, Tasmanian rock lobster caught off the southwest coast. The disadvantage of not uniquely identifying the lobster at the point of capture means that fishers would not be able to correlate between pot catchability, pot location, lobster condition and handling practices against the market price received, and consumer feedback of a particular lobster. However fishers could correlate information at a catch level. Ideally the lobster should be tagged as they are placed into the vessel's holding tanks. This "id" could then be scanned into the business management system and matched against the pot_id, catch_id, and trip_id.

An alternative proposition would be to tag or uniquely "id" the order (boxes) upon dispatch from the processing factory. In this case, traceability of a particular lobster would not be possible for fishers, because once the catch arrives at the processing factory they are sorted and placed in tanks that may consist of other fishers' catches. However, traceability between processors, freight forwarders, freight providers and buyers would be possible. Similar tracking systems are already in place with freight forwarders and airlines which allow tracking of product during transit, however monitoring environmental conditions such as temperature and location requires a smart chip tagging device such as a Radio Frequency Identification (RFID) tag. RFID tags have a low powered transmitter that requires a reader to upload data, which can be downloaded onto a website for the processor to view. The reader needs to be within 3 metres of the tag and clear of any obstruction such as a concrete wall or airplane wall. The reader can be hand-held or mounted on a wall. Based on these tag requirements, the data can only be read on the ground, upon departure, during transfer at an airport, or arrival at the destination. The freight forwarder would be in the best position to collect this information. However tracking the product beyond the airport is based on industry agents being on the ground to collect this information. There appears to be no evidence of official acceptance by Australian airlines in using this technology, and feedback from freight forwarders and airlines in Australia make it clear that any transmitting device would not be allowed on a plane. However, it appears that it is possible for the device to be accepted by the airlines due to its low transmission and business rules. An alternative to the RFIDs is a passive barcoding system, which contains key information that allows some form of traceability. The barcode systems currently being used for domestic and international airlines contain airline bill/consignment number, buyer destination, and exporter details. However these barcode systems are not integrated

between the domestic and international airlines, and there is limited information flow along the supply chain to other supply chain participants.

For the Rock Lobster Electronic Management System to be adopted, commitment and support from all supply chain members are necessary to ensure data is collected and recorded in the system; there is data and system integrity; and information is utilised strategically. However feedback raised by DPIWE highlights their reservations about replacing existing paper-based information systems with computer-based systems for the quota management system and the catch and effort logbook system. Their concerns include loss of control over the system when third parties become involved such as Telstra; loss of electronic information with no hard copy back up; loss of personal customer service by DPIWE; operation costs outweigh benefits; electronic evidence is less likely to stand up in a court of law; and lack of understanding about digital signatures compared to hand written signatures.

Other Australian fisheries using electronic logbooks, such as the Northern Prawn Fishery, also share the concern over the cost of data transmission exceeding the costs of the paper-based system. The use of electronic evidence in a court of law is an established practice since 1999 with the introduction of the *Electronic Transactions Act 1999* and the use of digital signatures in place of hand written signatures. The Australian Fisheries Management Authority (AFMA) has used electronic data as evidence for at least five years, particularly with organisations such as Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). AFMA encourages electronic data to be transmitted weekly to ensure data is not lost on the vessel. It is a valid concern that electronic data can be lost, however contingencies need to be put into place to prevent this from happening. AFMA also advised the industry to avoid using proprietary software developers to develop a Rock Lobster Electronic Management System. Companies often lock the industry into particular software that is unable to be integrated with other systems. AFMA recommended that open-ended standards for software, such as the utilisation of Extensible Markup Language (XML), should be used to allow for interfacing with most systems regardless of the proprietor.

From a compliance perspective, DPIWE and Tasmania Police were clearly more concerned about the movement of product (weights) in and out of the processing factory rather than individually tracing fishers' catches. Tracking catches between the fishers,

processors and end buyers was deemed to be not of interest or beneficial for compliance managers. They also failed to envisage fishers being willing to tag lobsters and therefore could not see any alternatives to trace the lobster from the fisher to the processor. These concerns were reinforced by some fishers concerns in tagging lobsters while at sea.

> I think a lot of fishermen will resist it. To me I can see the obvious benefits, but anything that adds to the amount of time at sea, because many blokes are out all day long, and trying to get them to do extra functions is quite hard (Fisher, pers.comm., 2003).

The other issue raised was that during a trip, fishers are able to catch lobsters from a number of regions and mix the catches together in holding tanks. Unless you tag each lobster, it would be impossible to trace the individual lobster back to the area where it had been caught. However from a downstream perspective, if a processor wished to know where a fisher's catch is likely to be caught from, the fisher, using GPS plotter information, could provide the areas fished during that trip, such as a grid or region fished. I suspect from consumer, marketplace or AQIS perspectives this level of traceability would be sufficient for proof of origin. The benefits of tagging each lobster would mainly be for the fishers, processors, and research scientists.

> A lot has to occur at the processor level, partly because most fishermen want to get rid of the catch. The processors do the quality control, and the separating and grading for the markets. Plus many fishermen aren't prepared to give you day to day information on where they are fishing, but they would give a whole trip average like south-west, south-east, or whether they caught them [lobsters] in deep water or shallow water. At the end of the trip that information could go with the load (Fisher, pers.comm., 2003).

From a fisher's perspective, there were a number of benefits identified and concerns raised in regard to the proposed business management system. Fishers appreciated the need to collect key information about their operations such as handling techniques, codes of practices, and catch data. The fishers interviewed appreciated the need to supply catch information to research bodies like the TAFI for the purpose of resource

assessment. Many of these fishers were already participating in a research project of some sort, and appreciated the need to capture information about handling practices of catch for the purposes of quality assurance from a market perspective. The possibility of tagging for the purposes of traceability for fishers as well other supply chain members is seen as advantageous for promotion of the industry and feedback of product. However the logistics, together with costs in time and money are key inhibitors. Some fishers would tag their own catch, however most would prefer that the tagging be done at the processor stage to avoid interference with onboard operations at sea. Some fishers see it as a way of promoting themselves, the region from which the product is harvested, and their handling practices. If the lobsters were tagged easily, the product information would go with the load at the end of the trip. An example of the concept is the *LobsterTales* model initiated by the US Maine Lobster fishers. The identification of the product for the purposes of traceability and marketing are considered a way of branding the product and obtaining a competitive advantage. To achieve these benefits, the system would require a marketplace and good buyer relationship to ensure the system could be operational and provide value to the industry supply chain. Yet fishers had reservations about confidentiality of information. Quota and logbook requirements specify key information to be provided to the State Government for the purpose of quota management and compliance, and resource management through catch and effort data. This requirement is legislated and non-compliance means significant penalties such as hefty fines. The issue of confidentiality and how much information should be provided is a contentious issue, as managers and researchers struggle to get fishers to provide more information, while fishers resist with the view of protecting their fishing spots and avoiding time consuming data recording with limited connection with the benefits of undertaking these tasks. Much of the fishers' concerns about confidentiality stems from one incident where it was alleged that a Tasmanian Government employee who had access to fishers' catch history, used it for personal gains in their own fishing business. The story has been enough to cause fishers to be protective of the amount of information provided to State and Commonwealth Government agencies about their fishing grounds and operations. Hence the reaction when fishers are asked about whether they keep a personal logbook in addition to the DPIWE logbook and quota docket book. Fishers are also competitive and protective of their intellectual property.

However, asked the question in a different way, fishers do use technology such as GPS plotters to record fishing practices, which in some instances is quite extensive and sophisticated. It appears some of the information recorded is a flow-on from research projects involving fishers who have identified the benefits of capturing this information for their own business. GPS plotters have provided a means to record catch details at specific fishing locations for future reference. The data collected provide fishers with information about pot performance and high return rates on fishing spots. The degree of detailed information recorded on plotters varies according to how much a fisher wants to know about fish. The information is carefully guarded because it allows them to make very accurate estimates of weight against numbers, lobster condition, and preferred fishing grounds. Some fishers keep a personal logbook independent of the DPIWE's logbook, but feel reluctant to admit they keep additional information in fear of fisheries managers advocating legislation to access that information and possibility threaten the fishers' competitive advantage and intellectual property. Fishers regard the amount of information required for DPIWE's logbook as sufficient.

Competition among fishers appears to be just as significant as ever. With the introduction of quota, it would seem that the effort would reduce and that all fishers licensed to fish quota would have equal ability to catch their allocated quota. However it appears that other pressures, such as discussions about the efficacy and introduction of Marine Protected Areas (MPAs) and market demands, maybe perceived to reduce the "size of the paddock" and therefore reduce the area in which fishers can operate. Hence they concentrate effort on specific areas, where normally the effort may be more evenly distributed.

> When the quota management system came in, we had a paddock that big, and now with marine parks, the paddocks are shrinking. It is not hurting the fish, but hurting the operators (Fisher/Processor, pers.comm., 2003).

It has even been argued by some fishers that closed seasons contribute to increasing competitiveness, and that opening the seasons and allowing markets to dictate quality of lobster harvested would aid self-management of the resource. This outcome could occur if processors would accept only a certain standard of quality and fishers would only harvest a certain quality of lobster. The reality is that not everyone has the same values about the resource, industry and market place. Thus the only way to ensure

everyone follows a standard of quality is to regulate it because, in the price driven market place, poor quality lobster will always find a buyer.

At the interview, some fishers said that having access to IS/IT and web technology at sea would be beneficial. Web access at sea means that fishers can access vital and important information relevant to their fishing operations and safety, such as weather, market prices, and cost-effective communication with families, processors and equipment suppliers. Some fishers who are required to use VMS on their vessels also appreciate the safety benefits that it provides. Weather is regarded as an important factor in fishing, and web technology is able to provide affordable and timely information about weather allowing fishers to have greater confidence about determining whether to go to sea or not, for how long, where they fish, and to what depths. Inshore fishing on the southwest coast of Tasmania is particularly subject to weather conditions. When weather information is based on telephone or facsimile, the cost of accessing this facility a number of times a day is significantly higher than accessing accurate information via the Internet.

Like fishers, some processors interviewed about the proposed system appreciated the potential benefits that it could offer, while others failed to see the benefits. As stated in Chapter 5, the degree of sophistication of existing stock management systems used by processors within the processing factory is variable. Most processing activities stored in processors' heads, unless there is a regulatory requirement to document key information. Some processors rely on paper-based systems such as stock flow sheets, while others use computer-based systems, such as accounting packages, to record fisher details, size, quality, and numbers and weights of rock lobster coming in and out of the factory. The systems also allow processors to know how much fish they have in the tank and the quality when a buyer wants to place an order. They also have historical records of the catch description of each fisher from whom they buy. So over time, a database is generated on each fisher, and processors know the reputation of each fisher such as quality of catch. Traceability within the processing plant is virtually non-existent, mainly due to the lack of regulatory requirements and there is limited knowledge about the ultimate destination of a particular fisher's catch or lobster.

The relationship between processors and exporters, and overseas buyers is very important for the processor. Some processors deal with a number of buyers, however

generally there is preference for one or two which they have developed a better relationship with in terms of trust, understanding and communication. In the complex world of exporting lobster to China, these relationships with buyers are essential for processors. However, as stated earlier, there appears to be reluctance from processors to seek alternative markets due to the market dominance of China who have generally paid the highest price.

From the perspective of DED managers in terms of branding, they are supportive of marketing Tasmanian product under the banner of the Australian brand, as it is possible to promote the place of origin within this. However the reliance by the industry on the Chinese/Hong Kong black market for entry of product may be an inhibitor and not advantageous to highlight or promote.

> The average Chinese consumer would not know the origins of the rock lobster as it is marketed as "rock lobster" with no place of origin. Only a small percentage of the up market restaurants would be interested in the products origins. However this can change. (Trade and Market Development Manager, pers. comm., 2003).

Another inhibitor of branding Tasmanian rock lobster using tags or labelling of boxes in the current major market is that any identification of origin is removed from the boxes.

> When the fish go across that border all the labels are torn off it, and they are put back into tanks and then before they are shipped to Beijing or Shanghai, they are put back into other boxes without any labels. There is no way of branding your product (Processor, pers. comm., 2003).

From an industry development perspective, developing a tracking system to gain information from the marketplace for upstream supply chain members is important, however there is a need to have somebody that is reliable on the ground collecting this information for industry. It is also important to have a marketplace that is willing for this information to reach consumers, in addition to fishers and processors. The competitive advantage for the current Chinese buyers is the lack of transparency for either end of the supply chain.

> So it is a beneficial aspect to look beyond the processor to the buyer. I am not sure how you do that. Getting reliable information back. If the industry were serious about tackling this issue, they would have a person placed in Xiangzen, who would check the fish on arrival. Now that would mean a lot of coordination and all exporters would need to commit to that (Industry Development Manager, pers.comm., 2003).

The possible advent of a free trade agreement between China and Australia may provide an opportunity for greater transparency along the supply chain. Exporters would be able to sell their rock lobster through the proper channels and gain access to the consumers. The Chinese consumers who are concerned about food quality may also reinforce the demand for increased supply chain transparency, cool chain management, and proof of origin for their food products.

> One day the market will become more concerned with cool chain management and all those other aspects, and not stressing the fish will become more paramount (Industry Development Manager, pers.comm., 2003).

> So there would be aspects of size and ultimately of quality aspects that would become more paramount, particularly if we are looking at developing markets as you have suggested in Europe, or alternatively other Chinese people throughout the world. You would have to be in a better position I would say, for the customer, if you could guarantee quality of the fish (Industry Development Manager, pers.comm., 2003).

From a fisheries management perspective in relation to the proposed system, the biggest hurdles are data quality; system integrity, communicating benefits, and ensuring the benefits outweigh the costs. Data quality becomes an issue when trying to get fishers to enter information into a system. Also observed by fisheries research scientists, it appears as a result of resistance from industry, any collection of industry information needs to be enforced. Experience has shown that "voluntary fields in logbooks are a waste of time as they are not properly filled out ... Better to get a small quantity of good quality data" (Fisheries researcher, pers.comm., 2003).

> If you are envisaging an electronic system where fishers enter information electronically which is sent to us in substitution for the paper-based system, there are issues in terms of data entry error processes. At the moment if we make data entry errors we have a paper copy (Compliance Manager, pers.comm., 2003).

Resistance to collecting and providing information from the fishing community is initially because of concerns in confidentiality and the time required to complete the extra information fields in the fishers' logbooks. However, if the fishing communities realise the benefits, cooperation occurs. The perceived benefits of the system from a fisher's perspective are important. There is a concern by personnel in DPIWE that it would take longer to enter data into an electronic data recording system than writing the information down on paper. "It all comes down to having a package of incentives" (Fisheries Manager, pers.comm., 2003).

In terms of collecting market and quality information from other supply chain members other than fishers and processors, both fisheries management and research scientists felt it was simply beyond their charter. Marketplace information is not regarded as part of the primary information sought by DPIWE for the purposes of resource management, however if managers want this information they can seek it from other government agencies, such as DED and Austrade, and industry bodies such as the TRLFA. "Our market intelligence mainly finishes as it goes out the processor's door" (Fisheries Manager, pers.comm., 2003). "Purpose information collected related to compliance rather than purpose information for market information" (Fisheries Manager, pers.comm., 2003).

> We can extract a wealth of information and understanding about what we think might happening from a marketing point of view from the processors quota docket book and processing quota dispatch document. But we do not have the interest and resources, so we do not have a need for that data (Fisheries Manager, pers.comm., 2003).

However, both stakeholders in the industry acknowledged the need for this information to provide a complete picture of the industry supply chain, and improve management and research policies. One identified difficulty for DPIWE in regard to market

information is not having reliable information at the point of sale in Tasmania. This information could be extracted from the information already provided to DPIWE by the processors, however the information is not explicit.

> The government has just put out a whole of industry development plan type thing. So we are in the process of re-writing the industry profiles, so from a resource management point of view it is easy to make statements about catches and so on, but we do not have good information about employment, and good information about markets or market opportunities for us. This is in contrast with the Marine farming sector where production information is more readily collected and therefore provides a picture about the employment and an understanding of how the sector may be changing, particularly in terms of production shifts (Fisheries Manager, pers.comm., 2003).

"One of the difficulties that we have I think is trying to convince industry why we need this information" (Fisheries Manager, pers.comm., 2003). One significant observation made by DPIWE was in relation to custodians of the data and Rock Lobster Electronic Management System. Essentially there is a need for a governing body to manage the system.

> If you were going to run a traceability type process, it needs to be run by a government organisation or a private organisation. It can't be open access. You got to have levels of security on it. Only people who are authorized can have access to the information through an information service (Fisheries Manager, pers.comm., 2003).

From a trade and market development perspective:

> DPIWE will eventually have to consider the possibility of adopting an electronic system for their compliance and quota management (Trade and Market Development Manager, pers.comm., 2003).

Electronic data collection would be seen as advantageous for scientific research particularly if it was possible to capture higher resolution data, (for example, latitude,

longitude and depth) and it would be useful for fishers to gain feedback on quota and catch rates.

> Ideally an infrared system on a pot to determine the number of lobsters going in and size. When the pot came to the surface it would give a GPS location, and beam back to a satellite all the information about the lobsters (Fisheries Researcher, pers.comm., 2003).

However the system would have to be enforced to ensure quality information was collected. Information collected electronically for fishers would be useful in determining the correlation between high returns against season, location, depth, water salinity and temperature, colour, size, and condition of lobster. The information would also allow fishers to high grade and split their catch to gain better returns and match market requirements.

Other information that would be regarded as useful by the scientists includes size structure of the catch. Fisheries researchers believe processors could assist in collecting useful information by measuring and recording sizes at the processing plant. Understanding fishers' behaviour against market trends would also be useful to model the fleet dynamics and predicting future trends in exploitation.

> There is a lot of information stored in the heads of fishermen about what they have seen, whether catch rates are down, and where there is a good run of Stripey trumpeter around. If you could start documenting this, that would be fantastic (Fisheries Researcher, pers.comm., 2003).

> Scientists timeline is short and so there is not a long history and knowledge about the industry. Fishermen have the biggest history about the long-term effects with the fishery (Fisheries Researcher, pers.comm., 2003).

The economics of the fishery would also be considered useful by fisheries researchers based on current information that is very crude and behind other industries and states. The economic information could include estimated number of jobs involved in an industry and the true economic impact of the whole fleet including fishers and people in

associated sectors. "Tracking lobsters along the supply chain would be a way of quantifying the actual economic impacts" (Fisheries Researcher, pers.comm., 2003). Other information could include time fields such as beach price and sale price, estimated capital value and market capitalisation of the industry and the ability to track that through. "Market capitalisation is a direct threat to increasing or getting new markets" (Fisheries Researcher, pers.comm., 2003). "The sustainability of the industry is a balance between ensuring stocks are sustainable and the stocks can be exploited at the same time" (Fisheries Researcher, pers.comm., 2003). "Nice to show on a yearly basis the value of the catch and seasonal patterns which could contribute to modelling exercises and management strategies" (Fisheries Researcher, pers.comm., 2003).

Recommended Rock Lobster Electronic Management System

Against the feedback provided by industry stakeholders, in this next section I recommend an IS/IT system and strategy for the Tasmanian rock lobster industry to adopt. From the lessons learned, concerns raised, and suggestions gathered, I recommend the proposed IS/IT Solution Two, the Rock Lobster Electronic Management System as an appropriate framework for the industry to strategically plan for the next ten years. This strategy is a long term plan and it should be noted that a ten year time frame is deemed realistic for an industry that will require significant change, not only in structure, but also in culture. Taking a staged approach, I am confident that the principles underlying this framework will guide and assist the industry in developing information management systems. These principles will also provide a valuable foundation to strategically manage change in a dynamic global business environment, and ensure a viable and sustainable future for the industry.

In making these observations on the basis of the CSFs, lessons from proposed IS/IT Solution One highlight the potential advantages of a lead agency cooperative company to unite fishers and processors, and encourage them to work together and empower themselves to seek alternative marketplaces and set viable prices that absorb price fluctuations. I think that the Tasmanian industry stakeholders should further explore this concept. The main difference I propose from the original proposal from IS/IT Solution One is that fishers and processors have complete ownership and autonomy of the company, rather than having a partnership with a third party who may have conflicting vested interests. Gertler (2001) reinforces the need for an autonomous

cooperative to ensure success. Table 6-3 presents a series of recommended stages that the industry should follow in adopting the Rock Lobster Electronic Management System.

Table 6-3: Rock Lobster Electronic Management System: recommended stages for a ten-year plan

Stages	Recommend Stages for a ten-year plan	Time Frame
1	Establish a cooperative market company to represent the fishing industry in terms of supply chain management, industry development and market development initiatives	1 year
2	Conduct research into key target market places such as China, Japan, Korea, Malaysia, Taiwan, European Union, and Unites States	3-5 years
3	Establish market places and have industry agents on the ground in the market place	3-7 years
4	Implement the Rock Lobster Electronic Management System	
4a	Business management system 1. Develop stand-alone business management system for fishers and processors 2. Integrate business management system with freight forwarders 3. Develop stand-alone business management system for buyers (subject to industry agent placed in the marketplace)	Step one and two; 2 years Step three; 1-7 years (subject to completion of stage 3)
4b	Tagging system (full implementation is subject to industry agent placed in the marketplace) 1. Trial RFID tag between processors, exporters, freight forwarders and airlines 2. Extend trial to include buyers 3. Extend trial to include processors tagging each lobster to reflect the fisher and trip details	Trials only; 3 years Step 2 subject to completion of stage 3

Stage 1: Establish a Cooperative Marketing Company

The first stage in implementing a Rock Lobster Electronic Management System for the Tasmanian rock lobster fishers and processors is to establish a cooperative marketing company to represent the rock lobster fishing industry and promote market diversification, supply chain, industry development and market development initiatives. The company's role will also include being a custodian of the Rock Lobster Electronic Management System, where an agreement is made among supply chain members about information management and dissemination at an industry level to assist with industry research projects. The company will have Tasmanian rock lobster industry shareholders who will be rewarded through dividends made from the sale of rock lobster to alternative markets that are not currently being targeted by existing processors and exporters. As experienced in Solution One, initially, shareholders may not receive a

dividend while markets are being established, however it is envisaged a return on investment will be achieved over time.

The aim is to empower fishers and Tasmanian owner-operated processors to seek new markets and to not rely on existing major markets. The company will be a platform to undertake market intelligence research, establish agents in key marketplaces to represent the industry, understand the business culture, and to provide reliable feedback to upstream supply chain members. The company will also provide a processing service for fishers who wish to seek alternative market places where existing processors are unwilling to pursue. The ultimate aims are to increase the value of Tasmanian rock lobster to a viable and sustainable level for Tasmanian owner-operators of fishing and processing, and to ensure a level of financial security through stablisation of the beach price paid. These can be achieved through increased competition for current major overseas buyers through the establishment of alternative market places. To ensure that such outcomes are achieved and sustained, it is imperative that an appropriate proportion of the revenue is returned for the purpose of maintaining vigilant strategic planning and research for industry and market development.

Stage 2: Develop Markets

Once the cooperative company is established (Table 6-3), it is necessary for funding to be sourced for the purpose of market development (Step Two) with the current major market and alternative markets. The aim is to diversify and seek niche high valued markets suitable for the Tasmanian rock lobster that ultimately minimises the risks of relying on one or two major markets. By diversifying the markets, there is less pressure on the industry to harvest product that only meets the criteria of one market place, for example, red rock lobster. New markets and new market requirements, means opening up opportunities for other grades of rock lobster.

This stage is a long-term investment for the cooperative and industry, as it requires extensive work to establish market intelligence and an understanding of the business culture. It should be implemented as soon as possible, although it can also be undertaken parallel to other stages, such as Stage Three, which involves the use of an industry agent in the marketplace.

Stage 3: Appoint Industry Agent

Once a target market place has been identified and sufficient market research has been undertaken, the next key stage is the appointment of an industry agent. This agent is to be highly active in providing feedback to the company, and should represent the industry and its members in the market place. It is possible that the industry agent should be indigenous to (or at least highly familiar with) the target country to ensure a full appreciation and understanding of the business culture, and the nuances specific to a region, province and so on. It is also imperative that the agent is trustworthy and has good communications skills in communicating with the company. Their importance to the success of the company, the implementation of the Rock Lobster Electronic Management System, and the survival of the Tasmanian owned fishing businesses must be emphasised.

Stage 4: Implement Rock Lobster Electronic Management System

The outcome of this stage should be the implementation of the Rock Lobster Electronic Management System, which involves two parts, a) business management system, and b) tagging system. The successful implementation of these two parts requires extensive trials and the establishment of industry agents in target marketplaces where feedback is required.

Part A: Business management system

Using the proposed IS/IT Solution Two as the framework, the first part is to establish a "stand alone" business management system, a vessel-based and land-based system for fishers and processors (Table 6-4). The aim is to develop a system for the purpose of collecting data specifically for industry use.

Table 6-4: Business Management System

Supply Chain Members	Information collected	Reports generated
Fishers	Trip and catch details (date, time), GPS lat/long, numbers, weights, depth, quality descriptors, beach price, purchaser details (processor name), paging reference number, product identification, and environmental observations. Operating and capital costs	• Logbook and Quota docket book reports for DPIWE • Market reports such as name of fishermen and vessel, catch details, quality description
Processor	Fishers' Market report, quality/catch description upon arrival, beach price, sale price, buyer details, destination details, freight provider details, and consignment number	• Quota docket book report for DPIWE • Market Report: Fishers' Market report, buyer and freight details • Feedback report: Sale price and product status upon arrival at processing plant and at buyer
Freight Provider	Fishers' market report, processor's market report, destination details, consignment number, freight cost and product quality during transit	• Market report: Fishers' market report, processor's market report, tariffs, and freight duration and product quality during transit • Feedback report: Departure and arrival dates, freight duration, freight cost and product quality during transit
Wholesale Buyer	Market report: Freight provider's market report, product status upon arrival, retail destination, and retail price	• Market feedback report: Product status upon arrival, retail destination, and retail price

Based on concerns raised by State Government representatives about using the electronic system to provide catch and effort and quota data in place of the paper-based system, it was decided that the regulatory quota and fisheries license information should be kept separate. Fishers and processors will be able to store this information on their system and produce reports, but these reports will then need to be transferred to the DPIWE logbooks and Quota docket books and follow the existing protocol with DPIWE. Perhaps in time and with proven success of the system, like its Commonwealth counterpart, AFMA, DPIWE may be more accepting of electronic versions of the information. However for the moment, the main focus will be to collect information for industry purposes. If research institutions and government agencies wish to gain access to this information they will need to request permission from the cooperative company's board of directors. This process aims to protect the confidentiality and intellectual property of the Tasmanian rock lobster industry.

From a fisher's perspective, the business management system will begin with recording the catch to the *pot* level of detail. However to allow for future development, there will

also be the facility to record to the *lobster* level. From a processor's perspective, the system will be an electronic stock management system.

Part B: Tagging System

The full implementation of a tagging system is dependent upon Stage Three, where an industry agent is placed in the marketplace. This process is necessary for system integrity to be maintained and ensure reliable information is fed back to the fishers. However, while market research and the establishment of an industry agent is taking place in the targeted marketplaces, it will be possible to commence tagging trials. The trials will test technology such as RFID tags, and business processes along the supply chain in terms of its ability to integrate with business management systems and other established information systems such as the airline's tracking systems. As the markets become established, the trials can then be extended to include the buyers.

Another aspect of the trials is to explore the degree of accepted detail in which the product can be tagged. For example: tag at the box level; tag at the lobster level upon arrival at the factory; or tag at the lobster level upon entering the holding tanks on the vessel. My recommendation is initially to begin at the box level at the processing factory. Upon dispatch of an order, each box is uniquely identified and recorded on the processor's business management system. Upon arrival, an industry representative at the wholesaler's factory scans the barcode before sorting. This information is transmitted back to the processor to provide feedback in terms of arrival of order, boxes, and condition of lobster. Tag information includes: market reports provided by fishers, processors, freight providers to forward upstream; market feedback reports from buyers, freight providers, and processors; and GPS location during transit and temperature readings. Tagging system options to trial include the RFID tag between processors, exporters, freight forwarders and airlines, buyers; and then extending the trial to include processors tagging each lobster to reflect the fisher and trip details.

Summary

Based on the insights into the current issues and emerging trends relating to the Tasmanian rock lobster industry, the Southern rock lobster industry, and at a higher level, the Australian seafood industry, I have reviewed the IS/IT solution proposed in Chapter Four and recommend one system for the industry to adopt. That system uses

the proposed IS/IT Solution Two as the framework for a ten-year strategic plan for the Tasmanian rock lobster industry, and takes onboard a key strategy from IS/IT Solution One, namely the cooperative marketing company. By establishing a cooperative marketing company with Tasmanian owner-operated shareholders, a central body will strategically represent the industry participants in the global market place. The company will also be a driver and facilitator for industry research in the fields of supply chain management, industry development, trade and market development, and knowledge management, and will enable the development and implementation of systems such as quality management, environmental management and information management systems. Finally, it will also undertake the custodian role of the systems listed, and associated data and information. To place these findings and recommended system in a broader context in terms of global food chains and managing change, the next part of the thesis, Part Three, will provide a discussion of the key themes of this thesis; sustainability, supply chain, the seafood industry, and IS/IT.

PART THREE: SECURING THE FUTURE – DISCUSSION AND CONCLUSIONS

(Courtesy of Rod Berens)

Preface

Part three is entitled "Securing the Future – Discussion and Conclusions" and consists of two chapters. In Chapter Seven, I recontextualise the proposed and evaluated Solution Two in its larger social and spatial domains. In addition, I explore, at a global scale, the key themes introduced in Chapter One relating to sustainability, IS/IT, and SCM in relation to the seafood/fishing industry and the risks and uncertainties it faces in a globalised world. I re-examine the Tasmanian rock lobster industry in relation to how IS/IT can aid the industry in securing its resource and future; thus contributing to sustainability outcomes. I also discuss restructuring and adjustment with particular reference to two key drivers of change, namely: IS/IT and globalisation; trends relating to sustainability; supply chains; R-3s; and the fisheries/seafood industry. I then explore options available to the Tasmanian rock lobster industry and discuss how industry members can manage these trends and changes, and create a sustainable future. In Chapter Eight, I summarise and reflect on my research questions and objectives, and draw conclusions based on my theory, methodology, findings, analysis and recommendations. I then propose a future research agenda.

CHAPTER SEVEN: SECURING THE FUTURE: IS/IT, AND THE SEAFOOD INDUSTRY

In the chapter, I revisit the challenges of how to manage seafood industry supply chains to secure the future, advance sustainability outcomes, and deal with risk and uncertainty. In particular, I stress the need for an integrative approach to managing the Tasmanian rock lobster industry. I examine a range of issues affecting the seafood industry and highlight some relevant trends and strategies associated with SCM and IS/IT. Fostering a sustainable Tasmanian rock lobster industry is the fundamental objective of this research. I then focus on the future of the Tasmanian rock lobster industry, and make a number of observations about its viability and long-term sustainability.

My reference to "securing the future" applies to financial security and individual autonomy of industry participants in terms of lifestyle and employment, and collective relationships among various food industries, producers, regulators and consumers. The term can also refer to food security which encompasses food safety and quality assurance along the supply chain against deliberate contamination and invisible hazards associated with genetically modified foods and radiation and poor codes of practice.

The application of IS/IT concepts can assist in securing the future for R-3 communities, the fishing/seafood industry and, in particular, the Tasmanian rock lobster industry. IS/IT applications offer the industry strategic solutions and tools to facilitate improvements in identifying and addressing risk and uncertainty along the supply chain. IS/IT and globalisation are significant and interrelated drivers of change in food industries and R-3 communities in particular. In this chapter I highlight some of the effects that IS/IT and globalisation have on these industries and communities, and explore how these drivers have affected food chains at various scales.

The degree of success of IS/IT applications within any industry or organisation depends upon their appropriateness and implementation. Solution Three described in Chapter Seven demonstrates that appropriate IS/IT strategies can assist SCM, and help stakeholders to manage change, uncertainty and risk; can assist with strategic planning; and can ensure industry competitiveness in a global economy.

Securing the Future of R-3s and Local Fishing Industries

Securing the future of R-3s and local fishing industries is about enabling these industries and communities to adjust and restructure with change and with minimal detrimental impact to their viability.

Rural restructuring and adjustment is often referred to in agriculture scholarly literature and describes primary industry businesses adapting to change; whether it is related to changes in market place, resource management, environmental conditions, technology or globalisation (Black et al. 2000). Often agricultural adjustment and rural restructuring is emphasised in times of crisis and is reactive to disasters whether natural or human-made, for example, drought, flood, unexpected slumps in commodity prices and/or high interest rates and changes in consumer tastes and trends (ABS 1998: 20; Black et al. 2000: 14; Stayner 1996). Hoggart and Paniagua (2001) argue that rural restructuring should not be based on something that is based on 'facts' in relation to change, it should be based on the social dimension of change. "[W]hen seen as a shift in society from one condition to another, 'restructuring' should embody major qualitative, and not just quantitative, change in social structures and practices" (Hoggart & Paniagua 2001: 42). The authors further describe restructuring in terms of involving "fundamental readjustments in a variety of spheres of life, where processes of change are causally linked" (Hoggart & Paniagua 2001: 43). The Australian Government has introduced schemes to facilitate structural adjustment in the farm sector, but often it is directed to farmers in crisis instead of being an ongoing process to ensure sustainability for R-3s and industry. Major drivers of adjustment and rural restructuring have been identified as:

> The impact of global changes in patterns of food production, distribution and consumption, the large-scale effects of technological changes (including biotechnologies), the influence of transnational agribusiness, the roles played by governments, and the challenges or resistances coming from various social movements such as environmental, consumer, health and animal rights movements (Black et al. 2000: 17).

The impact of these drivers in combination over the last half century has caused adjustment not only for land farmers, but all primary producers, businesses and communities that rely on the land and sea.

> Technological change has been a major factor driving the process of adjustment during the greater part of the twentieth century. In agriculture, the increasing mechanism of agriculture, together with advances in genetics, animal nutrition, fertilizers and pest management have all contributed to improvements in farm productivity. These technologies have also reduced the need for farm labour and increased the total area that an individual farmer can operate successfully (Black et al. 2000: 13).

In the context of the fishing/seafood industry, Conway et al. (2002) provide a description of how fishing communities manage endogenous and exogenous forces using innovation.

> In the fishing community, innovation appears in many forms, and fishing families often demonstrate human creative potential in the face of challenges. On the most basic level, fishers must be able to adapt to changing weather, ocean conditions, fisheries, markets, and regulations. Thinking creatively about where to catch fish, using novel means to communicate with distant family members, creating organisations that heal divisions in the industry, and developing new ways to manage fisheries are just some areas where innovations are being tried (Conway et al 2002: 21).

From their experience with the Oregon fishing families, the Internet provides new communication opportunities for those with web access. Fishers' families use the Internet to send e-mail and even use it for games between players on land and at sea. With just over half the vessels now having Internet access at sea, ready communication for fishers and their families, government authorities, managers and researchers ashore is more attainable. Ashore, the Internet not only provides fisher families with the opportunity to converse with sea going members, but it also allows social contact with partners, organisations and commodity groups in other remote and metropolitan areas. "This type of cross-community communication tool can help decrease isolation, increase involvement, and develop a more balanced exchange of ideas within the fishing community and between the fishing and management communities" (Conway et al. 2002: 28).

IS/IT is a significant driver of change, whether in business, industry or a community. IS/IT is a major component of most organisations' strategic visions, particularly in relation to SCM and competitive advantage. The application of IS/IT in Australian primary industries has been widespread (Table 7-2) and varied from e-commerce applications, to online community groups, websites, information service websites and online trading applications.

Table 7-2: Examples of ICT in Agriculture

The Western Australian Internet community hour	An online community project that aims to address the 'digital divide' issues associated with equity and access through online training of novice users of the Internet. This project is supported by the Sustainability section of the Western Australian Department of Premier and Cabinet (2002).
The Tasmanian Apple and Pear industry	Implemented an electronic stock control system incorporating anticipated marketing disposal forecasting (TECC 2003a).
The Dunlop Park Angus Stud	Based in north-west of Tasmania, who developed a website dedicated to Angus cattle breeding and includes online catalogue of past genetic information and past particulars on their breeding stock. The website attracts enquiries from all over the world (TECC 2003b).
South Australia's Teague Australia	A seed and grain brokerage involved in domestic and export marketing with the provision of grain market information as well as consulting services, Teague Australia saw electronic commerce as being a useful tool for developing a Customer Relationship Management system using a website, online customer accounts and short message services (SMS) information services (TECC 2003c).
Tamar Valley Roses	Based in the Tamar Valley, northern Tasmania, the company connected to the 'always-on' Broadband Internet service and developed a website. These tools allowed the company to reduce administration overheads, improve customer service, create effective marketing campaigns aimed at exiting new customers, and increase sales (TECC 2003d).

IS/IT applications in the seafood industry have contributed to increasing the efficiency of effort in harvesting, processing, transportation, trade and marketing, and business management. Seafood enterprises, governments, industry associations and marketing groups have also utilised IS/IT to improve business efficiency along the supply chain. Examples include information service websites and e-trading platforms, e-logbooks, freight logistics tracking systems, and cool chain systems, satellite communication, and VMS. Fishers have become so 'efficient' in their harvesting practices that State and Commonwealth management authorities have had to implement various management strategies, such as input and output control methods, to ensure that resources are not over-exploited. The effectiveness of these fisheries management methods and the affects of technology on seafood/fishing industries are explored later in this chapter.

E-logbook systems are a particular example of IS/IT applications in fishing/seafood industry. These systems have specific relevance for resource assessment and

management, quality management, and compliance. E-logbooks use catch and effort data as a key source of information about the impact of the fishery on the resource. AFMA is an example of an organisation that has assisted a number of Commonwealth commercial fishing industries to use e-logbooks to collect and provide electronic data to it. Other examples of fisheries e-logbooks designed to capture and manage commercial fishing data for industry members include OLFISH, E-Boat, and ERNIE (Seafood New Zealand 2002).

The US Maine Lobster fishery project, *LobsterTales*, is an example of an IS/IT application and a basic tagging system. *LobsterTales* requires fishers to tag each lobster with a unique number that correlates to them. Via the Internet, the technology allows fishers to gain feedback on the point of sale and for the consumer to gain feedback on the point of origin. Another example is the European Union's *Tracefish project*[11], which also uses fisheries logbook data to assess quality management and traceability along the supply chain. In other primary and manufacturing industries, tags, such as barcodes, Radio Frequency Identification Devices (RFID), data loggers or embedded microchips, often assist traceability of product. Freight forwarders and transport providers have also pushed this technology to assist traceability of product during shipment. Tagging technologies allow products to be uniquely identified to points of origin. They can also store other information such as environmental conditions (temperature and altitude), GPS locations, and company information. Data can be accessed using transmitters and transponders, which send and retrieve information that is then downloaded to databases and accessed via the web (for example, <www.exago.com.au>). Despite these useful characteristics, the challenge for IS/IT developers is to create applications for the fishing/seafood industry that are adaptable to the vast array of fish products and supply chains.

IS/IT and R-3 Communities: change and adjustment

In this section, I demonstrate the significant impact IS/IT can have on industries, businesses and communities, whether it is a positive or negative driver of change. As IS/IT facilitates communication and trading networks across national boundaries, it is also regarded as a contributor to globalisation. The next section discusses the shift in food supply chains and the role IS/IT in terms of its ability assist food industries to adapt to change.

[11] Tracefish - European Commission Concerted Action project initiated in 2001 (Denton, 2002).

Technology has brought significant benefits for industry, however it should be acknowledged that the impact of technology on community, industry or business might not always be beneficial. In recent times, IS/IT advances have overcome some of the geographical boundaries that have inhibited products and services to be extended to rural areas, and include telephone, fax, Internet and email. Other technologies and innovations include airlines, trucks, railways and shipping. Coupled with many of the driving forces of adjustment and rural restructuring discussed earlier in this chapter, to continue the primary industry business commercially there is little alternative to what Cochrane (1965) calls as 'the technological treadmill'.

The social effects of IS/IT on R-3 communities is described by Barling and Castleman (2000); Flink (1988); and Fischer (1992), "Railways, motor vehicles, and the telephone have all played a part in enabling the inhabitants of R-3 communities to extend their range of business and social contacts" (Barling & Castleman 2000: 4; Flink 1988; Fischer 1992). These effects were responsible for breaking down rural isolation. "However, the same forces that have empowered R-3 citizens to maintain social networks beyond the locality can be blamed for eroding social cohesion of the local community" (Barling & Castleman 2000: 4; Lynd & Lynd 1929; Meyerowitz 1985). Other views have seen technology as actually preserving and enhancing the local patterns and behaviour (Barling & Castleman 2000; Wiley & Rice 1933).

A number of papers have been published in the last 2-3 years focusing on electronic commerce (EC) and R-3s in Australia. The papers (see examples; Barling & Castleman; Swatman & Castleman; Wilde, Coulthard, Castleman & Hewett; Wilde; and Coulthard) essentially question the National Office for the Information Economy (NOIE) model and its optimistic view that EC will provide benefits to R-3 communities and solve many of the problems experienced in these areas. In brief, NOIE's five basic assumptions are: a reduced tyranny of distance and increased access to global markets; presenting a regional image and focal points; productivity gains through more efficient procurement and sales; new products and services; and the production of a "catalytic effect". Coulthard's (2001: 2) concern with NOIE's approach is that they fail to acknowledge the differences between metropolitan regions and non-metropolitan regions in terms of the "composition of a region's underlying economy", geography, and business status.

His study indicates that there are a few clues in the NOIE study that not all regions may necessarily benefit from EC, with some regions experiencing a decline in employment as a result of EC disintermediation (removal of the middle man). He concludes that the possible negative impacts of EC on R-3s should be considered as a tonic to the optimistic view of EC policy makers, and to be a challenge to theoretically and empirically examine the potential impact of EC in regional areas. He also suggests that EC may well serve some firms, some regions and some countries more than others, and that the challenge is to identify which regions, what types of firms and under what circumstances. "By understanding these dynamics it may then be possible to assist regions to cope with and avoid or ameliorate the possible negative impact of EC and globalisation and to capitalise on the advantages" (Coulthard 2001: 7).

Other authors explore the impacts of technologies on R-3s in Australia. Barling and Castleman (2000) explore the adoption and diffusion of technologies in R-3 communities. Their paper includes an analysis of the historical effects of transport and communication technologies in these communities, with the aim of understanding the impacts of the "Internet Revolution" on R-3 communities based on past experiences. They suggest that the impacts of the "Internet Revolution" are not all that different to the impact of transport and communications technologies, such as motor vehicles, railways and telephone, has had on the R-3 communities.

> On the one hand they facilitated the integration of R-3 communities with the wider world, by overcoming substantial barriers of time and distance. On the other hand, the very same technologies possibly undermined the cohesion and independence of R-3 areas. While they brought the outside in, they also presented many alternatives to local life. This had an impact on the local community as well as the local economy (Barling & Castleman, 2000: 3).

The demographic divide began to emerge during the late 1960s and early 1970s, and was attributed to improvements in transport technology, together with changing lifestyle preferences. These factors contributed to the movement of people from metropolitan areas into peri-urban regions and/or environments perceived to have high amenity value (Black et al. 2000: 24; Burnley & Murphy 2004; Sant & Simons 1993). At the same time, "processes of adjustment, together with perceptions of lifestyle inequalities

between urban and rural areas, were contributing to outmigration from broadacre agriculture regions" (Black et al. 2000: 24).

Much of the decline has been seen to lie initially with technological change and adjustment. Agricultural adjustment, made possible by farm modernisation and mechanisation, has reduced the number of farms, farm workers and farming families, thereby contributing to reduced employment opportunities in rural areas (Burnley and Murphy 2004). At the same time, improvements in transport and IS/IT have allowed industries and services to concentrate in larger regional centres where economies of scale can be maximised and wider hinterlands served (Beer et al. 1994; Black et al. 2000). In the smaller towns, improvements in transport technology and mobility have seen farmers and residents bypass local services in favour of the greater variety and price competitiveness of those services and amenities available in larger centres (Black et al. 2000: 24; Smailes 1996). For those in smaller towns, the outcome is widely held to be a vicious cycle of decline, since rural population loss produces negative multipliers resulting in the contraction of local economies, the withdrawal of services, the erosion of local employment opportunities and further outmigration (Black et al. 2000: 24; Sorensen 1995).

Studies based on 1991 Australian Bureau of Statistics Census data confirm that internal migration in Australia occurs most severely in regions dependent upon broadacre grain and livestock production, where the majority of the outmigrants are between 15 to 35 years of age (Black et al. 2000: 24). These population movement statistics of broadacre farms are reiterated by Burnley and Murphy (2004). The impact of outmigration of this age group for a rural community is significant as further population decline can occur due to the reduction in birth rates in the area, thus generating a distorted age profile with significant consequences to social interaction and community sustainability, and finally impacting on economic growth as this population section tends to generate economic growth through higher levels of spending than other sections of the population (Black et al. 2000: 24). The reasons for this trend include the combination of greater educational, employment and lifestyle opportunities in urban areas. Other studies (McKenzie 1994; Smailes 1997; Tonts 1998) found that areas of low household and individual incomes tend to be associated with high levels of depopulation, in addition to gradual withdrawal of public services in rural areas, not to mention the significant psychological impact on rural communities. Black et al. (2000), McKenzie (1994), and Sorensen (1995) suggest

that the changes can lead to a sense of deprivation among the remaining rural residents and contribute to further outmigration.

The economic benefits of these technologies have been obvious with a more efficient flow of goods within and beyond the region, and wider access business support. However, allowing people to trade outside their local communities resulted in a depleted demand for goods and services within the R-3 economy (Barling & Castleman, 2000).

> Through electronic commerce, businesses in R-3 areas are further empowered to trade outside of their community. Intuitively, what business the Internet can bring into a community, it can also take out by giving local customers access to external businesses. It is widely anticipated that a net loss of business in R-3 communities will ensue from both business-to-business and business-to-consumer electronic commerce. The rapid uptake of Internet technologies and consistent growth of electronic commerce imply that the detrimental impacts on R-3 economies from purchasing outside of the community could potentially be far greater than those of other technologies (Barling & Castleman, 2000: 6).
>
> It is possible that the development of communication technologies combined with compelling forces of globalisation result in vulnerable R-3 communities being threatened by further withdrawals of infrastructure and, hence, further decline of their economy and community. This does not mean that R-3 communities are powerless to manipulate Internet technology to their circumstance. However, it is apparent that common-sense solutions will not always achieve these aims. Appropriate action can be taken only if informed by a thorough understanding of the wider dynamics of technology and R-3 development (Barling & Castleman, 2000: 7).

Against the population movement trend of broadacre farming communities and townships, Burnley and Murphy (2004) highlight a "population turnaround" or "sea change" in relation to perimetropolitan and high amenity growth regions where internal migration of the national population is seeking lower-key, lower-cost lifestyle in beautiful settings in Australian coastal locations, which attributes to an overall population increase in rural Australia. The shift in population to Australian coastlines

may provide a greater economic incentive for telecommunications investment and other facilities enjoyed by urban counterparts, which, in turn, provides access to technology and services for local primary industries to be more strategic and competitive in the global market place. However, this population shift should be managed with caution by state and local governments in relation to planning and environmental and social management, and to ensure the intrinsic characteristics of these Australian coastal communities are not eroded away.

The Shift in Food Supply Chains

In this section, I make it clear that there is a global movement in consumer driven food chains. This movement is based on consumer preferences for greater accountability by industry to prove origin and ensure food quality and safety is of an acceptable standard. The security of the food source and supply chain is the primarily concern of consumers, which in turn has driven quality chain management systems, such as traceability systems, to be developed and implemented or improved. IS/IT applications certainly can assist with quality chain management systems to collect, store, process and disseminate vital information along the supply chain. In the next section I discuss the tension between the local and the global for primary industries, and the definition of R-3s, and placing Tasmania in the global marketplace.

With reference to supply chain definitions described in Chapter One, supply chain objectives obtain benefits by streamlining the movement of goods from the production line into the customer's hands, by providing early notice of demand fluctuations, and coordination of business processes across a number of cooperating organisations. Supply chains are also about meeting the customer requirements (Mowat & Collins 2000). Todd (2000), Mowat and Collins (2000), Kalakota and Whinston (1997), and Sengupta (2004) highlight a fundamental shift in SCM where consumers/customers are initiating the supply chain through demand. With regard to food supply chains, Todd (2000) refers to the 'through-chain approach' as a means to assure food integrity to the consumer at every link in the supply chain. With Mowat and Collins (2000) he also refers to the re-orientation of the whole-of-chain approach or 'chain reversal', where the consumer is the driver of change in the supply chain. Many industries have developed initiatives to implement supply chains such as "just-in-time, quick response, efficient consumer response, vendor managed inventory, and continuous replenishment, which

all have the same goal: to manage the supply chain effectively" (Kalakota & Whinston, 1997: 285). Supply chain developments such as efficient consumer response (ECR) can be observed in Fearne and Hughes' (1999) paper on the UK fresh produce industry. Driven by retailers, such as Tesco and Sainbury, there is a need for more integrated supply chain relationships and rationalisation of the supply base to increase product financial returns through own label products, and supply chain integrity and product quality.

The consumer/customer initiated supply chain (also known as the chain reversal (Todd 2000) or pull model (build-to-order) (Kalakota & Whinston 1997)) contrasts with the traditional manufacturing push-based model. That model is about pushing the merchandise into the customer's hands, whereas the "pull" model is about the customer initiating the supply chain" (Kalakota & Whinston 1997). According to Todd (2000) customers are not only driving demand, but also a cornucopia of consumer demands such as assurances on food safety, traceability, animal welfare practices, good environmental management and a whole raft of quality attributes. Mentzer (2004) also supports the need to fully focus on the demand side of the supply chain. Kalakota and Whinston (1997) also describes the pull model, which dictates a need for supporting increased variability (product variants); reduced lead times; improved quality and lower unit cost; operational excellence; and comprehensive performance measures for control purposes.

> The pull factors shaping supply chains are exerting tremendous pressure on business strategy. Instead of trying to gain a competitive advantage on the basis of quality or price, companies are seeking to gain an edge through their ability to deliver the right product in the right amount at the right time...Few companies handle the pull model, as effective SCM requires firms to: gather customer demand requirements quickly and accurately; make the best choices about how they can meet those requirements at the lowest possible cost; make informed decisions along the entire supply chain, from procuring raw materials to manufacturing/assembling products; and distribute finished goods to the consumer and collect the requisite payment (Kalakota & Whinston 1997: 289-290).

I have established that, in the case of the Tasmanian rock lobster industry members, who have been described as 'price takers', the supply chain is very much controlled by the marketplace. The existing fragmented industry supply chain reduces the ability for its members to manage change and ensure a sustainable future. It is apparent that customers/consumers are driving the chain in terms of preferences and requirements. It also is apparent that SCM strategies need to be adopted by industry members to assist in managing change and external forces. In light of the supply chain definitions and demand driven trends, the integrative SCM strategy I have created may assist the Tasmanian rock lobster industry members to develop IS/IT concepts to manage risk and uncertainty along the supply chain. By researching and mapping the industry supply chain in terms of product and information processes and flows, I have gained a better understanding of the industry and determine what computer-based information system would be appropriate.

To create a Rock Lobster Electronic Management System means taking an integrative approach to the industry supply chain and creating a computer-based information system that stores and disseminates information pertinent to SCM and information management. This industry information system means linking disparate information systems and collecting tacit knowledge from supply chain participants along the supply chain. The transformation of the supply chain processes from paper transactions to the electronic transactions is supported by the efficiency of computer-based systems to store and disseminate vast amounts of information quickly. Having ready information about the supply chain at hand, peak industry bodies are able to make timely decisions and strategies to manage change and ensure the industry remains viable and sustainable – economically, socially and biologically. Information systems are a strategic business management tool to manage risk and uncertainty. The use of IS/IT to assist SCM is supported by Turban et al. (2000) and O'Keefe (2001) as B2B electronic commerce applications can provide a competitive advantage through the utilisation of electronic networks, communications, protocols, and the value-adding of culture, reputation, and relationship assets developed along the supply chain.

The Internet can provide the most economical B2B EC platform for linking companies without additional network implementation. B2B can also contribute to "lower purchase costs, reduced inventory, enhanced efficiency of logistics, as well as to increased sales and lowered sales and marketing costs (Turban et al. 2000: 201).

However it is important to ensure that the data collected is of business value for the supply chain, rather than be data-rich and knowledge poor (Sengupta 2004).

By establishing a Rock Lobster Electronic Management System, opportunities arise to establish a quality chain management (QCM) system to monitor the quality of the product and associated processes. An example from Europe supports this assertion:

In response to issues relating to European consumer concerns of seafood quality assurance, safety, and traceability, a European Commission Concerted Action project, Tracefish, was initiated in 2001. The Tracefish concept is an electronic system of chain traceability, and was initially limited to finfish and their products destined for human consumption. The project builds on that basis of the EU legal requirements for each food business operator to independently record sources of supplies and destinations of products (Denton 2002). Participation in this scheme is voluntary but in order for it to function, there are agreed protocols and standards for the system. The development of this standard is currently 'work in progress' as a series of CEN[12] workshop consultations is undertaken at Tracefish Management Group meetings and conferences. Three Tracefish standards have been developed: an information standard for captured fish distribution chains, for example, what information should be generated and held; a similar information standard for farmed fish distribution chains; and a technical standard for the electronic communication of the data. These standards are to be expressed as CEN Workshop Agreements. Once established, they will provide a basis for IT service providers to develop business solutions (applications) for the trade. This system does not exclude the use of paper systems to satisfy information standards, although the obvious benefits of business efficiency would be lost (Denton 2002).

The approach adopted by Denton (2002) in the Tracefish project takes into account the diversity of the distribution chains, and assumes that the fisheries appear to comprise an arrangement of characteristic components or 'building blocks' and the information requirements associated with each of the 'building blocks' can be standardised. The characteristic components are fishing vessels; vessel landing businesses and auction markets; processors; transporters and storers; traders and wholesalers; and retailers and caterers (Denton 2002). The commonality among the components is the need for

[12] Comité Européen de Normalisation (CEN), the European Committee for Standardization, <www.cenorm.org>.

information (Table 7-3), but it is not always the case that all the components are used in each supply chain. Nevertheless information about the nature of the food being produced is required by law for various purposes and must be made available to the appropriate authorities or persons for those purposes. These requirements vary with national legislation and the types of food and food business under scutiny (Denton 2002). On the other hand, commercially *desirable* information (Table 7-4) on the nature of the food and the operations involved is sought by food businesses for other reasons to maximise the efficiency of operations; limit liabilities under product liability and safety legislation; assure safety and quality of products; or enable accurate labelling and substantiate marketing claims. The requirements for such information also vary from business to business (Denton 2002).

Table 7-3: Seafood and Operations Traceability Information Requirements

Fishing Logs	vessel identification number, master, fishing method, fishing areas and times, catch species and quantities, landing place and time, that must be supplied by the master to the fisheries authority
Records for the first sale of fish	vessel identification number, master, species, size and quality grades, date and place of sale, identification number of buyer and seller, quantities and prices, that must be supplied by the seller to the fisheries authority
Species, method of production and area of origin	For many products is required by EU law to be labelled at retail sale, and hence which must be passed through the distribution chain from capture onward
The results of chemical and bacterial analyses and temperature control logs or other variables	Specifically required under food safety legislation or under the general obligation for the monitoring of critical control points, which must be held by food business operators and be accessible by food authority (and be directly supplied to them in some instances)
Animal health, particularly disease control, and welfare information concerning the origins, movement and condition of some species and products, particularly live shellfish	Must be supplied or be available to the authorities and/or be passed along the chain to other food business operators
Customs and excise and trading (financial) information	Must be held by businesses and supplied to the appropriate authorities for purposes such as taxation

Sourced: Adapted from Denton (2002).

Table 7-4: Commercially desirable information on the nature of the food and the operations involved

Information	Description
Details of raw materials	Products, processes and controls; required for reasons of business efficiency, product labelling and to ensure product safety and quality
Ethical information on the nature of the fisheries	Sustainability and environmental impact
Fish capture details	The date of capture of the fish and data on temperature control through the chain; required to assure product safety and quality
The GMP status of the food business operators involved in the chain	Required to ensure product safety and quality

Sourced: Adapted from Denton (2002).

Despite some overlap in the sorts of information required for quality chain management, traceability uptake by food industries varies across regions. For example, Frederiksen and Bremner (2001) conducted a comparative study between three Danish and three Australian fish chains. The Australian fish chains included the Rock Lobster, Bluefin, and Kuruma prawn chains. Interviews suggested that traceability within Australian fish chains was regarded as very important and was facilitated by serial numbers on products. While traceability measures were deemed sufficient, fishers were prepared for an increase in quality measures subject to customer demand. In terms of technology use, most chain members had access to most technologies including Internet and email, but rarely used it. In contrast, the Danish fish chains included three different but typical chains that deal with the fresh fish for the domestic market only, extending from the fishing vessel to the retailer. The chains were designated by their final step as: Supermarket chain, Shop-in-shop chain and Retailer chain. Interviews suggested that traceability within the three Danish fish chains were deemed insufficient and that increased internal traceability was needed. Technology use was much the same as the Australian fish chains as most industry participants relied on manual paper-based systems. However both the Danish and Australia chains predicted and accepted the shift to use electronic means in the future. Frederiksen and Bremner (2001) concluded that traceability would be the basis for the development of electronic commerce between companies again and between companies and end users. For Australian chains, there are opportunities to minimise time spent on manually based traceability systems. A computerised traceability system, such as the Rock Lobster Electronic Management System that I have proposed in this thesis, would enable information to be entered in the system only once and would promote easy and efficient access to historical data if

required. Relevant product data could be accessed at each step along the supply chain, thus ensuring efficient chain relations and providing the grounds for trust to develop.

A quality index that can be universally understood and readily transmitted, and that provides a measure of time-temperature history of fish and a prediction of remaining shelf-life to satisfy the requirements of e-trading will have significant reach. Not surprisingly then the Quality Index Method (QIM) is being widely adopted in Europe by industry and research organisations. QIM also has potential applications in the USA and Canada. In Asia, there are no systems using QIM; however Japanese technologists are aware of these systems (Bremner 2002b). QIM is based on a demerit point system, where no one feature biases the result. There are approximately 10 to 15 parameters, which provide sufficient features to discriminate between good and poor quality product. These constitute an agreed scoring system of quality for fishers' who answer each question to meet the QIM. Commercial pressure will ensure honesty so if there is cheating, credibility of fishers and other associated operators will be lost. The performance of each boat is judged and season trends of boats are reviewed. All these steps are to maintain product quality along the supply chain (Bremner 2002b). Table 7-5 describes the key points associated with Quality Index (QI) schemes.

Table 7-5: Quality Index Scheme characteristics[13]

1	Evaluate the post catch state of fish in a way related to 'equivalent number of days on ice'
2	Express the resultant evaluation as a number from 0 (immediate postcatch) to 15 or to 20 depending on the species evaluation when it is unsaleable for normal use
3	Transmit numerical index by normal and electronic means
4	Evaluate rapid visual inspection with scoring of a sufficient number of common major characteristics on simple 0 to 3 point scales then totalling the scores to provide the index
5	Evaluate the stored fish using a taste panel

Source: Adapted from Bremner 2002b

In Australia, the advantages of traceability have prompted the development of a working group on quality indexing, initiated and coordinated by Dr Alan Bremner, with

[13] Please note, the index is a linear relationship with days of storage of the fish at 0°C, thus an evaluation provides information on the current state of the fish and estimates of both the time elapsed since it was caught and the remaining shelf-life according to the purpose it is normally used for, such as sashimi, top restaurant, pub trade, curry). This index has proved to be more reliable, accurate and reproducible at estimating the state of fish than any other biochemical, chemical, mechanical or electronic test system. The technical work involved in developing the index requires investigating fish whose immediate post catch handling is monitored and this involves logistic and operational stringencies for some species.

support from the Seafood Industry Development Fund and Seafood Services Australia (SSA). The objectives of the working group were to develop a strategic plan for establishing a Quality Index for selected Australian seafood. There is strong involvement of the commercial partners with key industry personnel and commercial organisations engaged in the development and implementation of the project. These stakeholders are representatives from across the chain including Sydney Fish Market (SFM), representation from catching (SETFIA) and aquaculture, support sectors SSA, Seafood Quality Management Initiative (SQMI), Fisheries Research and Development Corporation (FRDC), and training bodies. An agreed quality index has enormous advantages in monitoring every aspect of the seafood chain from catch through to final point of sale. Properly used, a quality index can help eliminate inefficiencies provide standard material, minimise waste, provide control records, improve image, diagnose faults, predict shelf life, reduce disputes and enhance market confidence in the products (Bremner 2002b).

An outcome of the workshop for seafood QIM in Australia was the enunciation of a vision: the ability for all major Australian seafood to be evaluated by a quality index system that has wide market acceptance with both domestic and export markets, and that it is a tool for the industry to assess/evaluate seafood quality with a seafood quality index system by 2010 (Bremner, 2002b).

The Sydney Fish Market's e-trading system, "SFM Live", uses a quality assurance method that is based on the Irish Index grading system. However "SFM Live" managers are now looking at QIM to establish seafood handling guidelines for auctioning. Other indicators of quality for buyers include the reputation of the vessel, fisher, and seller. Information is a new form of value adding and information on catchers/suppliers needs to have an index rating (Boulter 2003).

In addition to projects such as QIM, EAN standards are also playing a major role in the traceability of products within the food industry, particularly for Australia (EAN 2004). At the Out of Home Supply Forum, a combined statement from the Chief Executives of the four major distributors and the Chairman of the Australian Food and Grocery Council, Bernard Berson (Bidvest), David Knox (Countrywide), Darren Miller (Combined Food Services), Brad Dean (NAFDA), and Terry Ryan (Australian Food and Grocery Council) advised that distributors in the food service sector and their

suppliers had set 1 January 2003 for the adoption of globally consistent EAN barcodes on all products, cartons and pallets, and for integration with the electronic catalogue, EANnet (EAN 2004; Food Australia 2002). This commitment to food quality standards follows the trends in Europe and USA based on the benefits of EAN standards by retail grocery and other sectors. The benefits of EAN standards provide reliable, unique and globally consistent product identification, which supports best practice procurement, replenishment and logistics, reduces supply chain costs and improves traceability across the food service market (Food Australia 2002).

Participants involved in initiatives, such as QIM, are yet to explore live seafood products in relation to quality assurance. The focus to date has been on fresh-frozen finfish. In addition, there has been limited work done on other seafood products such as crustaceans and molluscs. However studies have been undertaken on the physiology and live transport of seafood products such as wrasse and rock lobsters. Relevant work undertaken in aquaculture on the post-harvesting physiology of live lobsters has also been transferable to live seafood transportation. Effort by industry has also been made to establish codes of practice for the industry.

In response to the need for comprehensive data on the stress of live lobsters associated with capture, handling, storage and transport, and the effects on the quality and survival of live lobsters, a workshop was conducted involving scientists and industry. Taylor et al. (1997) reports the outcomes of the workshop in terms of the physiology and live transport of lobsters, and discusses how the stress levels between species of lobster can vary and determine the success rate of live transportation. The paper identifies the importance of understanding the mechanisms of stress and document indicators of the levels of stress. Even for species such as *Jasus edwardsii* that have successful systems employed for handling and transport, occasional batches of stressed lobsters have entered the live export process. Handling mishaps occasionally make large numbers of lobsters too weak for export. In this paper, stress is described as:

> [A] physiological response to an internal or external change. In the context of live transport, potential stressors include the capture and landing of lobsters, post-capture transfers, induction of vigorous escape behaviour (tail flips), physical damage (e.g. limb loss, blood loss), interactions between lobsters, low water quality in recirculated holding

> tanks, and exposure of the lobsters to air. Stress responses can be evaluated subjectively (behaviour, vigour, simple postural tests), or expressed quantitatively by measured changes in physiological variables such as oxygen uptake, heart rate, muscle metabolites, and blood gases, pH, hormones and ions (Taylor et al. 1997: 817).

These indicators of stress are supported by Paterson and Spanoghe (1997) who focused on the stress indicators of western rock lobsters (*Panulirus Cygnus*) with a particular reference to grading. For western rock lobsters, processing staff uses damage, posture and responsiveness of the rock lobsters to grade them for live export. The concern is that the lobsters graded as unfit for live transport can have their effects reversed with alteration in conditions, and the lobsters graded as fit are actually stressed and likely to die during export. It was concluded from the research that the stress levels were difficult to monitor during commercial handling by processing plants, and that there were no external indicators of stress that could be quantitatively measured. It was also concluded that the experience and skill level of individual processing handlers (tacit knowledge) were the best way of determining the live export grade. The handling practices by supply chain members were seen to be the most reliable, practical and cost effective method of ensuring quality by the industry. Consequently guides such as "Guide for the Rock Lobster Industry No.1 - Optimising water quality" (Crear & Allen 2002) have been developed for industry to assist in improving live holding systems. Other best practice initiatives for rock lobster have been undertaken by the Western Australian Fishing Industry Council (WAFIC) in conjunction with other states to create an educational video for the Australian rock lobster industry. Roberts and Carragher (2001; 2004) are also undertaking postgraduate research into exploring the levels of stress indicators in commercially harvested rock lobster, *Jasus edwardsii*, of the southern zone rock lobster fishery, South Australia.

R-3s: Local versus Global

Securing the future of fishing/seafood industries, particularly in relation to the security of fish species, ecosystems, and supply chains, is about ensuring industries are able to manage obstacles commonly faced by R-3 industries and the threats from the global market place. To ensure the Tasmanian rock lobster industry is able to manage these obstacles, and for its members to maintain a viable and sustainable lifestyle and future,

it is important to understand the role of sustainability, supply chain management, and IS/IT have within the industry.

The Tasmanian rock lobster industry is an example of a primary industry that exists in a R-3 area, but trades and operates in a global economy. The tension between the local and the global for this industry is mirrored in other Australian and overseas primary industries. Grimes (2000; 2003) and Malecki (2003) highlight this observation in the European Union and the United States in relation to technology in rural communities.

There are numerous interpretations that define the concept of rural. Black et al. (2000) refers to the National Rural Health Alliance (1998) definition of rural Australia as being very diverse and includes

> farming areas, agricultural service centers, mining towns, coastal communities attracting holiday-makers and retirees, Aboriginal outstations, remote islands, alternative communities, wilderness and dessert areas, and many of the major regional centers (Black et al. 2000: 6).

Grimes (2000) describes rural areas as "parts of the space economy which are least affected by the process of urbanization, and are therefore more associated with a much more dispersed pattern of population distribution and economic activity" (Grimes 2000: 13). Malecki (2003) describes the rural as paying the penalty of population density and distance from markets, information, labour, and most other resources. More broadly, R-3s have specific socio-demographic and socio-cultural characteristics such as agency and youth out-migration, various economic activities, and diverse land use settlement patterns (ABS 1996b; Black et al. 2000).

Coastal communities are an important subcategory of R-3s, but in his analysis, Black et al. (2000) associates them primarily with tourism and retirement. He fails to acknowledge that members of coastal communities often rely on primary industries such as fisheries, aquaculture, and agriculture, and that many coastal residents face issues and pressures that are similar to those confronted by their inland counterparts. Tyranny of distance to the marketplace, economic pressures of a global economy, and tensions between owner-operated and corporate business challenge fishing, seafood and

aquaculture industries in coastal areas and thus affect entire communities and regions. These pressures require townspeople to seek income from other sources, notably tourism. An example of such economic pressures can be found in Conway's et al. (2002) paper about fishing families, communities and management in Oregon, USA. "[M]any Oregon coastal communities have economic and cultural roots in the timber and tourism industries. Declines in the fishing and timber industries have necessitated the relocation of many families" (Conway et al. 2002: 21). Rossiter and Stead (2003) draw comparable conclusions to this observation by acknowledging the economic and social issues affecting fishers of the Northeast of Scotland in addition to the biological issues.

Remoteness is a significant characteristic of the fishing industry, as many fishers are required to live and work in R-3 regions to minimise travelling time to fishing grounds. "The isolated nature of their work at sea contributes to a sense of belonging to an exclusive community, which at times can lead to an "us against them" mentality" (Conway et al. 2002: 21; see also Davis 1986; Jentoft 1999). Like farmers, fishers are subjected to limited facilities and services taken for granted in urban areas.

Tasmanian rock lobster industry fishers experience constant tension between the independent autonomous fishing lifestyle and the business of trading their catch and covering capital and operating costs. Fishing and going to sea reflect the fishers' independent nature, while simultaneously highlighting their sense of belonging to fishing communities. However capital and operating costs, and returns on investment quickly remind fishers that this lifestyle can only be sustained if their businesses remain viable and have secure returns on investment. These challenges are evident in fishing communities where young people find it increasingly difficult to have a career in such industries. As a result of increasingly high establishment costs (such as purchasing licences, vessels, fishing gear, and quota), new entrant fishers often face servicing enormous loans and consequently becoming vulnerable to market fluctuations. The risks are often seen as too great, and therefore potential new entrants seek alternative careers, which affect the local labour force and contributes to an imbalance in industry demographics. In other contexts, these trends are also noted by Cole (2003), Rossiter and Stead (2003), and Fulcher (2000).

The final section to this chapter explores the future of the Tasmanian rock lobster industry, with particular reference to a recommended management approach and IS/IT strategy.

The Future of the Industry: A New Management Approach

The future of the Tasmanian rock lobster industry is dependent upon an integrative approach to managing the industry supply chain. Industry sustainability strategies need to encompass the environmental, economic and social aspects. This approach also needs to be reflected in fisheries research and management and extends beyond the biological stock assessments undertaken my fisheries research and management agencies. The approach needs to encompass industry development, trade and marketing strategies, and engage with the supply chain community through consultation with stakeholders and participants. It has already been recognised and addressed by some organisations and industries at both a national level and in Tasmania. Organisations such as Seafood Services Australia are establishing initiatives and programs to assist the Australian seafood industry become more sustainable and adapt to change. TAFI is also undertaking socio-economic research projects with the Tasmanian rock lobster industry in recognition of the wealth of knowledge that industry participants have to share and invest in their industry. However, greater effort in business and industry development is still required, particularly in relation to development business management systems and quality chain management systems.

There is significant uncertainty, risk and vulnerability for an R-3 industry dependent on major market places as industry members become price takers and subject to global trends and events. In addition, fisheries management regulations and market investment lead to high costs of entry into the fishery, and therefore creating financial pressure from both ends of the chain for industry members. Risk management strategies, therefore, need to be established. By understanding the Tasmanian rock lobster industry supply chain, including the end market place, and applying business analysis strategies such as Information modelling, SWOT analysis and Critical Success Factors, areas for improvement can be identified and strategies offered such as establishing a quality management system and an industry information system.

SCM, QCM, and traceability all play a role and have had an impact in some way on the Tasmanian rock lobster industry. In parallel with many industries, the Tasmanian rock lobster industry has multiple players and business processes that allow the raw product to arrive at the end user, and like many other R-3 industries, the customer drives the industry supply chain. However, in the case of the Tasmanian rock lobster industry (also experienced by other states harvesting Southern Rock Lobster), the customer, namely the Chinese wholesale importer, appears to be more dominant than the consumer. From an upstream (fishers and exporters) and downstream (consumers) perspective, the business culture of the Chinese importers has caused poor transparency in terms of the product flow and business processes between the transport provider and the consumer. The lack of transparency has contributed towards the fishers and processors being price-takers for a high valued product with limited supply. The lack of transparency is also the reason why consumers have little awareness of the product they are consuming, which often leads to potential species substitution. Tasmanian owned export processors state that the Chinese marketplace (importer) is driven by price and that quality is used as a bargaining tool. If the importer does not want to pay a certain price for Southern rock lobster, it is reflected in the 'claim', which means that the importer will claim for the number of mortalities in a shipment. Consequently, based on compensation agreements between the exporter and importer, the importers will pay less for the shipment. From an exporter's perspective, it is difficult to prove if the claim is legitimate. Some exporters suspect that importers continue to sell the dead rock lobsters after compensation.

A significant threat is the loss of ownership of Tasmanian processing factories to the marketplace. The loss of ownership means greater control over the supply chain by the major marketplace, namely China, for Tasmanian rock lobster, and exporters that are not privy to the business culture feel vulnerable. To some extent these Tasmanian owned exporters have made little effort to learn the language and culture that they depend upon for their livelihoods. The vulnerability of relying on a major dominant marketplace is also a concern for fishers who have experienced dramatic beach price fluctuations and increasing operating and capital costs. However it should be noted that both fishers and processors have also enjoyed the high prices and have been reluctant to think and act strategically, and to seek alternative markets. Unfortunately when the beach prices have been good, the fishers and processors have allowed the market to dominate and become price-makers. The significance of this position for fishers and

processors means that when there is a down turn in the market and there are poor returns, the existence of fishers and processors is threatened. The lack of transparency of the industry supply chain has also led to distrust and distorted information among supply chain members and has driven the fishers to explore concepts such as IS/IT.

For several years, the TRLFA has sought to explore the potential application of IS/IT for its industry. The drive to explore IS/IT was to assist in obtaining a greater understanding of the role of supply chain members and business processes, particularly at the customer end, and to make more informed choices about the strategic direction of the industry. It also became apparent that other primary industries, particularly seafood, were also heading down this path. The positive outcome of such an approach could provide the industry with the ability to adapt to change not only physically but psychologically. By having an improved information system and knowledge base, the R-3 industry would be able to participate and compete in a sustainable manner in a global economy without forgoing the intrinsic characteristics that define the industry.

In relation to other contexts, Barling and Castleman (2000) and Grimes (2000, 2003) provide examples of some negative impacts of technology for R-3 industries, and how technology can contribute to the demise of R-3 communities in terms of population, demographics, and social well being. Grimes (2003) also highlights the challenges of providing telecommunication facilities for small dispersed populated areas, and emphasises the inequity of services between rural and urban areas as a result of economic decisions by telecommunications companies. Often the failure in the adoption of technology in rural areas can also be associated with the approach taken by government policies and initiatives, who may apply urban strategies to rural areas without acknowledging the differences associated with these areas. Based on these lessons, any IS/IT initiative for the Tasmanian rock lobster industry would need to include industry stakeholder consultation and acceptance before commencing.

For the Tasmanian rock lobster industry, IS/IT has been seen as a means for fishers to reach the end buyers such as restaurants, hotels, and consumers, and to by-pass some of the supply chain members currently involved in the processing, wholesale and distribution end of the supply chain. Fishers have felt compelled to have more participation and drive towards establishing a strategic business plan for the future relating to quality accreditation, marketing, understanding consumer requirements and

ultimately ensuring long term economical and social sustainability for the Tasmanian rock lobster fishing community. However the IS/IT solutions discussed in the earlier chapters highlight the importance of establishing strategic partnerships between the supply chain members to practically achieve any re-engineering of the supply chain processes.

The fishers' frustration with being price takers rather than price makers has been a primary driver behind the push to explore IS/IT, and establish a website and e-trading platform for the industry. However the journey to achieve these goals has been long, turbulent and subject to very few 'quick wins'. To the frustration of the industry members, most of the gains in strategic planning are not tangible or evident until there is a down turn in the existing marketplace. Industry members only fully appreciate the investment when there are external threats on price. The few fishers who do recognise the benefits of strategic planning and investment often have been in the fishery long enough to remember the impact of past market down turns or are new entrants exposed to long term financial commitments.

The current signs of market vulnerability reinforce the importance of searching for new markets and reviewing the current methods of doing business. Border closures, impending stricter border controls and tariffs associated with the market are also reasons for increased concern on the current market stability. Therefore, the exploration of alternative markets and strategic planning by fishers and processors are necessary, but they would be required to have a greater understanding of market segmentation in terms of the cultural differences associated with different regions. The fishers and processors would also require an understanding about the consumer requirements and regulations for product specification and quality compared with existing markets. The contrasting customer requirements and regulations is particularly the case in Europe with movements towards traceability of seafood, such as the Tracefish project. The exploration of IS/IT in the Tasmanian rock lobster industry could possibly be more than just trading rock lobsters online, and that IS/IT could assist the industry to review their supply chain, and improve business processes such as QCM.

From the research undertaken on the post-harvest stress indicators of live rock lobster it has become apparent that perhaps not all species or seafood products are suitable for the QIM. However this outcome does not remove the importance of QCM of rock lobsters.

For the time being, codes of practice for processing, handling and grading of export lobsters may have to suffice, however there will be continuing pressure from markets to improve the methods used. The increasing drive for quality assurance of food chains by consumer also means a greater focus on the application of the existing collected data by fishers and processors. The Tracefish project (Denton 2002) is an example of a quality management system derived from fisheries logbook data. Quota docket books and catch and effort logbooks are sources of information already collected by the Tasmanian rock lobster industry that could assist in identifying and tracing product along the supply chain, particularly if EAN standards are applied to the food industry. At the end of the day, no matter whether one is trading lobsters by fax/phone or online, quality assurance, reputation, and accreditation are necessary if one is also attempting to secure existing markets and source new markets. It should be noted that as such processes are consumer driven, it is unlikely that industry members will take any radical steps unless they are forced to. However, any moves in this direction by them could certainly be regarded as a competitive advantage. In this vein, it is noteworthy that Batt and Morooka (2003) support the move for quality management systems as a competitive advantage in the marketplace based on his observations with the Western Australian rock lobster exports to Japan.

The two IS/IT solutions explored in earlier chapters highlight the complexity of implementing IS/IT in an R-3 industry, and that the business processes and information flows are just as important as the technology. Hence the reason for recommending a Rock Lobster Electronic Management System framework for the Tasmanian rock lobster industry. The ten-year framework is a long-term strategic plan for the industry that incorporates the development of a business management system and tagging system, in addition to research and restructuring the supply chain. The lessons learned from both proposed business cases highlight the need for a cooperative marketing company to represent and unite the Tasmanian supply chain participants, and to facilitate research, and marketing and industry development initiatives. The company would also be custodians of the industry supply chain information systems. By taking an integrative approach to SCM, it would be instrumental in uniting a fragmented industry and ensuring the industry has a sustainable future through improved information systems and knowledge management. Finally, in relation to food security, a cooperative marketing company would also contribute towards financial security, the

security of the supply chain integrity (food quality and codes of practices), and the security of industry information and intellectual property.

Summary

In this chapter I have explored the need to secure the future for industry supply chains and their associated communities. I have also examined security in the context of food quality and safety, as well as the security of resources and industry viability against the endogenous and exogenous forces, and the security of information. IS/IT and globalisation are major drivers of change, and of restructuring and adjustment in both agriculture and fishing/seafood industries, whether it is to do with trade and marketing, technology and communications or the environment such as drought or flood. It appears that very little of this research is directed to fisheries and the seafood industry, considering they too comply with the definitions of R-3 communities. The chapter has drawn links from these drivers to the fisheries/seafood industry, in terms of what it means to the Tasmanian rock lobster industry and how the industry considers managing this to ensure a sustainable future. The conclusion is that for a fishing/seafood industry whose members wish to remain competitive and sustainable in an uncertain global economy, SCM and the appropriate utilisation of IS/IT may be a strategy in achieving this outcome.

CHAPTER EIGHT: CONCLUSIONS, REFLECTIONS AND THE FUTURE AGENDA

Conclusions

What are the major processes and information flows along the Tasmanian rock lobster industry supply chain?

The current Tasmanian rock lobster industry supply chain is largely a manual information system, which includes a number disparate systems that reside with government agencies and other supply chain participants such as fishers, processors, transport providers and wholesalers. The formal information collected is recorded by the State Government agency, DPIWE's Quota Management System and Integrated Catch and Effort System. It is collected by fishers and processors and is monitored by fisheries compliance officers and Tasmanian police officers. It also reflects the volumes and movements of the catch, such as areas fished, weights and numbers, unloading, receiving and dispatching details such as dates and times. Its collection is compulsory and non-compliance calls for severe penalties for industry. The formal information from the upstream supply chain participants is reliable and consistent in terms of using it as a platform to establish a supply chain information system.

Other information flows includes beach and market price, condition of product such as soft shell and number of legs, product preferences such as colour and size, and product availability. It has been observed by fishers and other supply chain members that supply and demand is manipulated by the 'middlemen' to determine beach and market price, and ensure there are healthy margins. The lack of transparency along the supply chain from a fishers' perspective is the suspected cause for lack of trust, poor relations and lack of understanding of the business process and culture of other supply chain participants. Market information is subject to supply chain members passing on information through price and order specifications. Very little feedback is provided to fishers from the marketplace on the quality and end sale price of their product.

Tacit knowledge is common with fishers and processors in terms of fishing and processing operations and product handling. This knowledge is particularly used in determining quality of product at point of capture, unloading, receiving, processing, and dispatching. Fishers also use tacit knowledge during fishing operations. The

experience and unique knowledge of the sea, their vessel, the coastline, and changes in the environment are extremely valuable for fisheries researchers and managers.

Transport providers including freight forwarders and airline carriers also have information and knowledge stored in their systems that do not always flow to processors or importers. Airway bills and consignment details hold key information about the product been shipped including the sender and receiver details, destination, carrier, product type, and airport transfer details. The airways bills are necessary for international flights and are useful to track product for the freight forwarders. Many perishable primary industries are adopting cool chain management techniques to monitor environmental conditions of the product during transit. Technology such as RFID devices can be used to collect information such as temperature and altitude, which is then read by a hand held reader at the end of the flight, and downloaded onto a computer and made available to senders of product over the web.

For exporters, there are many risks and uncertainties associated with the transportation of rock lobsters. As the transportation of rock lobsters are dependent on passenger flights, "offloads" can be an issue where freight is removed from the plane to make way for passenger luggage. This issue often causes delays in the shipment of the product to the destination, and can affect a sale if there is a tight deadline. Other issues associated with transportation of rock lobsters from a processor's perspective are the destination. As the major market place is China, and the current major entry point is Hong Kong, there are three main issues which exporters have to deal with: border closures; airport closures due to weather conditions e.g. hurricanes; and lack of transparency of product movement from airport to importer's factory. Therefore there is uncertainty for the exporter in regard to the validity of quality claims from buyers associated with the rock lobster.

What are the current and possible future characteristics of the supply chain?

By using SWOT analysis to analyse the findings gathered from participant observations and industry consultation, a current and future profile of the Tasmanian rock lobster industry is developed. A number of key themes emerged relating to industry threats and opportunities include sustainability, accountability, quality assurance, and the need for an integrative approach to manage the industry.

The current industry supply chain consists of a number of limitations: limited flow and sharing of knowledge and information about the Tasmanian rock lobster industry in relation to markets, consumer trends, and business culture; limited knowledge about how these downstream processes affect the fisheries resource and fishing communities; limited knowledge of how fisheries management policies and plans impact on fishing communities; and how fisheries management policies and plans have been undertaken in isolation of the downstream processes and trends.

Sustainability is a major concern for most key industry stakeholders interviewed, whether it may be industry viability, resource management, and managing change. An emerging trend associated with sustainability is the emotion economy where there is an increase customer/consumer drive for food chains to meet standards in terms of quality, food safely, and ethics. Industry accountability of operating and handling practices is another emerging requirement from the public and consumers. Codes of practice such as the impact on the environment, food handling and processing standards and conditions, and transport conditions are some of the requirements that industry need to address. These trends are partly associated with globalisation is two ways: as a reaction to global food chains where the product may consist of a number of origins; and as a reaction to increasing global consumer awareness and drive for quality assurance of food sources, traceability, and standards of practice. To address these concerns, management systems for the environment, and food quality and safety have been establish. Examples include EMS, cool chain management systems, and traceability systems such as Tracefish and QIM.

The sustainability of the industry also relates to managing the supply chain and enabling the industry to adjust to change. ESD principles have been the backbone of many fisheries management plans and policies. However evidence has indicated in other fisheries around the world that managing industry based on quantitative catch and effort data and stock assessments may not necessary produce a sustainable management plan and policy for the whole of industry. In saying this, the fishing communities may suffer based on policies that use data that only comes from one source. The management of a fishery/industry needs to take an integrative approach to the supply chain and manage it accordingly using both upstream and downstream information gathered from supply chain participants.

How can IS/IT assist the seafood industry, in particular the Tasmanian rock lobster industry, to improve business processes along the supply chain and (via numerous feedback mechanisms) then assist the pursuit of economic, social and environmental outcomes that are more sustainable than those which typify the industry at present?

IS/IT can assist or inhibit sustainability. IS/IT strategies and methodologies can assist in strategic planning and industry development to ensure competitive advantage. IS/IT can assist in establishing systems to address quality assurance and traceability of food chains requirements by tracking, capturing, storing, and disseminating information. IS/IT can assist in capturing tacit knowledge of industry participants relevant to quality and environmental management and food safety, and codes of practice. IS/IT strategies can also link disparate information systems to improve the information sharing along the supply chain. IS/IT can also assist traceability of product through capturing information and tracking the product. For consumers, IS/IT can provide a means to prove the origin of a food product, while for upstream members, to gain feedback on product from consumers and the marketplace. IS/IT is able to assist industry members to monitor high risk areas along the supply chain, such as monitoring environmental conditions during transport. Finally IS/IT can also establish a stand alone business information management system for both fishers and processors to collect, retrieve and analyse data pertinent to their business.

Business information, such as fishing operations, can also be collected, stored, and analysed in an information system for the purpose of assisting with business management at an individual business or industry level. By having business information and knowledge, competitive advantages can be achieved through using this information and knowledge for decision support, managing ignorance and uncertainty, and adapting to change.

However despite the identified benefits of IS/IT for the Tasmanian rock lobster industry, there are a number of CSFs that need to be achieved to ensure IS/IT is not inappropriately implemented. The findings and literature throughout this thesis highlight the potential harm IS/IT can have on a primary industry or R-3 community if it is not adequately researched, designed, and appropriately implemented. To avoid the negative effects of IS/IT, some key CSFs are specifically listed for this industry. Firstly there is a need to have a long-term strategic framework for the industry, which involves

undertaking research and establishing a Tasmanian rock lobster industry cooperative marketing group before implementing any IS/IT. There is a need to conduct market research and learn about the business culture of the target markets, and there is a need to establish an industry representative that is on the ground in the market place and is part of the business culture. Finally and most importantly, there is a need to get business processes working first before implementation of IS/IT applications.

Rock Lobster Reflections

This industry partnered doctoral project has been evolutionary and dynamic, and a significant learning experience for me. The issue of managing change has not only been an industry experience, but it also has been my experience whilst undertaking this research. Managing changing exogenous forces and trends in the global market place and from technology have been as significant for this thesis topic as it has been for the industry. Consequently this research environment has exposed me to unique and opportunistic experiences and observations that would be difficult to replicate in a more staged research setting. From this experience, I have learnt that when dealing with such a dynamic topic, it is important to be flexible and be prepared to adapt to change.

This research environment has also exposed me with other challenges, such as managing the research role of the participant observer, managing changes in industry priorities, and the involvement of third party electronic trading providers. The degree of familiarity with the research setting and participants provided me with a privileged acceptance where I could gain valuable insights into the industry. This position highlighted the need for a balance between the participant and observer role. My awareness of this issue was a major driver to remain faithful to the research plan, questions and objectives of achieving a doctoral thesis.

This thesis also developed my appreciation of the value of multi-disciplinary approaches in understanding and managing an industry. The use of complimentary theories, methods, tools and techniques from various fields of thought are significant in ensuring balanced management plans and policies are established to ensure a sustainable future for the industry. Interpretive approaches are particularly important to capture the richness of an industry and its dependent communities. This thesis also humbles me in terms of my understanding and knowledge about the industry, as I feel I

am only at the beginning of a long-term vision described in my recommended IS/IT solution, which encompasses my future research agenda.

Future Research Agenda

Based on the recommended strategic plan for the Tasmanian rock lobster industry, it is clear that there is a future research plan that includes the implementation of IS/IT, and the diversification and development of markets. The ten-year strategic plan initially requires undertaking research in the current target marketplace to acquire knowledge, information and understanding of the supply chain and business culture. There is also a need to explore alternative markets and remove the potential strangle hold that China has on the industry.

In the thesis it has been deemed out of scope to map the industry supply chain in China primarily because of the complexity of the business culture and the absence of a gatekeeper for that research setting. However since the commencement of the thesis, opportunities to gain entry to the research setting in China has assisted in the initiation of a project to complete the mapping of the industry supply chain and to gain access to the Chinese consumers. This project aims to tie in with the potential establishment of a free trade agreement (FTA) with China, and aims to explore the potential impacts of a FTA on the current Chinese wholesalers. The potential research questions I propose include: Will the FTA provide greater transparency for the Tasmania fishers and processors? Will the industry have better market reach to the consumers in China? Through greater education of the Tasmanian rock lobster, will consumers be able to purchase more Tasmanian rock lobster? Will the Chinese wholesalers maintain control over the industry and the consumers? By establishing an industry representative in the marketplace, will this assist in the marketing of Tasmanian rock lobster in China and improve customer perceptions and choices? Will the potential increase in demand be passed up the supply chain? (or will there be just greater species substitution with cheaper product), and finally will education of consumers reduce this?

The framework developed for undertaking this Tasmanian rock lobster supply chain project in China, will hopefully be transferable to research on alternative markets such as the United States and the European Union. Hopefully this framework will assist the

industry in understanding the business culture and consumers, and ensure the product is targeted appropriately.

In addition to the market research work in China, there is also a need for further research into the application of tracking devices, such as RFIDs, in the live seafood industry. The application of such technology aims to provide traceability information, such as proof of origin to consumers, and to also provide feedback information on environmental monitoring to processors and fishers so they can apply risk management strategies more effectively.

These two suggested research projects are significant components of the strategic plan recommended in this thesis, and will ultimately provide direct tangible benefits to the members of the Tasmanian rock lobster industry.

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APPENDICES

Appendix 1 Letter and Information Sheet

UNIVERSITY
OF TASMANIA

30th October 2003

Mr Rock Lobster
Rocky Reef Rd
East Coast, Tas 7117

Dear Mr Lobster

THE TASMANIAN ROCK LOBSTER INDUSTRY ELOGBOOK SYSTEM

I am a PhD candidate with the School of Geography and Environmental Studies, University of Tasmania, and my project is "The Role of Information Systems/Technology in the Seafood Industry, with a particular reference to the Tasmanian rock lobster industry". In this work I am partnered with the Tasmanian Rock Lobster Fishermen's Association (TRLFA).

The project involves exploring a number of avenues where information systems and technology could assist the industry, particularly in terms of supply chain management, business, trade and market development.

One particular avenue that I am currently exploring with the industry is the feasibility of an electronic logbook (elogbook) system. The concept has been inspired by two projects; the Australian E-Boat project and the European Tracefish project. The elogbook system is essentially an information system that uses fisheries logbook and quota information as the basis for establishing stronger communication and information links along the supply chain.

In this case, the initial focus is on the Tasmanian rock lobster industry. However if this research shows that an elogbook system may be feasible, it is anticipated that the scope could be broadened to include the entire seafood industry in Tasmania.

In light of all of this, as Van Dieman Seafoods play a significant role in the Tasmanian rock lobster industry, I would like to present to you the elogbook system concept with the aim of gaining constructive feedback on the system's feasibility, and highlighting any oversights and issues that need to be taken into account if the industry were to go down this path.

I would like to arrange an interview time with you to discuss the proposed elogbook system and gain your feedback.

The interview is entirely voluntary and will be handled in a confidential manner. The interviewee has the right to refuse and withdraw from the interview at any time. The result of the interviews will be transcribed and either email or mailed to you for verification. In addition, further interviews may be arranged to seek clarification or elaboration. This will be determined based on a "as needed" basis.

The research data acquired will be stored on the researcher's machine. Two copies will be created on a CD, one for the University and another to be for the researcher to use as a backup throughout the duration of the project. After the completion of the three year project, the University will hold onto the data for five years.

If you have any queries in regards to this project, the contact persons and chief investigators are;

1. Dr Les Wood
   Associate Professor
   Head of School
   Supervisor
   Department of Geography and Environmental Studies
   Phone (03) 62262489
   Email: Les.Wood@utas.edu.au

2. Dr Elaine Stratford
Supervisor
Department of Geography and Environmental Studies
Phone (03) 62262462
Email: Elaine.Stratford@utas.edu.au

3. Miss Tristan Richards
PhD Student
Department of Geography and Environmental Studies
Phone (03) 62435163
Mobile 0418 591 709
Email: Tristan.Richards@bigpond.com

The project has received ethical approval from the University Human Research Ethics Committee. If you have any concerns about the ethical nature or have complaints about the manner in which the project is conducted, you can contact the Chair or Executive Officer of the University Human Research Ethics Committee.

Dr Janet Vial
Chair
Phone (03) 62 264842

Ms Chris Hooper
Executive Officer
Phone (03) 62 262763

Attached is an information kit, and an outline of interview questions that I plan to ask at the interview. I will make contact with you by phone or email within two weeks of sending this letter to arrange an interview time at your earliest convenience. If you have any questions or concerns please feel free to contact me on 0418591709 or by email Tristan.Richards@bigpond.com.

Yours sincerely

Tristan Richards B.App.Sci (Fisheries), Grad.Dip.Sci., B.Info.Sys(Hons)

PhD Candidate
School of Geography and Environmental Studies
University of Tasmania

Statement of Informed Consent

Title of project:

The Role of Information Systems/Technology in the Seafood Industry, with a particular reference to the Tasmanian rock lobster industry.

1. I have read and understood the 'Information Sheet' for this study.
2. The nature and possible effects of the study have been explained to me.
3. I understand that the study involves personal interviews.
4. I understand that there maybe some questions that will make me feel uncomfortable and sensitive.
5. I understand that all research data will be treated as confidential.
6. Any questions that I have asked have been answered to my satisfaction.
7. I agree that research data gathered for the study may be published provided that I cannot be identified as a subject.
8. I agree to participate in this investigation and understand that I may withdraw at any time without prejudice.

Name of participant

Signature of participant Date

9. Investigator:

I have explained this project and the implications of participation in it to this volunteer and I believe that the consent is informed and that he/she understands the implications of participation.

Name of investigator

Signature of investigator Date

Appendix 2 Interviews with Industry Stakeholders

Fishers

- What kind of communications and information technology do you use in your fishing business?
- Do most fishers have this kind of technology for their fishing business?
- Can you describe the main steps from catching to landing the lobster?
- Can you describe the kinds of information being collected by you for quota compliance?
- Can you describe the kinds of information being collected by you for government logbook compliance?
- What other kinds of information being regularly collected by you and other fishers during fishing and landing operations?
- Is this information recorded on paper or electronically?
- Are there any problems associated with the collection of the data? ie. Time required and the logistics.
- What would be your suggestions for improvement in the collection of this information?
- How much time does it take to collect this information during a trip?
- What effects would/might there be on your business if you had greater access to this information electronically?
- What effects might there be on you or your business if you could record and send the quota docket book and logbook data to DPIWE electronically?
- Would product feedback from the market place be useful or not useful to you?
- Would you be prepared to take the time to tag each lobster or at least label the catch, if you knew that it would ultimately provide your business and the industry with more product feedback information as well as reducing the time to complete the compliance paperwork with greater accuracy?
- How would you feel about working and sharing information with processors and buyers?
- In your estimation, do processors readily communicate what the market is looking for ie. In terms of quality.
- How do you assess quality of lobster?

- Who do you see as the most influential/dominant/powerful supply chain member?

Processors

- What kind of communications and information technology do you use in your business?
- Do most processors have this kind of technology for their business?
- Can you describe the main steps involved from collecting the catch from the wharf to selling and sending the lobster the buyer?
- How do you manage the coordination of freight?
- Do you currently gain feedback from freight providers on the product's progress?
- What happens if live product arrives dead on arrival or its quality is unsatisfactory from the buyer's perspective?
- Is this the responsibility of the processor or the freight provider?
- What kind of information do you collect for DPIWE quota compliance?
- What other information about the lobsters do you collect and record for your own business?
- Are there any problems associated with the collection of the data? ie. Time required and the logistics.
- What would be your suggestions for improvement in the collection of this information?
- If you collect information, is it recorded electronically?
- How would you feel if you could record electronically information collected for DPIWE and for your the business?
- How would you feel if fishers could provide catch details such as catch description, numbers and weights electronically as they become available for purchase?
- How do you currently gain information about market trends?
- How do you assess quality of lobsters?
- Is quality information recorded?
- Are there any quality/export standards that you use as a reference to?
- At what point of the supply chain do you feel the live product is at its most vulnerable in terms of its health and quality?

- Can you envisage a system that would allow tracing lobsters from individual fishers through to particular markets?
- What kind of strategies are the processors developing for the future, particularly in terms of marketing, quality assurance and supply chain management.
- Who do you see as the most influential/dominant/powerful supply chain member?

Researchers

- What information do you currently obtain from fishers or processors, either via the quota management system and other data collection programs?
- Are there any problems associated with the collection of this information? For example, reliability, data integrity and quality and timeliness of data collection and entering into the system.
- What would be your suggestions for improvement in the collection of this information?
- What other information could fishers and other supply chain members provide that you would consider useful for your research?
- Would organisations such as TAFI consider undertaking future research work in the fields of fisheries marketing and supply chain management, if this information would become more readily available?
- If fishers were to enter logbook and quota information onto an electronic system, what kind of issues could you envisage that may arise?
- Who do you see as the most influential/dominant/powerful supply chain member?

Fisheries Managers

- Who are the main suppliers of information from the industry?
- What sorts of information is collected from the industry?
- Is one form of information collected dominant?
- How is such information mostly collected?
- What are the objectives of obtaining this information for fisheries management purposes?
- Are there any problems relating to the collection of data from the industry supply chain members? ie. data quality and data integrity.

- What would be your suggestions for improvement in the collection of this information?
- What other information would be considered useful from industry that could assist with managing the resource?
- What proportion of your time is allocated to monitoring, researching, managing and developing policies from the business aspect of the industry, for example, managing the supply chain?
- Would organisations such as DPIWE considering undertaking future management and policy work in the fields of fisheries marketing and supply chain management, particularly if this information was more readily available?
- Would the concept of gaining information from all members of the supply chain be considered beneficial to a fisheries manager's role?
- Who do you see as the most influential/dominant/powerful supply chain member?

Monitoring, Compliance and Enforcement

- What information do you currently collect from industry?
- Who are the key providers of the information?
- How is this information stored, retrieved and analysed?
- Are there any problems relating to the collection of the information?
- What would be your suggestions for improvement in the collection of this information?
- How would you feel about the possibility of industry participants electronically recording required information for compliance?
- How would you feel about the idea of being able to track the lobster product from the day it was caught to the day it was sold in terms of monitoring the resource?
- Who do you see as the most influential/dominant/powerful supply chain member?

Trade and Marketing

- What proportion of your time is allocated to monitoring, researching, managing and developing policies from the business aspect of the industry, for example, managing the supply chain?

- What sources of information do you use to gain information about the industry in regards to business, trade and marketing?
- What information do you generally gain from the supply chain in terms of current market trends?
- What information from industry participants would you consider useful for market development and supply chain management?
- How do you normally communicate trade and marketing information to the industry supply chain members ie. What are the feedback mechanisms?
- How would you feel about the idea of being able to track the lobster product from the day it was caught to the day it was sold to the end buyer in terms of monitoring the resource for trade and marketing purposes?
- Would feed-forward information be useful from downstream supply chain members, particularly in terms of managing supply and demand and meeting market requirements?
- Who do you see as the most influential/dominant/powerful supply chain member?

Transport and Logistics

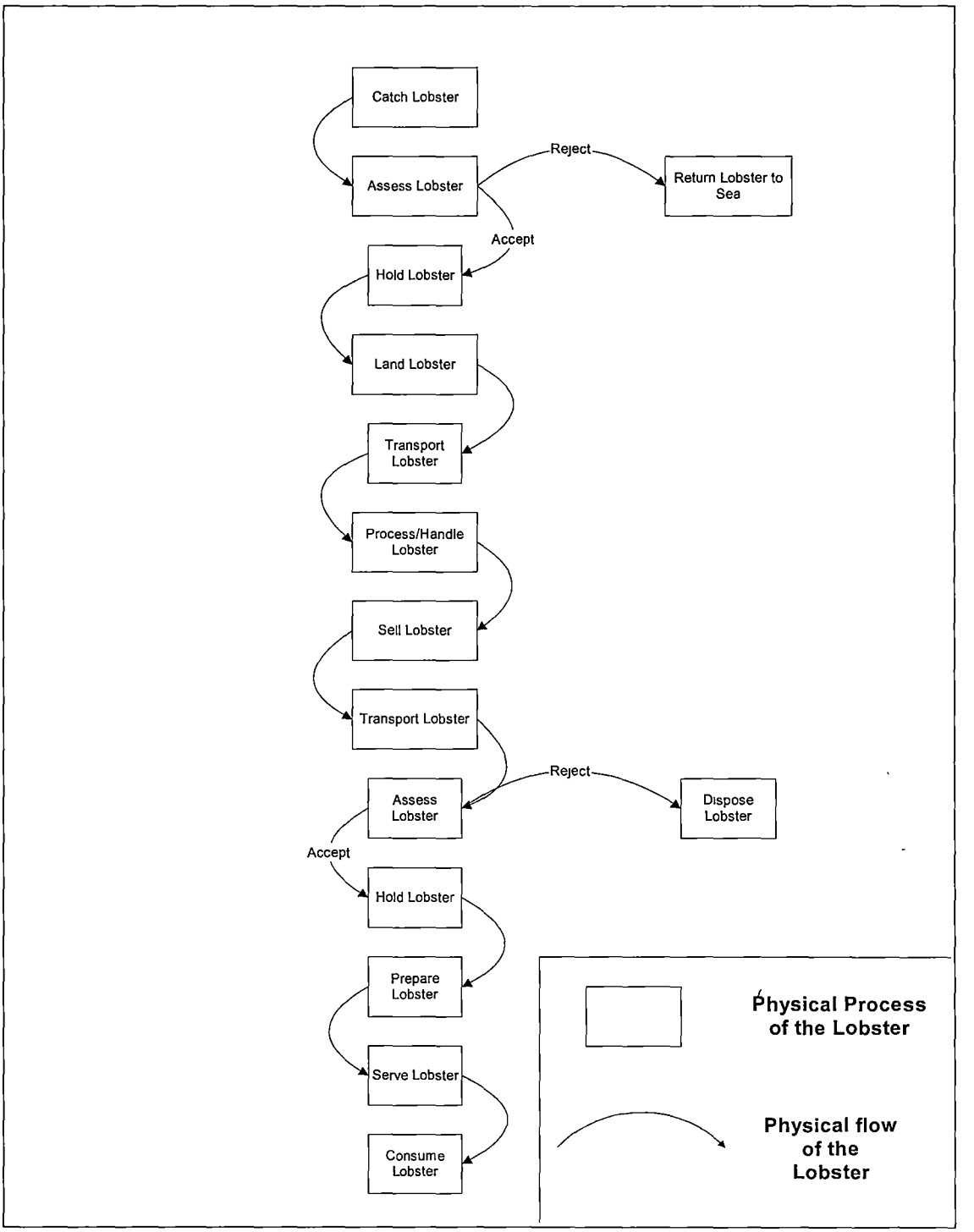
- Can you describe the main steps involved in transporting the live lobster from the processor to the end buyer?
- Are there any problems associated with the above process?
- What kind of communications and information technology do you use in your business?
- How would you feel about the idea of being able to track the lobster product from the day it was caught to the day it was sold in terms of managing the supply chain and logistics?
- Would feed-forward information be useful from downstream supply chain members, particularly in terms of coordinating freight space etc?
- To improve freight services and logistics for the industry from a freight service provider's perspective, what information from the other industry participants such as fishers and processors would be useful?
- Who do you see as the most influential/dominant/powerful supply chain member?

Buyers

- How do you currently acquire information about the lobster product?
- What are the main issues associated with the supply of lobsters by the Tasmanian rock lobster industry?
- Would feed-forward information be useful from downstream supply chain members, particularly in terms of managing supply and demand and meeting market requirements?
- How would you feel if catch information such as availability and product attributes were made more available to buyers from the fishers and processors?
- How would you feel about providing formal feedback on market requirements and trends, product specification, and product and customer service to downstream supply chain members?
- Who do you see as the most influential/dominant/powerful supply chain member?

Appendix 3 Physical Processes of the Tasmanian Rock Lobster Industry Supply Chain

Appendix 3-1: The physical process flow diagram of the Tasmanian Rock Lobster Industry supply chain.



Appendix 4 E-Logbook Mapping Project: Data Requirements

Appendix 4-1: DPIWE data requirements from fishers' quota docket books

E-Logbook Mapping Project for the Tasmanian Rock Lobster Industry: Fishing Data Requirements			
Task	**Information Required**	**Information collected by**	**Information sent to**
Unloading rock lobster (fishers)	• Name and distinguishing mark of vessel • Intended port of unloading • Intended date of unloading • Estimated time of unloading • The number of rock lobster on board • Estimated weight of rock lobster on board (kg) • Intended purchaser of the rock lobster (name of processor or fish handler)	Holder of a fishing licence (rock lobster) Report needs to occur at least 2 hours before unloading	Fishers directly contact a Page Service Operator on a dedicated phone number
Emergency unloading (due to a sudden freshwater problem, or other emergency situation).	• Name and distinguishing mark of vessel • Port of unloading • Date of arrival • Time of arrival • Time of unloading • The number of rock lobster unloaded • Estimated weight of rock lobster unloaded • Intended purchaser of the rock lobster (name of processor or fish handler)	The holder of a fishing licence (rock lobster) (or someone on their behalf)	Fishers directly contacts a Page Service Operator on a dedicated phone number
Unloading rock lobster into a fish cauf	• Name and distinguishing mark of vessel • Cauf registration number • Date and time of unloading • Estimated number of rock lobster to be placed into the fish cauf • Are all the rock lobster unloaded into the cauf	The holder of a fishing licence (rock lobster) (or someone on their behalf)	Fishers directly contacts a Page Service Operator on a dedicated phone number
Movement report	• Destination of lobster (town name) • Rock Lobster licence entitlement number • Receivers' street number and address • Estimated time of arrival. • Unloaded vessel name and distinguishing mark • The type and registration number of the vehicle transporting the lobster • Exact weight of rock lobster (taken from the quota docket book)	The holder of a fishing licence	Needs to notify the reporting service before the rock lobster leaves the immediate proximity of a fishing vessel from which it was unloaded
Receipt report	• The time and place of receipt • The reference number from the 'Prior transport' Pager report • The weight of the rock lobster received	The holder of the fish licence	

Task	Information Required	Information collected by	Information sent to
Dispatch Report	• Destination (town) of the rock lobster despatched from • Rock Lobster licence entitlement number. • Date of dispatch • Time of dispatch • Destination (town) of the rock lobster despatched from • The name of the person/company being despatched to • Exact weight of rock lobster being dispatched • Vehicle/aircraft registration number. • What is the number of the fish Dispatch Docket, AQIS Certificate or Consignment Note that is with the fish?	The holder of the fish licence	Needs to notify the reporting service within 2 hours before dispatching any rock lobster out of the State
Cancellation report	• Old Reference number	The holder of the fish handling licence	Reporting service must be notified within 2 hours of when the original activity should of occurred

Source: DPIWE (1997 & 2001a).

Appendix 4-2: DPIWE logbook requirements

Landing Docket Book			
PART A	Rock lobster entitlement number Vessel distinguishing mark, date and time of unloading Location of unloading Number and type of containers (bags) of rock lobster Exact weight of rock lobster Number of rock lobster (taken from the daily catch log) Destination of consignment (must be a licensed lobster receiver) Name and signature of the holder Were all rock lobster unloaded from the vessel Weight and number sold to an unlicensed receiver The receipt number issued by the paging service	The holder of a fishing licence (rock lobster) must enter on the original of a rock lobster quota docket Part A	Must send the original of the completed rock lobster quota docket to DPIWE within 48 hours of unloading
PART B	Time of departure from unloading site Name of driver, with signature and date Exact weight of rock lobster Type and registration number of vehicle The receipt number issued by the paging service	The holder of a fish processing licence (rock lobster) or fish handling licence must enter on the original of a rock lobster quota docket Part B	
Sale of rock lobster by fishers	The fisher will have to issue a sales receipt detailing; the number of rock lobster sold the weight of rock lobster sold who the rock lobster has been sold to which boat from which the rock lobster have come the weight and number will also need to be recorded in part A of the rock lobster docket book, as these rock lobster are part of the quota system		
Daily log sheet (rock lobster catch record)	Number of pot lifts per day Number of rock lobster caught per day Day and night shots Area fished and depth	Holders of fishing licences (rock lobster) will be required to complete this daily log sheet to record their fish operation details	Fishers will need to keep the log book on the vessel at all times and will be required to forward copies of the daily catch log to DPIWE on a monthly basis

Source: DPIWE (1997 & 2001a).

Appendix 4-3: DPIWE data quota requirements from processors

E-Logbook Mapping Project for the Tasmanian Rock Lobster Industry: Processing/Handling Data Requirements			
Task	**Information Required**	**Information collected by**	**Information sent to**
Prior Movement report	Port of landing Estimated time of unloading Processor or handler Rock Lobster licence entitlement number Unloaded vessel name and distinguishing mark Estimated weight of rock lobster unloaded	The holder of a fish processing licence	Needs to notify the reporting service 30mins before the rock lobster leaves the immediate proximity of a site of unloading
Movement report	Destination of lobster (town name) Receivers street number and address Estimated time of arrival Processor or handler Rock Lobster licence entitlement number Unloaded vessel name and distinguishing mark Port or town being moved from The type and registration number of the vehicle transporting the lobster Exact weight of rock lobster (taken from the quota docket book)	The holder of a fish processing licence who takes possession of rock lobster within the immediate proximity of the site of unloading	Needs to notify the reporting service before the rock lobster leaves the immediate proximity of a fishing vessel from which it was unloaded
Receipt report (ex Fisher)	Destination of lobster (town name) Receivers street number and address The time of receipt Processor or handler Rock Lobster licence entitlement number The reference number of Movement Report' The exact weight of the rock lobster received	The holder of a fish processing licence	Needs to notify the reporting service 15mins after receiving rock lobster
Receipt report (Other)	Destination of lobster (town name) Receivers street number and address The time of receipt Processor or handler Rock Lobster licence entitlement number. Name of person/company from which the lobster was obtained The exact weight of the rock lobster received	The holder of a fish processing licence	Needs to notify the reporting service 15mins after receiving rock lobster
Dispatch Report	Destination (town) of the rock lobster despatched from Processor or handler Rock Lobster licence entitlement number Date of dispatch Time of dispatch Vehicle registration number Destination (town/port/airport) of the rock lobster despatched to Exact weight of rock lobster being dispatched	The holder of the fish licence	Needs to notify the reporting service before the rock lobster leaves the immediate proximity of processing premises

Source: DPIWE (1997 & 2001b).

Appendix 5 Summary Industry Supply Chain Walkthrough

Appendix 5-1: Summary Industry Supply Chain Walkthrough

Entity	Process	Data Store	Control Process	Information Flow	Information	Quota Requirements
Fishers	Catch	Personal logbooks GPS DPIWE logbooks Fishers neuro data stores		From processor From Weather buearu Personal records of fishers – GPS	Weather Season Size Colour Location Depth	
	Assess	Fishers neuro data stores	Assess quality		Condition Size Colour	Legal Size Soft Shells
	Seek Processor	DPIWE Logbook	Accept	To processor	Colour Size Condition	
	Return to Sea		Reject		Condition Size Quota	Legal size
	Personal consumption		Accept		Condition	5 lobsters permitted
Fishers	Sell	Quota docket book	Accept	To processor	Beach Price weights, numbers Port	
Processors	Buy	Quota docket book	Accept	To fisher	Beach Price weights, numbers Port	
Fishers	Unload	Quota docket book			Beach Price weights, numbers Port Processor details	Unloading report Quota docket book
Processors	Receive	Quota docket book			Beach Price weights, numbers Port Fishermen details	Receipt report Quota docket book
Processor	Transport					
Processor	Grade	Processors neuro data stores	Assess quality		Condition Size Colour	Legal Size Soft Shells
	Sell Export		Accept		Condition Colour Size	
	Sell Domestic Lobster		Accept		Condition Colour Size	
	Dispose Process		Reject		Condition Stock Rotation	
Buyer	Sell Export			Places offer	Flight availability Destination Credit rating Size Colour Volume Price	Dispatch report

Entity	Process	Data Store	Control Process	Information Flow	Information	Quota Requirements
Processor	Sell Export			Counter offer	Flight availability Destination Credit rating Size Colour Volume price	Dispatch report
Processor	Seek Alternative buyer		Reject Offer		Market Price Flight availability Destination Credit rating	Dispatch report
Processor	Transport		Accept Offer		Destination Cost Consignment note Flight details Export documentation	AQIS documentation
Buyer	Receive				Consignment note Flight details Market price	
Buyer	Grade		Assess quality	From Processor	Condition Colour Price	
Buyer	Distribute		Accept	To Consumer		
Buyer	Seek Compensation		Reject	To Processor	Price	