SAILING FOR SUSTAINABILITY: THE POTENTIAL OF SAIL TECHNOLOGY AS AN ADAPTATION TOOL FOR OCEANIA. A VOYAGE OF INQUIRY AND INTERROGATION THROUGH THE LENS OF A FIJIAN CASE STUDY

BY

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I pass, like night, from land to land;
I have strange power of speech;
The moment that his face I see,
I know that man must hear me:
To him my tale I teach.

Coleridge, *the Rime of the Ancient Mariner.*

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i. Abstract

This thesis records an action research-based inquiry into the potential of sail technology as an adaptation intervention for sea-transport that would assist Oceanic communities (at local and national levels) (re)claim resilience in the face of growing threats from climate change and extreme fossil-fuel dependency. The issue is explored at micro, meso, and macro geographic levels and temporally across past heritage, the current situation and looking to a future horizon. A case study approach is employed, where possible focussed through a Fijian lens. The thesis finds that while there are grounds for expanded research into and priority of sustainable sea-transport, this central issue facing most Oceania communities remains invisible within the policy space at all levels and has been hitherto ignored by regional and development agencies. Barriers are identified as being as much perceptual as actual, and lack of technology is not the primary issue but rather more deep-seated factors including ownership, operation, and management spread across multiple 'well-beings' including culture and socio-economic concerns. There are multiple lessons to learn from interrogation of the past.

The process of inquiry was initiated within existing *talanoa* of key partner communities in Fiji and has, in turn, proved catalytic in initiating both fresh research into Fijian seafaring heritage – particularly that concerning the *Waqa Tabu* or *Drua* and its related culture in Fiji and central Oceania - and a growing network of interest in an agenda of sustainable sea-transport for this region. The former proved elemental to a programme of art and performance undertaken by the Oceania Centre for Arts, Culture and Pacific Studies leading up to the Festival of Pacific Arts in the Solomons 2012 and both strands were brought together in the region's first international 'Sustainable Sea-Transport Talanoa' hosted by the University of the South Pacific in November 2012. It now appears there is sufficient critical mass generated to ensure a sustained programme of both action and research will ensue and it is suggested critical learning of collaboration and partnership as well as measures for assessing the sustainability of such a programme can be gleaned from other Oceanic Participatory Learning and Action experiences, in particular the Fiji Local Marine Management Area programme.

ii. Acknowledgements

An enormous number of people assisted in the production of this thesis and the related research supporting it, far too many to name or acknowledge adequately here. You all know who you are; vinaka vakalevu. Any *mana* that associates with this work belongs rightfully to you collectively; all errors and mistakes are mine alone. In particular I need to thank my many friends and colleagues from Solodamu, Na Korova, Fiji Islands Voyaging Society, and the University of the South Pacific; my supervisors and mentors John Overton, Teresia Teaiwa, Joeli Veitayaki, and Peter Horsley. The Sailing for Sustainability gang and our ever growing number of friends and partners across Oceania and internationally have been rock solid throughout.

I could never have done any of this without the love and continuous support of my fine sons and crew, Sammy, Jack and Spike. My absolute sea-anchor at all times has been my skipper and partner Alison Newell. Despite the name on the title, this is hers as much as it is mine.

In 1998 I dedicated my Master's Thesis to four young sons of Oceania; the eco-warriors of tomorrow. Catalytic to casting off on this PhD journey of discovery were three true friends and mentors who have shaped my personal life and my academic career; each of whom encouraged my deep passion for sailing and for *drua*; each were visionary warriors of knowledge and standard bearers of their age. They are giants amongst men. All three passed in the opening stages of this journey. This thesis is dedicated to the inspiration of Alifereti Bogiva, Epeli Hau'ofa, and James Ernest Ritchie. May my tears soften your passing and wash your memory afresh. Loloma.

iii. Acronyms and Abbreviations

ADB	Asian Development Bank
AusAID	Australian Agency for International Development
BAU	Business as Usual
CCIP	Climate Change Implementation Plan
dwt	deadweight ton
EU	European Union
FDB	Fiji Development Bank
FIVS	Fiji Islands Voyaging Society
FLMMA	Fiji Local Marine Management Area network
FNU	Fiji National University, School of Maritime Studies
FPRTS	Forum Principles on Regional Transport Services
GHG	Greenhouse Gases
GNI	Gross National Income
GSS	Government Shipping Service
Gt	Giga-tonnes
GT	Gross Tonnage
HFO	Heavy Fuel Oil
ICCT	International Council on Clean Transportation
IMO	International Maritime Organisation
IPR	Intellectual Property Right
IRR	Investment Rate of Return
ICS	International Chamber of Shipping
LMMA	Local Marine Management Area
LOA	Length Over All

MDG	Millennium Development Goals
MDO	Marine Diesel Oil
MFAT	New Zealand Ministry of Foreign Affairs and Trade
mmt	million metric tonnes
MPA	Marine Protected Area
MSAF	Maritime Safety Authority of Fiji (previously Fiji Islands Maritime Safety Authority – FIMSA)
MV	Motor Vessel
nm	nautical mile
OCACPS	Oceanic Centre for Arts, Culture and Pacific Studies, USP
ODA	Official Development Assistance
PCCP	Pacific Climate Change Program
PFL	Pacific Forum Line
PIC	Pacific Island Countries
PICT	Pacific Island Countries and Territories
PM	Prime Minister
PLA	Participatory Learning and Action
PRA	Participatory Rural Appraisal
PV	Photo voltaic technology
PVF	Pacific Voyagers Foundation
Ro-Ro	Roll-on, Roll-off ferries
RRA	Rapid Rural Appraisal
S4S	Sailing For Sustainability (NZ).
SIS	Small Island States
SIDS	Small Island Developing States
SPC	Secretariat of the Pacific Community

SPREP	Secretariat of the Pacific Regional Environment Programme
SSL	Samoa Shipping Line
SSTT 2012	Sustainable Sea-Transport Talanoa 2012, USP, Suva.
STI	Sustainable Transport Initiative
SV	Sailing Vessel
SVV	Sustainable Village Vessel
TEU	Twenty-foot Container Equivalent
TK	Traditional Knowledge
UCL	University College London
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USP	University of the South Pacific
VUW	Victoria University of Wellington
WWF-SPP	Worldwide Fund for Nature - South Pacific Programme

iv. Glossary of Fijian Terms

bati	teeth; edge; a social group which traditionally was the land border defender to another group to which it owed special allegiance
bosenikoro	village council
bure	traditional Fijian house/meeting house
camakau	outrigger sailing vessels; outrigger version of drua
dalo	*Colocasia esculenta;* taro; a staple starchy Fijian root crop
dina	right; true
drua	Fijian double hulled sailing vessel
kai	prefix denoting the place that people come "from"; e.g. kai Kadavu are people from Kadavu
kailoma	of mixed Fijian/European parentage
kaivalagi	visitor/tourist/European
kaivanua	person of the land
kaiwai	person of the sea; sailor
kerekere	request
koro	village
laca	sail
lotu	church; religion
magimagi	sinnet rope made from coconut husk fibre
mai	come
mana	power; power to effect
masi	tapa, bark cloth made from the paper mulberry plant
mataisau	craftsman; builder; shipwright clan
mataitoga	Tongan shipwright; carpenter

matanivanua	spokesperson
mataqali	an agnatically-related social unit; a primary division of the village; clan
qase	elder; old person
qoliqoli	communally owned fishing ground
saucoko	construction style of drua and camakau using a single large hollowed log as the hull basal component
solevu	kinship-related gathering and ritualised exchanges. Major solevu involved large parties on fleets of vessels carrying enormous quantities of goods
soli	contribution
tabetebete	construction style of drua and camakau where multiple planks are sewn to a scarfed keel
tabu	taboo; sacred; prohibition
tanoa	a large round wooden bowl for mixing *yagona*
taukei	indigenous person
tikina	district; administrative sub-unit of a Province
turanganikoro	administrative head of a village; village spokesperson
vanua	land, people and way of life; largest founding social unit
voivoi	*Pandanus thurstoni*, used for mat and sail making
waqa	boat, ship, vessel
yagona	kava (*Piper methysticum*); ceremonial drink in Fiji
yavusa	second largest social unit

v. Glossary of Terminology

bunker	*n.* The propulsion fuel loaded onto a ship, vessel, or aircraft; fuel used for transportation. *v.* to load propulsion fuel onto a craft.
Central Oceania	After Hau`ofa (2008:77). Includes: Nauru, Kiribati, Tuvalu, Tonga, Fiji, Samoa, Rotuma, Futuna, Uvea, Tokelau, and Niue.
Cultural knowledge	All forms of culturally held understanding, including oral history and story.
Drua catchment	The geographical spread in which *drua*, *kalia*, and *'alia* vessels operated; including Tonga, Fiji, Samoa, Rotuma, Futuna, Uvea, and New Caledonia.
Lemaki	Samoan specialist craftsman brought to the Lau by Tongans in the late eighteenth century; hereditary descendants of Lemaki
Oceania	The largest ocean and all it contains; (re-)created by Epeli Hau`ofa in response to the ill-conceived rebranding by successive waves of European re-namers over the past ½ millennia. Other names include Te Moananui o Kiva/Kiwa, Pacific, etc. Hau'ofa further divided into Eastern, Central, Western, and Northern Oceania.

Chapter 1. Overview

> *In the Pacific, the next few decades will see climate change of unprecedented rapidity taking place ... Our understanding of what is likely to happen in the future allows humanity an excellent opportunity to plan ahead, to anticipate the probable changes and to take action to minimise their undesirable effects* (Nunn, 2010b).

> *The maritime history of the Pacific peoples is recognised as part of the shaping of Pacific societies but is also a basis for comparison in making changes for the future. Not least is the possibility of a renaissance of commercial sail under changing economic relationships between distance, rising cost of fuel, environmental concerns, and the always available Pacific wind systems for assistance in ship propulsion* (Couper, 2009:208).

1.1. Statement of Intent: Toward *Verstehen* (Illumination/Understanding)

This thesis records the result of a four year inquiry[1], specifically an interrogation and evaluation, of the potential that sail technology offers as a sustainable adaptation tool in face of challenges posed to the communities of Oceania. It concludes that such adaptation will assist communities at local, national, and regional level build resilience. The adaptation is available, or at least emergent, but unrealised and the primary barriers are perceptual.

Sails are to Oceania as wheels are to continents. The capability to colonise one-third of the globe under sail and without metal is arguably the greatest technological intellectual property right of Oceanic peoples. Historic maritime analyses (e.g. Couper, 2009; D'Arcy, 2006, 2008; Finney, 1994, 2003; Howe et al, 2006; Irwin, 1992) concur on a common picture at the time of European contact of an ocean heavily populated with indigenous sailing vessels of size and capacity comparable with or greater than that of the arriving Europeans. Such technology was highly developed and functional, diverse in type, readily available and an essential facet to all aspects of life – from artisanal fishing and local village transport to inter-island/inter-archipelago warfare, trade, and diplomacy. All was indigenously designed, built, owned, operated, and island-centred.

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[1] Inquiry, evaluand, evaluation, foci, verstehen are used here in the context of Naturalistic Inquiry (after Lincoln and Guba, 1985) and discussed further in Section 3.3. A 'geographical interrogation' (after Lewis, 2009) of the focus would be an alternative descriptive.

Yet, within decades this supremacy was displaced with first, European sailing technology and ultimately by carbon-fuelled, mechanically-propelled vessels. In Fiji, the field research base for this inquiry, only isolated examples of sail remain either in a recreational, tourism-related capacity or small, remnant pockets of indigenous and displaced native sailing knowledge.

Sea-transport in Oceania is far broader than just movement of goods and people from one location to another. It is central to Oceanic culture and epistemology. This thesis contends that there is a strong case for investigating and prioritising a revitalisation of sail technology and sailing culture as an industrial sea-transport solution to (re)building resilience in the face of climate change and fossil-fuel dependence/supply issues in Oceania. The reality of any sail-powered future use needs to be carefully considered. Industrial, small-scale sea-transport ventures in this part of the world are, at best, only marginally profitable and always high-risk, regardless of the technology employed.

There has been considerable examination by historians, ethnographers, sociologists, and anthropologists of the past role of both the pure-sail technology and the trade/social interaction it facilitated in the history and development of the region (e.g. Couper, 2009; D'Arcy, 2006; Hage and Harary, 1996; Kirch, 2002; Sahlins, 1962, Thompson, 1940; Tippet, 1968). To date no study has sought to assess what role it might play now in enabling Oceanic island and coastal communities toward more 'sustainable' futures. This thesis is offered as my *sevusevu* to the *talanoa* on sustainable futures for Oceania to begin to fill that gap. The findings are neither comprehensive nor complete; such a claim will require significantly more work across several disciplines. But they are sufficient to provide *verstehen* or illuminated knowledge of the subject, provide a sound basis for continued inquiry and are sufficient to justify further prioritised attention.

This inquiry focus began at the micro level, a single, coastal island village in Fiji where no-one owns a wheeled vehicle and whose life is dominated by the sea (Sections 1.3.1 and 4.1). It arrives at its current juncture with multiple foci from village to globe, temporally spread across past millennia and looking toward a future horizon. It finds that issues of sea-transport remain universal and primary, a basic human need of Oceanic peoples today and tomorrow as throughout all human interaction with this Ocean, the largest natural feature in the world. Oceania's sea-transport scenario is unique, a region of remote and minute transport nodes of minimal economic significance spread over some of the longest communications lines in the world. The regional scenario is summarised in Section 4.2, narrowing back to a Fijian centre.

Current transport, especially domestic, is increasingly unsustainable and owes nothing to the Pacific's rich indigenous, historic, and arguably sustainable legacy of vessel/sail technology development. It is also almost exclusively fossil-fuel powered, largely owned in urban and external centres outside of the village/outer-island margins. Reliance on such technologies makes Oceanian communities (at village, province, and country levels) extremely vulnerable to changes in transport availability and fluctuations in fuel price and security.

There is little evidence that global initiatives will supply alternatives to current sea-transport options, and this holds true especially for Oceania. Few reports mention any future potential for sail technology, do so only briefly, and most are sceptical of its viability (see Section 4.3). There is a modern revolution in shipping technology emerging globally, albeit at low scale and impact, as sufficient popular consciousness rises of both the global merchant navy's contribution to GHG emissions and the industry's reluctance to take meaningful steps to mitigate the same. A range of potential alternative-propulsion technologies is becoming available to reduce or replace the current monopoly of fossil-fuel powered options. While there are grounds for confidence that this trend will increase, it will not necessarily do so with a focus and understanding of the unique sea-transport issues pertaining to Oceania. They will need guidance and amplification if they are to be applied in a timely and beneficial manner here. The global scenario and the related emerging technology is summarised in Section 4.3.

A Fiji-centred focal point has been taken for this study, although cognisant of its Oceanic and global setting. Historically, Fiji was an integral part of an extensive and complex political and trade network encompassing most of central Oceania[2], facilitated at the contact era by large fleets of Fijian-sourced sailing vessels. The inquiry began with the assumption that Fiji was the most logical Pacific starting point for initiating a technological revolution and remains firmly of that view at the end of this phase of research as discussed in Section 5.4. The resultant *verstehen* provided by this research should prove of benefit to more Oceanic communities and situations than the narrow range considered here. Given the universality of sea–transport to Oceanic communities, while acknowledging the wide diversity of Oceanic cultures and operating environments, it has relevance across the region, and many of the lessons for Fijian communities will be of interest to other Pacific locales.

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[2] Central Oceania is used in this thesis in the sense used by Hau`ofa (2008:77) and discussed further in Section 2.1.

This thesis focuses primarily on the example of sail or wind-powered technology, although other potentially valid alternatives are also possible and emergent (Section 4.3.3). It suggests that industrial application of sails and sail technology offers strong promise as an accessible, cost-effective, low-carbon, renewable, low-impact technology as rooted (anchored) in the Pacific as kava and coconuts. Re-association, if it can be proved attainable and sustainable, would be a practical Oceanic response to issues of climate change adaptation and the region's extreme dependence on imported fossil-fuel, as well as a much deeper reclamation/re-invigoration of a central iconic pillar of Oceanic identity and culture.

There are numerous challenges apparent to further investigation and practical trialling of sail in order to fully prove its validity. These are complex and previously poorly characterized or understood. Several are illuminated in this thesis (see in particular Chapter 5). They range from the practical (what technology, what ownership and management models, what policy frameworks, etc.) to the perceptual (bigger and faster motors are seen as a step toward 'development' while sails are seen as part of a quaint past, a step back not forward).

Not least of the challenges is the minimal visibility the issue has at all levels. All findings reached in this inquiry are tentative, as expected under a Naturalistic Inquiry process[3], but it is suggested that the global preference for a terrestrial-based, or continental-centred, epistemology is a causal reason. Sea-transport underpins all global security issues and is central to all global economies, industries, commerce, and trade. Shipping is the handmaiden of consumerism. It is the absolute lifeline of the Pacific region. Yet, as global debate on climate change intensifies, sea-transport rates a lesser priority and mention in policy than other matters. For example, IPCC reports on transport give greater attention to two-wheeled vehicles than shipping (Ribeiro, 2007). This is discussed in greater detail in Section 4.3.

In this thesis the discussion on future sea-transport options is couched within the context of climate change adaption (see in particular Section 2.2), not because it is the only pressing threat to Oceania's communities but because the size and immediacy of the problem out-shadows all others. But I advocate for the introduction of alternative-energy propelled shipping regardless of climate change, provided it proves cost-effective, and hence describe it as a "no regret" or "soft technology" adaption response.

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[3] See Section 3.3.

Globally, in the context of climate change, sea-transport issues are considered under the heading of "mitigation" and this categorisation overflows into an Oceanic setting, masking and skewing the real nature of the problem and severely limiting the ability to tackle the issues and seek realistic solutions. The association with mitigation has resulted in the paradox where Oceanic states are likely to pay greatly increased costs for sea-transport due to global mitigation regulations in the immediate future, while a failure regionally to correctly recognise it as an adaptation priority restricts access to climate financing to resource the necessary technological revolution. Prosecution of global-scale mitigation measures currently in train under IMO leadership are likely to lead only to increased costs and barriers for Oceania, whose contribution to the global issue is so minute as to be irrelevant, resulting in a double penalty for no visible benefit (see Section 4.3).

This thesis finds that alternative-energy vessels could potentially be a major fuel and cost-saving adaptation, whilst simultaneously providing additional benefits measured across a range of well-beings, for minimal research investment. If the subject is poorly recognised globally, in Oceania the issue is almost completely invisible. It is notable by its absence in any policy framework at any level (see Section 4.2). It certainly receives none of the attention currently focussed by donors and development agencies on other adaptation measures, including widespread renewable energy programmes (Section 2.2), particularly electricity generation projects. As the example of Tokelau shows, this can save only a fraction of the energy cost of sea-transport and does so at questionable economic benefit (Section 5.3). Continuing to ignore the position of transport generally, and sea-transport in particular, in regional energy budgets, plans, programmes and policy frameworks risks other interventions as being righty criticised for "playing around the edges" (Mayhew, 2011b).

There are numerous lessons available through interrogation of past case examples, knowledge, and learnings. The case for employing such an approach is set out in Section 2.1. Lessons are sought in both indigenous past, through examination of Central Oceania's *drua* culture[4] (Chapter 6), and in the experiences arising from previous alternative sea-transport experiments, in particular those resulting from the 1970's oil crisis (Chapter 5).

It was wrongly assumed at the outset of the research process that *drua* culture had been previously comprehensively explored and established in the literature. The research took a

[4] See Section 6.1 for a more detailed description of the meaning of this phrase as used throughout this thesis.

lengthy tangent in its middle phases as I sought to bring together the scattered record and to understand the tensions within the written accounts (Sections 6.2 and 6.3). This culminated in my participation in a process to search out the unwritten culturally held record (Section 6.4). As *drua* type vessels and their related associations have been heavily overshadowed within the region by Eastern Polynesian voyaging culture (e.g. see Goetzfridt, 1992 and discussion in Chapter 6), I considered the findings important enough to devote a large section of their own as a *sevusevu* to the *mataisau*, *mataitoga* and Lemaki; the descendants of the builders of arguably one of the finest bluewater sailing vessels of the pure-sail era.

For sea-transport options to change a shift in paradigm is required; it will need more than just an exchange of vehicle type or technology. It means adopting a new (or evolved) kind of transport scenario and that means overcoming a perceptual barrier that sail belongs to the past and bigger motors belong to a better, more 'developed' future. The iconic nature of *drua* and its place in Fiji, as with all such vessels to seafaring cultures in Oceania, offers an entry point to changing perception. I consider it to be one of the largest single factors likely to affect popular consciousness on the subject of sustainable shipping in Fiji. Consequently considerable energy and space has been devoted to this aspect of the inquiry. Retaining and re-invigorating this heritage is an essential priority for today's *mataisau* and strong support for the research approach was provided at the time by OCACPS and USP academics.

This thesis attempts to collate as broad an evidential base to support such a cultural reinvigoration/association as possible. My colleagues and I found at the end of this phase of research that knowledge, technology, and heritage of *drua* are still living, albeit in a highly fragile and vulnerable state. Our research results signal the need for a new journey of historical, cultural, and archaeological rediscovery for Fiji and central Oceania if this status is to change positively and this thesis contributes to setting a platform for that.

In prosecuting this inquiry, an Action Research approach has been adopted from the outset. The approach taken to methodology is set out in Chapter 3. By starting from a Naturalistic Inquiry focus-based approach, I have not set out to solve a question nor sought to provide exhaustive or conclusive findings. In keeping with Naturalistic Inquiry precepts it has generated more questions than it provides answers to. The research has also taken a number of turns in direction and focus, an expected, even desired, outcome of a reiterative analytic process. The resultant thesis is not seamless. I prefer to think of it as a collage of understandings and supporting information.

A case study approach has been taken to reporting, again consistent with a Naturalistic Inquiry framework. *Talanoa* (see Section 3.5), and literature and internet searches (Section 3.7) have been employed as the primary data acquisition and investigative tools. In the course of the research I have attempted to immerse myself as much as possible in both the subject and the location, sailing to Fiji for at least six months of each of the last four years. In that time I have embedded myself (and my family) in three distinct Fiji communities (to the extent it is possible for a *kaivalagi* to gain temporary entry to such) described in Section 1.3; the *koro* of Solodamu in Kadavu; the re-located Moce community of Na Korova, a squatter camp on the edge of Suva; and also in the family of the Fiji Islands Voyaging Society and the crew of *Uto ni Yalo,* Fiji's first voyaging 'canoe' in the modern age. Each relationship was facilitated entirely serendipitously. I have taken the position throughout of an active participant/observer and my intervention has resulted in some small ways to the connecting of the fates of all three communities (and of course with that of my own family).

I have also situated myself throughout this research process within the technology being explored and advocated for, using alternative energy and low-carbon technologies exclusively for home and office, and sail-power for the vast majority of my transport across more than 15,000nm[5] of ocean over four years. My eight-year old son has calculated our carbon footprint to be less than one litre of fuel used (transport, electricity, cooking, and heating) per day for a family of four-six people or less than 2% of the New Zealand household average over the lifetime of this research[6]. With the exception of one season I have not used terrestrial private transport and in that instance I bought a small car to travel from Northland to Wellington and back to attend university. That single trip used more fossil-fuel than my family consumed in the rest of the entire year. While employment of these measures has required a total rethink of my and my family's lifestyle and priorities, we have not suffered any reduction in 'wellness' (a term I greatly preference to 'sustainability'). Almost all the technology we employ is old, proven, readily available, and not overly difficult to acquire or master. It is definitely available to Oceanic communities.

While our low-carbon and low-consumption choices are personal ones, I firmly believe that the evidence of the increasing costs of global GHG emissions is now overwhelming and that unless the global community, and those of us from the developed world in particular, do not

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5 Nautical miles (nm) are used throughout for measurement of distances at sea.

6 Newell, J., 2012, unpublished.

immediately change our current behaviours and consumptive patterns drastically, all our children's' futures are grim indeed. The priority afforded this matter by world leaders, especially in the 'developed' and continental world is pathetic and inexcusable. The inspiration is from Gandhi – *to lead by example is not an option; it is the only option.*

And so I come to a tension in the presentation of this thesis. While I understand my academic responsibility is to demonstrate that defendable processes have been employed to provide a contribution of originality of thought to the greater debate, I also consider I have an equal responsibility to provide research findings of practical or demonstrable application back to Oceania, especially given the immediacy and urgency of the situation. That the "Pacific Way"[7] revolves on reciprocity is one of the prominent learnings I have gained in my Oceanic voyaging to date. To attempt to honour that I have used this thesis as a chart to leave as many soundings of the reefs I have encountered for the benefit of any wayfinder that follows.

If alternatives such as those discussed are to be introduced, then this needs to be assessed against the benefit it contributes. Determining sustainability requires a far-wider assessment than just considering vessel technology and application. Critical understanding of social and cultural interfaces of sea-transport and its multiple stakeholders is essential. Such understanding must start with acknowledgement that the context for these communities is Oceanic not continental. And so the inquiry commences by situating it in current writings on Oceanic epistemology (Section 2.1) and the issues considered within this inquiry are viewed through the lens of ocean throughout.

The inquiry was initially focussed on the potential for micro-scale, sail-powered, multi-hulled vessels based in coastal villages in Fijian waters. Over the course of the inquiry the focus expanded in several directions; spatially to examining shipping at a national, regional, and global level; temporally to look at heritage and lessons for sea-transport in Fiji's past and toward the horizon to ask what options might be offered in the near future. No conclusion is reached as to at what level alternative energy vessels should be centred; there are issues and roles to consider for all of them. The conclusion is drawn that issues of policy, ownership, and management, not the technology itself, are the central ones to now grapple with. It is essential to recognise that the industrial application needs to occur within a wider setting than just an economic or commercial sphere; especially in Oceania where traditional culture and

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[7] See Crocombe (1976) and Mara (1997) for further discussion on this description.

society continue to play essential roles.

The canvas presented in this thesis is a broad one. At several stages in the research process I was encouraged by supervisors and mentors to narrow the focus to a single aspect of the inquiry. Such advice is sage and several times I was sorely tempted. The research into the great Fijian *drua* or *waqa tabu* culture is a prime example. Personally I would have been more than happy to have concentrated all my efforts on this one subject; there is certainly enough scope in this field alone for several dissertations and the subject is a fascinating and absorbing one for any true 'salt' or '*kaiwai*'. Ultimately I determined that the paucity of information or even starting points for debate across the breadth of the inquiry combined with the lack of focus on the broad issue in the current development industry left me as researcher with a responsibility to provide as wide an ambit as possible. In taking this approach, I acknowledge the potential for critical areas not being covered in the detail they deserve.

There are a number of aspects of inquiry that have not broached here. Three key omissions are especially worthy of note. While I consider that the review of the heritage record of *drua* culture provides an adequate coverage of the vessels and their operation, the related literature on the trading networks and culture/social interactions that these vessels supported and facilitated is not analyzed here in as great a detail. Fortunately, this aspect has been well-addressed by other commentators, in particular Laura Thompson (1938, 1940) who characterized the islands of southern Lau as a naturally balanced self-sufficient trade area (see also Hage and Harary, 1996; Reid, 1977; Sahlins, 1962; Tippet, 1968).

A second omission is any consideration of, and comparison with, local initiatives in sail powered sea-transport in other oceans of the world. The scuttlebutt amongst the international cruising fraternity is that there are pockets of local sailing renaissance occurring in Indonesia, Africa, and the Persian Gulf that would be well-worth interrogation and evaluation for applicable lessons for an Oceania context.

Thirdly, sufficient emphasis has not been placed on quantitative analysis of both costs and benefits at micro and macro-economic levels, nor have the economics of any alternative technologies been fully considered here. This is an emergent field in most alternative energy areas, in particular the use of alternative technologies for electricity generation[8]. As the

[8] See for example Syngellakis, K (2011) Renewable Energy Options for the Pacific, PPT presented at the Climate Parliament: Climate Change and Energy Access for All, 1-3 October, Lautoka for a broad discussion

Tokelau renewable energy project (Section 5.3.3) demonstrates, it is easy to portray any introduction of renewable energy for Small Island States as a benefit and a priority. But agencies leading these initiatives have a responsibility to make widely available both accurate information on such attempts, and to robustly demonstrate their overall viability.

In its narrowest interpretation, this inquiry has remained primarily an industrial one, although it strays across disciplinary boundaries in doing so. The more closely a lens is held to the focus of this inquiry, the more facets of the subject are exposed as requiring further scrutiny and assessment. It is entirely unrealistic to expect all of these to be covered in a single study. It does underscore the need for the subject to be considered from a multi-disciplinary (or trans-disciplinary) platform. As D'Arcy (2006) has already argued, historically seafaring in this ocean is about more than technology and seafaring skills and must be viewed in its wider social context. The inquiry must be situated within a field of knowledge broader than assessment of vessel and technology type and technical operation. Such an approach to research has previously been summarized by Wesley-Smith (1995:128). "Interdisciplinary work is distinguished first, and most obviously, by defining its objects of inquiry without reference to established disciplinary boundaries. It acknowledges that societies do not fall neatly into segments or compartments with labels coinciding with the names of university departments. It sees the connections between political, cultural, economic, social, linguistic, or spiritual phenomena, rather than emphasizing their separateness".

My view has firmed throughout my research that a village (embayment/island) which controls its own sea-transport is a village with options and opportunity - its capacity to be the master (mistress) of its own decision-making/governance/option selection enhanced, although at what resource or opportunity cost we don't yet know. Conversely, a village that is reliant on externally-controlled sea-transport is truly captive; dependent on decisions outside the immediate watershed. Alternative energy technologies offer an opportunity to allow such local control to be regained, and, this thesis argues, increase social and cultural resilience.

At the village level, as typified in the Solodamu case study, and at the national or regional, the barriers to successful introduction of such technology are as much (or more) politically, culturally and socially rooted as technological. And the technology cannot be considered in

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on the current lack of and need for comprehensive cost benefit analysis on all aspects of renewable energy interventions across the Pacific.
http://www.climateparl.net/cpcontent/pdfs/KSyngellakis%20RE%20Options.pdf accessed 20/11/2012

isolation to the economic or operational issues. Re-invigoration of a sailing culture in a country such as Fiji requires an understanding of the role such technology played in the past – where it was prominent not only as a means of transport, a facilitator of trade but as the subject of exchange itself. If these learnings are correct then all these aspects now require contribution from, amongst others, economics, geography, sociology, political science, development studies, engineering, business management, history, and anthropology.

The concluding Chapter 7 begins an open-ended discussion on how best to now move this agenda forward. I am confident it will move forward, although how and by whom is unclear. The process of conducting this inquiry itself has raised an interesting discourse and has been responsible for initiating an ongoing process for continued inquiry. Given the large scale (by Oceanic standards) and immediacy of the problem, the emergent nature of the technology and related knowledge, the small critical mass of the Oceanic communities and the convoluted nature of the myriad agencies and organisations potentially involved, I suggest a collaborative approach between stakeholders is desirable, albeit difficult. Important lessons can be learnt by evaluating and learning from past endeavours in other fields. The action research approach employed throughout this inquiry culminated in catalyzing a number of key stakeholders to collaboratively organise a three-day *talanoa* at USP in November 2012. This brought together presenters and participants from across the globe and the breadth of the subject broached in this thesis. The *talanoa* confirmed, congealed, and advanced the *verstehen* I had set out to achieve. It provided an appropriate port of safe haven to mark the end of this particular stage of the inquiry.

1.2. The Research Process

This section introduces the initial focal point of the inquiry, a chance meeting in a rural, coastal, Fiji island village. The four reiterations of focus that have marked the waypoints on the research voyage are outlined. The following section 1.3 introduces and discusses three critical relationships formed with differing Fiji communities that have influenced the progression of the inquiry.

1.2.1. Port of Departure – Solodamu 2008-2010

I am a New Zealander who lives by choice at sea on the Pacific Ocean. In 2006, while sailing in Fijian waters with my family on our wind-powered home, I responded to the *kerekere* of an

old friend, the late Alifereti Bogiva, to transport him and his family to his wife's ancestral village Solodamu, on the island of Kadavu, and participate in a *talanoa* he was facilitating on governance and sustainability planning for the *koro*. The consequential events of making a serendipitous decision to accept the village's invitation to participate are described in Section 4.1. Although not the original focus of that *talanoa* sea-transport was identified as a critical limiting factor and a potential option for both reducing future village expenditure and dependency while simultaneously offering sustainable income generation and employment.

Between 2008 and 2010 we returned periodically with Bogiva and with various family and sailing friends on a variety of wind-powered vessels to examine this issue further. The starting assumption was a simple one. With our sail-powered vessels we are capable of roaming this ocean and its islands at will and modest cost and with a minimal carbon footprint. As sailors we have collectively learnt the basic skills necessary to build, maintain, and operate small but robust and sea-worthy craft. Could this knowledge be transferred to the village sufficiently to enable it to operate sail-powered transport options that provided real benefits to the village, measurable across a range of well-beings?

We conducted rudimentary but sufficient research into the operating market to determine that the technology to construct or obtain a suitable vessel was available and that if sufficient expertise and capacity could be achieved, a small-scale transport enterprise could be operated economically. The procurement cost, although a large investment for a village, was not excessive. The capacity level of the village to undertake such a venture was minimal. We proceeded to assist the village to develop a basic business case, and then a detailed business plan. But the further we progressed, the more apparent it became that although such an option presents as logical, feasible, and practical in an economic sense seen through external lenses, there were innumerable challenges and barriers to its successful implementation.

By 2010 it was apparent that an isolated single-village, single-vessel intervention was impractical at that time for a range of reasons, which are explored in more detail in Section 4.1. While technologically and economically achievable, there were a number of 'game-breakers', critical issues that could not be resolved satisfactory - such as the impossibility of getting commercial insurance for a village-operated asset. The skill bases needed to be built for all facets of such an operation would require significant external intervention, certainly beyond the scope of a small team of part-time volunteers. It was also becoming increasingly apparent that the political and social structure of the village could be adversely impacted by

the scale and stress of the project, an effect that could negate any positive benefits. However, I remained convinced of both the centrality of sea-transport in the village context to almost all facets of daily life and increasingly aware of the limitations, burden, and unsustainability of current options available to the village.

During this period I had also begun to look around for other examples and then any literature at all in this field. It was surprisingly sparse. Globally and regionally there is an enormous increase in research, development, and delivery of alternative energy technologies, for electricity generation in particular. Despite the extreme degree of dependence of Pacific peoples on fossil-fuel generally and fossil-fuel powered sea-transport in particular; and despite the central place of sail-powered vessels in Fijian and wider Oceanic history, the issue is virtually invisible in any discussion on sustainable development or adaptation, whether at policy, agency, industry or academic level.

I remained convinced that my initial assumptions (that alternative propulsion technologies, wind-power in particular, potentially offer options to future Oceania communities that are available, accessible, affordable, adaptable, and appropriate) needed to be examined more closely and rigorously. If these assumptions were found to be valid, then this needed to be examined to tease out what barriers exist to further consideration of the options and what opportunities this might make available. Such an inquiry became the focus of my research proposal for PhD candidature.

1.2.2. Following the Seasons: Four Phases of Reiterative Reflection

The methodical approach, including Naturalistic Inquiry, is discussed in Chapter 3. A *priori* of that method is that it is emergent and employs reiterative analyses of accumulating data, with the lines of inquiry being refocused accordingly each time. In essence the inquiry covered four phases, each following the two traditional Oceanic seasons of relatively predictable trade winds interspersed with *boliwaqa* (passing low pressure systems with revolving winds) and the more violent 'cyclone season' or what Tom Davis (1999:64) called "the season of calms and storms". As I was using a bluewater vessel as a research platform, it needed to be moved out of the cyclone belt for insurance purposes during the season. And so a pattern of broad data collection (the 'thick descriptive' of Naturalistic Inquiry – Guba and Lincoln, 1985) in Fiji waters over the winter alternating with campus and boatyard reflection and assessment (of both data and ship) in NZ during our summer.

The first season was spent considering the lessons learnt from the Solodamu 'experiment' to date. Focus was strictly on the village level, on its political issues in a period of some transition and stress; on energy budgets measured in 1, 20 and 200 litre 'drums' and daily household incomes of $0-$20; on micro-technology (catamarans of 4-10dwt) and routes of less than 60nm. Culturally the focus was *kai Kadavu* and then *kai Viti.* Suva was a long trip away for villagers, Oceania was known largely through sport (particularly rugby) and church connections, and the world was literally a world away[9]. At the village level, issues of policy concerning sea-transport are vague and entirely practically orientated. There is cognisance of survey and licensing regulations concerning capacities, loadings, safety equipment, qualifications and licensing which have recently been the subject of government attention but are still very much considered as guidelines at best in Kadavu. Regional policy frameworks, international carbon reduction regulations, and the like are vague, vacuous, external abstractions in the village lexicon.

Although the greatest need for affordable and sustainable sea-transport is obviously at village and domestic level, and this increases the more remote the village/island is from the centre, there were too many 'game-breakers' outside of the village's decision-making and control to overcome. As the season ended in 2009 I had formed a relationship with the Fiji Islands Voyaging Society (Section 1.3.3) to *kerekere* for crew placements for some of the Solodamu youth to give them experience and sea-time on *Uto ni Yalo*. This led to the start of a reiterative *talanoa* on the potential for continuing to investigate the same technology but considering both ownership and management frameworks at a higher, even national level. This shift meant a need to widen the research to include understanding of Fiji's sea-transport context, including its history and current approaches to policy and service delivery of shipping. Again, the supporting literature proved thin (e.g. Bayliss-Smith et. al., 1988; Couper 1968, 1973, 2009; D'Arcy 2006, 2008) and additional data difficult to access.

The focus of inquiry had shifted. The potential for the same village objective to be served remained but now I was looking at the delivery mechanism being via a centrally-managed, cooperatively-owned fleet rather than an individual 'single vessel/single village' model. Most of the same issues that had been identified at village level remained albeit at an expanded scale. This phase is considered further in Section 5.4. Research moved from the

[9] I recognise these are broad generalisations, for example every Solodamu household has family members spread across the globe.

village micro to the sub-national/national meso that in turn required increasing cognisance of the regional and global macros. At the same time I began to collect information and lessons from previous experiments in alternative propulsion technologies, initially small-scale Pacific based sailing vessels and ultimately much broader.

In the third season, the focus again changed and splintered. Interest in the national level scenario continued, but with a focus on identifying the precursors for a sail vessel heritage revitalisation. A paper had been presented (Nuttall, 2012) by this time at the 2010 USP conference '"Future Challenges, Ancient Solutions" which set out the initial case in favour of both a sail technology investment for the region and a Fiji-led approach. The inquiry changed course and set off into the past to learn more of *drua*, egged on initially in a very Pacific, deferential manner by our friends at Korova (see Section 1.3.2) and, as the research gained momentum, friends, and colleagues at USP, OCACPS, FIVS, and elsewhere. Simultaneously I sought to place the broader research learnings into a regional and global context and to begin a study of the global shipping scenario. The search for solutions veered from a technological and practically-situated course to more theoretical and policy headings. The 2011 research season culminated in the field research trip to the Southern Lau and the *talanoa* of *mataisau* held in Suva on 30 November (Section 6.4).

In the final season, the inquiry has come back to a regional and forward-looking focus, this time considering matters of policy, both framework and implementation and direction. I have also sought to cement this sea-transport agenda within its climate change adaptation setting. The learnings to date are summarised in the comparison of two case examples; Rotuma and Tokelau in Section 5.3. As the *verstehen* began to coagulate, I started to consider the issues to be fronted as technology options continue to emerge. What relationships amongst key stakeholders will be needed if emergent opportunities are to be seized and maximized? What lessons can be deduced and adapted from other Oceanian models in other fields? A participatory action research approach has been maintained throughout, with research results and findings regularly reported throughout the growing network of stakeholders and participants. The USP-hosted international *talanoa* on sustainable sea-transport (summarized in Section 7.1) marked the end of the final season's research.

1.3. Presenting Sevusevu: A Tale of Three Communities and Reciprocity

Ravuvu (1983:120) defines *sevusevu* as "a ceremonial offering of *yagona* by the host to the

guest, or the guest to his host and done in respect of recognition and acceptance of one another". It is an essential exchange that starts and permeates all ceremonial and social behaviour, and underpins Fijian concepts of respect, *mana*, reciprocity, and social cohesion. It has correlates in all Oceanic cultures (Lebot, et al, 1992). *Sevusevu* marks the beginning and nature of a relationship (Katz, 1999; Ravuvu, 1987; Tomlinson, 2002, 2004). It has been used throughout the field research for this thesis as the starting place for building relationships and establishing trust with participants.

Sevusevu is generally associated with *yagona* (kava; *Piper methysticum)*, presentation, and sharing of which is integral to Fijian culture and identity (Katz, 1999; Toren, 1989) reflecting both spiritual and human hierarchical structures (Katz, 1999; Tomlinson, 2002), cultural unity, and reciprocity (Ravuvu, 1976, 1987). *Yaqona* is also called *wai ni vanua* (water of the land) and deemed by many Fijians to be an ingestible manifestation of their *vanua*, a drinkable representation of the people, the land, culture and cultural practice (Tomlinson, 2002, 2004).

This section acknowledges three communities with whom this research has been bound, who have been intimate research partners and, over the course of the research, have shared and fuelled my passion, processes, and outcomes. To a large extent the relationship forged with each has been the genus for the various foci of this thesis: Solodamu led to inquiry of what options exist for sustainable village sea-transport; Korova led to *drua* and its related culture; and FIVS brought a group of passionate and inspirational Fijians and Rotumans of all ages and walks of life desperate to revive their history and take it practically into the future.

Before introducing my hosts, guides, and fellow voyagers, I want to highlight the concept of reciprocity, a central tenant of a Fijian (and Oceanic) 'way of being' that Hau'ofa (2008:36) describes as the "core of all oceanic cultures". This discussion requires some cognisance of concepts such as *vakavanua*, *vakarokoroko,* and *loloma*, as well as the central role of *yagona* in Fijian society; all of which have their duplicates in other Pacific cultures. Such essential elements of Fijian culture and epistemology have been well characterised and discussed, initially by external observers such as Williams (1858), Henderson (1931), Thompson (1938) and Tippet (1968) and more recently by indigenous researchers, for example Nayacakalou (1975,1978), Ravuvu (1976, 1983, 1987), Tuwere (2002), Halapua (2003) and Nabobo-Baba (2006). Batibasaga et al (1999), Katz (1999), and Farrelly (2009) add to this discourse.

Vakavanua comes from the term *vanua* and means "the way of the Fijian people or in the

nature of the land, people, and customs" (Ravuvu, 1983:122). Huffer and Qalo (2004:95) consider understanding the concept of *vanua* is crucial "for all institutions, decision makers, and citizens of Fiji, and for all those who interact with Fiji (donors, non-governmental organizations, multilateral institutions, etc)". Halapua (2003:83) describes *vanua* as not only linking the ancestors to the present situation but offering a way of life with a sense of belonging and security for the future and providing a strong bond that connects people with deep emotional links to one another and to the environment. Fijians do not treat their land as a commodity that can be 'owned' in the capitalist sense of the word.

Vakavanua is an epistemological framework where culture and nature are bound; where to act in tune not in dominance with the environment is sought; where to be a willing contributor is valued; where the needs of the *vanua* and its communities are esteemed and self-interest subordinated. A central tenet in living *vakavanua* is that "individualism for its own sake is abhorred" (Nabobo-Baba, 2005:193). All decisions made should first and foremost concern the maintenance of social harmony in the community. The kinship system is vital for social, cultural, environmental, and economic sustainability and security and therefore must be nurtured (Farrelly, 2009).

Vakavanua is supported by preferencing of a range of complementary social constructs such as *vakarokoroko,* acts of respect and deference. Conflict and discord are avoided or resolved as a priority. Confrontation within a group or community certainly occurs, but when it does the visceral reaction is to dampen it, to quieten and dissipate it, not to stamp it out (Nayacakalou, 1978). *Loloma* is simply love, kindness, and compassion in its broadest terms.

Fiji, as with many cultures in Oceania, is very much a living culture. Successive waves of external influence (Samoan, Tongan and then European), followed by phases of colonialism, post-colonialism and today's globalisation have all impacted a traditional Fijian culture and worldview (Farrelly 2009; Nabobo-Baba, 2006). But language, daily life, cultural practices, beliefs, and epistemology are still distinctly and proudly Fijian. Tradition is used here in the sense described by Clifford (2003), not as a resistance to or a binary opposite of modernity, but a term bound with the evolving cultural practice and a way of raising essential questions about the ways culture is transmitted inter-generationally (Phillips, 2003). In Solodamu, for example, there are no traditional *bures*; the houses are of timber, block, and iron, but they are laid out in traditional Fijian fashion and the parts of the dwelling are respected in the traditional way. Despite being made of new materials, the *bure* fulfils a similar societal

function it always has; the same cultural mores govern its use today. Despite lures and influences of modernity and the changes wrought by urban drift and introduced constructs such as capitalism and consumerism, *vakavanua* is still the dominant mode of life. Adaptation (see Section 2.2) in the future needs to be fully cognisant of the cultural and social context. The Pacific is littered with the wreckage of projects that have not done so.

It is generally held that Pacific countries such as Fiji have developed enormous resilience that derives from their access to communal land, strong cultural identity, and systems of community governance and such resilience is supported today through strength of kinship ties, sharing of communal resources, and cultural obligations of reciprocity (Coates, 2009:30; also Aalbersberg et al, 2005; Bayliss-Smith et al, 1988; Veitayaki et al, 2011)[10]. Helu (1999) joins the dots between the concept of reciprocity between seafarers and a long evolving habitation on remote islands subject to intense and irregular pressures (cyclones, invasions, tsunami) and its inherent underpinning of Pacific culture today. Reciprocity is a survival mechanism, the Oceanic equivalent of an insurance policy against the future. In my own culture any sailor is required to respond to a mayday call; it is a code I believe all true sailors follow regardless of whether it is required under maritime law. We respond willingly, but not totally altruistically, in the knowledge we never know when it will be our turn to make the call. Tsunami, cyclone, drought, invasion, and rogue waves are indiscriminate and largely unpredictable. They can be swift and absolutely devastating in effect. At this point survival is often beyond the capacity of the community affected.

In *iTaukei* society today, maintenance of the traditional kinship system provides 'a safety net' that enables societal needs to be met in uncertain circumstances (Veitayaki et al, 2003, 2011). The incentive to work is driven by reciprocity rather than monetary reward, financial payment is secondary to kinship obligations (Batibasaga et al, 1999; Nayacakalou, 1978). Fijians know that if they foster the ties that bind the *vanua* by assisting those who need help, this will be reciprocated at a time when they too require the assistance of their kin. Those who maintain strong relationships with one's people are considered 'wealthy' (Farrelly, 2009).

Reciprocity as it occurs from deep within Oceanic cultures, in my view, comes from the unique cultural cauldron of being firstly sea people, of voyaging in small craft and living on exposed islands with often minimal resource bases. In this sense, the inhabitants of Oceania

[10] The concept of cultural resilience is discussed further in Section 2.2.3.

have been addressing issues of sustainability long before most continental and terrestrial cultures. When a resource base is overrun, the continental option of raising an army and heading over the hills to expand the base is not so readily available to an island community and even less so for a sea-borne community. I also assume that concepts most akin to reciprocity are amongst the Oceanic cultural traits Diaz (2001) would see retained in an evolving ethos of hypo-modernity (see Section 2.1).

The Fijian *kerekere* system[11] as it is known ubiquitously today, where one can ask for almost anything to be given through kinship ties, is regularly chastised by development proponents as a negative cultural attribute in today's increasingly globalised, consummerised and individualised society. For example the *Fiji Times* (1/6/2012) reported that the Commissioner Northern had challenged the Cakaudrove Provincial Council meeting to do away with the 'kerekere syndrome' in villages because it was impeding the people from becoming self-reliant. It is seen as "a handicap to successful commercial and economic development". Modernity and development are arguably the antithesis of a communally-based system based on sharing, humility, conflict avoidance, and respect. And in the case of Cakaudrove the Commissioner's call was met by letters to the editor questioning the wisdom of letting go culture so quickly when "this exchange or reciprocity is an age old relationship or culture that strengthens the village unity and has withstood the test of time" (*Fiji Times*, 4/6/2012).

The tension between *vakavanua* and modern commercial imperatives is real, a lesson reinforced in this thesis when we sought to identify the barriers to Solodamu becoming sea-transport operators. In true Pacific fashion, the tension was best resolvable by avoidance. It was better to forego the opportunity offered (although all bets were hedged as always) than to sacrifice erosion of chiefly *mana* and village cohesion.

Reciprocity is important to understanding the human context that inhabits and is bound to this Ocean. It is also important for understanding this thesis. Only part of the story told is documented here in written form. *Talanoa*, an oral orientated process, has been used extensively (see Section 3.5). It does not translate neatly or completely into an academic format. *Talanoa*, as with other aspects of the methodological approach employed, is a two-way process; it is not an extraction of data or knowledge but a mutually rewarding means of

[11] See Sahlins (1962) and Nicolas (1992) for a more in-depth discussion on the attributes of *kerekere.*

'making' learning. This thesis has become a sub-set of the *talanoa* on sea-transport and shipping; not the other way round. It has been submitted to enhance and add to the *talanoa* and it is fully expected the *talanoa* will continue beyond and outside of this thesis. I (and my family and friends) have been offered much over the course of this inquiry; knowledge, data, analysis, and insight certainly but deeper gifts of understanding, empathy, trust, and acceptance. I have been forgiven much as well. This thesis gives an opportunity to reciprocate the knowledge and understanding gained back to that *talanoa* and its participants. As an active participant I have not pretended to take an objective position to the inquiry or to be a detached and impotent observer. I have acted from a privileged and engaged position as *agent de change*, possibly *agent provocateur.*

1.3.1. Solodamu

The *koro* Solodamu is one of six villages in the *tikina* of Tavuki, the chiefly village on the island of Kadavu, the fourth biggest of Fiji's islands to the south of the main island of Viti Levu. Despite a sea barrier of only some 60nm, Kadavu is a rural outpost, regularly described on tourism sites as still very traditional in setting. There are 75 registered villages and only one small town and administration centre, Vunisea. A small number of tourist resorts, generally dedicated to surfing, diving, and fishing, are dotted around that offer some limited local employment opportunities but subsistence agriculture and fishing are the mainstays of Kadavu life. There are limited economic opportunities. Yagona is the primary cash export for which the island has a national and international reputation (Sofer, 2009). *ITaukei* are dominant, the 2007 census showed just eight Indo-Fijians amongst the approximately 10,000 residents (Fiji Department of Statistics, 2010).

Solodamu is a small village of some 20 odd households. It is a historic village. None of the inhabitants appear quite sure how old it is: "always"; "forever" and blank faces are common responses to asking how long it has been there. It certainly shows clearly on the first known map of Kadavu published by the Scottish Geographic Society in 1889 (Thompson, 1889). There are three land-owning *mataqali*[12] resident. The village is maintained on traditional cultural lines*, mataqali* roles, boundaries, and responsibilities to the *koro* collective and from there to the *tikina* and *yavusa*, are jealously guarded, Kadavu dialect is the dominant conversation, and cultural process and protocol imbue all facets of daily life.

[12] *Mataqali* have been referred to as 'clans' (Deane, 1921); 'an agnatically related social unit, usually a lineage of the larger clan' (Ravuvu, 1983); 'local group', 'patrilineal group', and 'sub-clan' (Nayacakalou, 1985).

When we first arrived in Solodamu in 2006 the village was displaying the classic hollowed population pyramid of rural remote villages under the impact of urban drift and migration. Young single men heavily outnumbered women; the very old and very young were prevalent and young married families in decline. The roll of the Tavuki primary school, which services the six villages, fell from 121 to 87 students between 2006 and 2010. However, in Solodamu resurgence in married youth returning has seen this trend reversing in the past two years.

Economic opportunities are few; the village generally has poor soil and steep hinterland. Various individuals have attempted over time to establish small businesses but, with the exception of a beekeeping initiative, have not been successfully sustained. While this can in part be ascribed to a lack of capacity, skills, and support, there is also a common element that the strain placed on any budding or successful entrepreneur by the proportionally increased demands on those individuals to contribute to the *vanua* and the pressures of *kerekere* make successful commerce a stressful and ultimately unrewarding business for many villagers.

Sofer (1985, 2007) has described how the marginal returns for shipping service providers to Kadavu, predominately Suva-based, sets up a vicious circle where shippers will not provide service unless assured of economic return but the lack of service means crops and other products for market are not produced. *Yagona* is the major exception due to the long keeping qualities of the product.

The modernist and current development literature would describe Solodamu as 'impoverished' and 'developing' or 'underdeveloped'. It certainly doesn't have much disposable income[13] and finding the weekly $5 for the village diesel generator bill is a matter of repeated stress to most households. Yet, I have regularly sat at a Sunday feast where the mat groaned with more food, all organic and preservative free, than we could ever eat. Usually only three ingredients were procured outside of the village catchment – noodles, rice, and canned tomato sauce. Such Fijian village economy has been described as "subsistence affluence" to distinguish it from the abject poverty that is prevalent in many other developing countries (Fisk, 1970; Knapman, 1987).

[13] Sofer (2007:241) found the average annual household cash income for Nalotu (a comparable village to Solodamu) to be FJ$3014.1, 42.3% coming from *yagona* sales.

Figure 1 Solodamu Community Forest Reserve and MPA

Figure 2 Solodamu

The village is a coastal one and its relationship with the sea dominates all facets of life and is essential to food security. Its *qoliqoli* is shared with neighbouring villages. The current site of the village is relocated a few hundred metres inland from the 'old' village which sits on the shoreline and was regularly inundated by storm surges in the 1980's, exacerbated by the removal of the coastal mangrove screen. A rutted dirt track provides the only terrestrial access, there are no vehicles owned in the village, and most transport is by sea in 'fibres'[14] powered by outboards of various sizes up to 60 hp.

In the 1980's significant mineral deposits (principally gold and copper) were confirmed under

[14] Fibreglass punts between 23-28' long and capable of carrying a payload of around 800 kg.

the 300m high bluffs[15] bordering the village, creating interest from multinationals such as RioTinto. Initial drillings confirmed that extraction would require enormous environmental damage. The bluffs are one of the last remaining intact coastal limestone forests once prevalent in Fiji (pers. com. Bogiva, A, 2006) and a breeding stronghold of the endangered Kadavu *kaka* (parrot). After intense community debate in the late 1980's/early 1990's the village decided to forego the potential benefits from a mining operation and established the first community forest reserve in Fiji (pers. com. Bogiva, 2006). Selected chiefs have the power to call *vonu* (turtles) from the reef from the cliff tops, a phenomenon witnessed by several of the international guests we have introduced to the village over recent years. An adjourning MPA has subsequently been established at the foot of the cliffs as part of the Fiji Locally Managed Marine Areas (FLMMA) programme.

In the period 2008-2010 I returned to Solodamu repeatedly, often with members of Solodamu's 'Suva division' on board, anchoring there for months at a time. During this period we were joined by a number of other international cruising vessels of varying descriptions as well as a number of international visiting friends. We regularly acted as the village 'bus' transporting villagers around Kadavu and to Suva. Largely we lived alongside the village, growing gardens on land the chief allocated us and participating in all aspects of village life, including births, weddings, and deaths. We have continued to visit the village repeatedly since. I return to the Solodamu case study in Section 4.1 to look specifically at their sea-transport scenario.

1.3.2. Korova

In 2009 we were anchored in Laucala Bay, Suva just off the USP campus on a beautiful tropical evening. I had spent a frustrating month on-line and in the USP library and Fiji Museum learning that there was no consolidated history of *drua* available and large sections of what records I had found appeared heavily disputed (see Section 6.3). By all accounts, except possibly on the remote islands of southern Lau, all indicators were that *drua* culture was now consigned to history and museum artefact. In two decades of sailing around the main islands of Fiji I had never encountered a traditional vessel at sea. The closest I had come was a small, derelict example in one Kadavu village. I had sailed on a small *drua* in 1994, then operating as a tourist attraction in Suva but apparently short-lived and now

[15] Solodamu means literally rocks red.

abandoned. I had seen a fleet of four *camakau* built hurriedly for the Melanesian Arts Festival in Suva in 2006 but these had all 'vanished' shortly after the event and no-one was able or willing to tell me their fate.

Figure 3 …in the fading twilight, the classic silhouette of an oceanic lateen *laca*…

As I looked out to the horizon where the surf could be seen breaking along the reef in the fading twilight, the classic silhouette of an oceanic lateen *laca* (sail) broke the line of the reef, sailing fast before a strong southeast breeze and heading toward us. My young sons and I leapt into our sailing dinghy and sped to intercept it. As we met, my sons were plucked from our dinghy and swept onto a large *camakau* with a ragged patchwork sail by a laughing and obviously Lauan crew. "*Mai, mai, lakomai* – come, *kaiwai,* we go to drink kava," they taunted as they raced ahead of me and disappeared into a muddy mangrove-shrouded creek in what I had always assumed was an uninhabited piece of city shoreline.

And thus began our relationship with the people of Na Korova (the fourth village), a Moce 'outlier' village literally squatting on the high-tide mark in the heart of Fiji's capital. That night I sat to *talanoa* until dawn amongst a village of sailors, who proudly claim they have never owned an outboard motor and still maintain a fleet of *camakau,* and talked sails and ships and storms and wrecks and felt completely 'at home'. These are *kaiwai dina*, true sailors brought up from birth at home on the deck of the *drua* and *camakau* as on land. Bera (nickname Angel), the *turaganikoro*, described his house as "a chicken shack to rest in when

the sea is too rough". Our *talanoa* has continued now for four years, ranging from religion to myth, from dugout to space travel, while my sons troop through the village hunting crabs. On behalf of his elders, Bera has continually pressed me to write "the book of our story, the story of *drua*". In 2011 we sailed Korova members to Solodamu so the men from Moce could offer to teach the Solodamu youth to build a *camakau.*

Because of their proximity to USP and Suva and their acknowledged expertise in boatbuilding, sailing, and other traditional Lauan arts and crafts (especially *masi*), Korova, their home in Moce, and their sailing has received significant academic study (e.g. Geraghty, 1994; Holbrook, 2002; Katz, 1999; Leota-ete, 2007). During the week-long 2012 'Drua Festival', the story of Korova was told in a two-page *Fiji Times* article (12/6/2012). The late Simione Paki was a renowned *drua* sailor in the southern Lau in the last half of the twentieth century, sailing regularly between the islands of the Lau and to Tonga. In 1992 he sailed with some of his sons to Suva in a *drua* and a *camakau* in search of income opportunities to provide education for his large family and they ended up camped on a small slither of foreshore at Laucala Bay where the *Tui Suva* granted them permission to reside. In 1993 one of the sons, Metuisela Biuvakaloloma, attempted to sail a second *drua* that never arrived. The family attributes the loss to the *drua* breaking a *tabu* on travelling on the sea while the body of the late Ratu Penaia Ganilau was being carried on the water. The village of Korova continues in Simione's wake, and still build and maintain a small fleet of *camakau* today.

1.3.3. Fiji Islands Voyaging Society[16]

At the 2008 Festival of Pacific Arts in Pago Pago, the veteran Maori actor Rawiri Paretene unveiled plans to assemble a fleet of traditional Pacific sailing craft so that collectively the representatives of Pacific peoples could sail to Hawaii in 2010 and protest the growing threat noise pollution from shipping, particularly military craft, poses to whales. It was announced that a sponsor, the German registered Okeanos Foundation, had agreed to fund both a fleet of seven *vaka,* to be distributed amongst both existing and yet to be formed Voyaging Societies in the main island groups, and a commercial-scale documentary directed by Paretene.

The Ministry of Culture and the Fiji Arts Council applied on behalf of Fiji and Rotuma to be one of the communities represented and in 2009 established FIVS. Initially it was hoped that

[16] See the Fiji Voyaging Website (http://www.fijivoyaging.com/) for details of their vessel *Uto ni Yalo* and its historic inaugural voyages of the past 3 years.

the new vessels would be representative of the diversity of Pacific traditional designs but ultimately the sponsor decided to have a New Zealand boatyard build a mould for a fleet based on the design of *Te Ao o Tonga* built by the late Sir Tom Davis in Rarotonga, in turn a modern representation of a Tahitian '*tipaeri'* class long-distance voyaging vessel. The designated Fijian vessel, *Uto ni Yalo,* a 22m high-tech fibreglass catamaran duly arrived in Suva from Auckland in 2010.

It marked a watershed in Fijian sailing. Up until this point, there had been no Fijian representation in the Pacific 'voyaging renaissance' sparked in Hawaii in the 1970's (Finney, 1976, 1984, 1993). Although there was a willing pool of recruits, the inaugural crew of 16 had only two experienced bluewater Fijian sailors to guide it. It left on what turned out to be a gruelling, storm-wracked voyage virtually unnoticed and returned to a hero's welcome. The crew has since been elevated in Fiji to the status of an international sports team. *Uto ni Yalo* has just returned from participating in the two-year, seven *vaka* 'Te Mana o Te Moana' voyage across the Pacific to the US and home via the Solomon's Festival of Pacific Arts[17]. Over 50 Fijian crew have sailed on *Uto* and there have now been Fijian crew representatives sailing on all the participating *vaka.*

While a little ironic, not to say totally historically inaccurate, a Fijian crew on a professionally-built, fibreglass replica of a Tahitian vessel type never seen in these waters previously, (designed by a Cook Islander, built by NZ boat builders and owned by a German 'philanthropist'), it has achieved the purpose of getting Fijians sailing again. The local success of initiatives such as *Uto ni Yalo* can only be positive in leveraging cultural history, pride, and achievement toward greater acceptance of the technology and acting as iconic sustainability flagships. The next step of course must be to turn to revive *drua* and all its related culture (see Chapter 6).

[17] It is not entirely clear what happened to Paretene and the objective of protesting shipping noise pollution. It would appear in this project, as with the Solodamu pilot boat (Section 5.1), that the role of sponsor quickly became synonymous with decision-maker and arbiter.

Figure 4 ***Uto ni Yalo***

Shortly after FIVS's inception I literally bumped into its President, Colin Philp, while landing from my dingy in Suva early one morning. The conversation led to me making a *kerekere* for FIVS to take on some of the Solodamu youth, a request that was favourably met. Today Sisi and her nephew Peni are old hands on the *Uto* crew, each serving as watch captains. Similarly we have been responsible for introducing FIVS and Korova. While the *kaiwai* of Moce have been initially suspicious of the new, strange, expensive, and modern 'foreigner' to their foreshore, they have also agreed to their youth sailing with FIVS. At the time of writing Jim Fuluna is in the Cook Islands as crew on *Marumaru Atea* learning traditional navigation from acknowledged Cook Island masters. His ambition is to sail a *drua* using only traditional means from Suva back to his home on Moce. Simione Paki's eldest son, Semiti Cama, an acknowledged master builder and sailor himself, also joined us as expert adviser on the FIVS *drua* research voyage to the Lau in 2011 (see Section 6.4).

FIVS is not a traditional community. Its members and crew come from all walks and all parts of Fiji and Rotuma. But as sailors, it is more than just a society; the bond formed by thousands of sea-miles is greater than that. As a community, it has been instrumental in this research agenda. Since the early stages of my research, FIVS and its network of supporters and allies have been integral to my programme. As with a more traditional Fijian community, they have woven *vakavanua* and Fijian protocol into all their activities and processes.

Chapter 2. Theoretical Perspective

This chapter situates the research within the context of current literature across three themes. The ocean is positioned as the lens through which the inquiry is focussed. The lessons and knowledge gleaned from an Oceanic past are positioned as the masthead from which to search the horizon for clues for a course to the future. The radar screen shows climate change as a developing tropical cyclone of unprecedented magnitude that is unavoidable on this passage regardless of the course set and so the third theme embeds this discourse on sea-transport within the general discourse on responses to climate change.

Chapter 2.1 considers the first two of these; the recent writings on an emerging indigenous Oceanic epistemology and the repeated reference from Pacific writers on the need for future actions to be centred on lessons from the past. The two are obviously and eternally intertwined here, where the ocean has always been the dominant feature, shaping all things physical, cultural, spiritual, political, throughout millennia of evolution, adaptation, and development. The research agenda presented here is loaded toward industrial application of sea-transport technology and renewable energies. Such future evolution, if it occurs, will happen in a context where both ocean and vessels have been historically and, to varying extents, remain today of wider importance to the inhabitants of this ocean than just industrial or economic, incorporating dimensions of extreme cultural and spiritual significance.

It is argued throughout this thesis that issues of sea-transport, while a key priority and absolute need for many Oceanic communities, are currently marginalised under a global post-colonial mind-set that greatly preferences the terrestrial and continental at the expense and masking of any Oceanic lens. For sea-transport, and alternatives to current unsustainable options, to be addressed this perceptual positioning needs to be re-examined and re-centred. This section revisits Diaz's (2001) call for Oceania to now re-empower its traditional and customary attributes to provide a current and future platform from which to combat and adapt to the increasing pressures and threats of globalisation and consumerism. Diaz asks for a new/evolved Oceanic epistemology of 'hypo-modernity' as shield against the rising global tide, even tsunami, of hyper-modernity.

Section 2.2 examines the current literature on climate change adaption and mitigation as well as the related theme of cultural resilience. This thesis builds an argument that sustainable sea-transport should be prioritised and developed as an adaption response by Oceanic

communities in the face of increasing pressures from fossil-fuel dependency and climate change. But globally (see Section 4.3) sea-transport is gargantuan, fiercely commercially competitive, international, and resistant to external control. Intervention responses to the industry's emissions profiles, the preserve of a slow-moving and cumbersome IMO, are categorised as mitigation. Such classification masks and skews the real nature of the issue to Oceanic communities and greatly restricts prioritisation of the subject through lack of appropriate policy formulation and downstream access to climate financing to underpin research and development of Oceanic-centred solutions. As discussed in Section 4.3, current global mitigation regulation initiatives are likely to significantly increase the costs of sea-transport in the region under a BAU scenario for no measurable regional benefit.

It is argued throughout that measures to introduce sustainable sea-transport, especially for remote island/village communities, can contribute positively to retention/revitalisation of local and national resilience. While such measures should be pursued regardless of these threats, they should, in the context of this research, be more correctly included, and prioritised as "no-regrets" or "soft-technology" adaptation interventions. Currently the subject is invisible within either development agency priorities or the related literature. Gaining any real traction in this area will be difficult while this situation remains. In particular, external resourcing for the essential initial research and development in this field is difficult to access.

2.1. Ocean as Lens, Past as Future

> *Oceania is vast, Oceania is expanding, Oceania is hospitable and generous, Oceania is humanity rising from the depths of brine and regions of fire deeper still, Oceania is us. We are the sea, we are the ocean, we must wake up to this ancient truth.* Hau'ofa, 1993:16

> *We carry the cultural and historical inheritance of ocean navigators of peerless skill and their courageous kin who crossed vast distances before the tribes of Europe had ventured forth from their small part of the earth.* Mara, 1999[18]

Oceanic perspectives are rarely to be seen in the general literature on sustainability and development issues. The total dominance of the sea and the absence of continent make

[18] http://dev.iwise.com/pVvWv accessed 2 July 2013.

Oceania unique among the world's regions. The differences are elemental. Continental approach, priority, process, solution, and thinking often simply do not fit (Barnett, 2001). The far greater part of the history of cultural evolution and interaction within the region has occurred in their absence. The research agenda pursued in this thesis has been premised on the assumption that Oceanic-centred paradigmal lenses are required for consideration of context and approach and should form the basis of research. An understanding of indigenous epistemologies may contribute to models of development that empower rather than reinforce neo-colonial attitudes through the application of unsuitable Western models of development (Gegeo, 2000; Hau'ofa, 2000; Hereniko, 2001; Huffer and Qalo, 2004 Quanchi, 2004).

SPREP's 2012 draft 'Framework for a Pacific Oceanscape' commences with this description: "In our Pacific Islands Ocean Region the ocean unites and divides, connects and separates, sustains and threatens our very survival. For all those who venture within this, the world's largest ocean, and who have made it their home the ocean influences every aspect of life. It has done so for millennia"[19]. Vessels and seafaring are handmaidens, the conduit to these relationships. Oceanians developed the world's first bluewater technology. With highly advanced understanding of sail and hull form and function Oceanians created sophisticated ocean-going vessels and did so thousands of years before humans anywhere else (e.g. Howe et al, 2006). Centuries before continental peoples tentatively and fearfully set out to cross their first ocean, Oceanians had explored, colonised and inhabited all of theirs.

Within traditional Oceania ontology the ocean is deity, in many Oceanic epistemologies the principal deity, and the vessels used and their means of use sacred in every sense. In Fiji the great *tabetebete* style *drua* were called *Waqa Tabu,* literally sacred ships (Thompson, 1940; Tippet, 1968). *Musu Waqa* were living memorials to deceased leaders, the tribute given to reaffirm alliances and allegiances (Tippet, 1968). Kirch and Green (2001:247) discuss ocean-going vessels as "vehicles through which mortals can commune with God, embodiments or spiritual homes for the divine". In Fiji today, statutes, regulations, regional frameworks, and government agencies govern commercial domestic sea-transport. Not so long ago, it was governed by powerful gods such as *Dakuwaqa*, visualised as a giant shark. Costs of transport were not reckoned in dollars to purchase or operate an industrial asset but in lives sacrificed for sacred icons to inveigle success. Sea passages were not feared barriers but exploited

[19] Draft Framework for a Pacific Oceanscape http://www.sprep.org/att/irc/ecopies/pacificregion/615.pdf accessed 1 Nov 2012

highways. Gaining cutting-edge marine technology was highly pursued, an ultimate goal of collective communities not an economic and logistical problem without visible solution.

Such worldviews have been eroded and depressed through the historic processes of colonisation and post-colonisation, surpassed by a western and continental imposed lens of the region as small, vulnerable, isolated, and dependent. But, as Hau'ofa (1993:7) chides "if we look at the myths, legends and oral traditions, and the cosmologies of the peoples of Oceania, it will become evident that they did not conceive of their world in such microscopic proportions. … their world was anything but tiny". Writings, led by Wendt (1976, 1982, Hau'ofa (1993, 2000, 2008), and Helu (1999) among others, have called for a sea-change in the way such relationships with both Oceania and its communities are conceptualised at the level of paradigm and such calls are now being echoed by the region's political leadership.

The development literature of Oceania, since European contact, has largely viewed the region and its issues from a terrestrial base using academic lenses that have evolved in continental societies. Until recently, such views have greatly preferenced a mindset of small, vulnerable, resource poor, underdeveloped and scattered communities, impotent economically and politically on a global stage, situated in an idyllic tropic maybe, but above all, dependent. The continued survival of these island states, let alone their enhanced communal well-being, is seen as only achievable with external patronage and aid. The historian Moorehead's (1966) *The Fatal Impact* typified a Pacific seen as a paradisiacal space fatally wounded by the incursion of Europeans. According to this paradigm islanders were the passive victims of an inevitable fate; bystanders, mute witnesses but not dominant actors. In this worldview the ocean is alien and negative: barrier, obstacle, restriction, impediment, threat.

In 1993 Hau'ofa's now oft quoted paper 'Our Sea of Islands' challenged this view in favour of a paradigmatic shift by Oceanians themselves to recast as big people at home on a big ocean with a big history. Islanders, he argued, were connected rather than separated by the sea. Far from being sea-locked peoples marooned on coral or volcanic tips of land, islanders formed an oceanic community based on vessels and voyaging.

Hau'ofa, whose writing over the past three decades consistently challenged prevailing notions about Oceania and prescriptions for its development, argued that Pacific Islanders' collective cultures and heritages and their identification as children of sea before land, facilitated movement, and connection. He called for a reclaiming and re-valorising of cultural traits

such as reciprocity, a re-owning of Pacific thinking and process under the rebranding of 'Oceania' and "proposes that students of the Pacific might yet claim alternative futures, presents, and pasts by reimagining the space they inhabit" (Teaiwa, 1996: 214).

'Our Sea of Islands' was not the first of such calls. In 1976, Wendt delivered, 'Towards a New Oceania', which he described as "a revolt against the hypocritical/exploitative aspects of our traditional/commercial and religious hierarchies, colonialism and neo-colonialism and the degrading values being imposed from outside and by some elements in our societies" (p.59). He was speaking to a new generation of Pacific writers and thinkers, the creative and critical voice and conscience of a region of island nations that made up "a multiplicity of social, economic, and political systems all in different stages of decolonisation" (Wendt, 1980: xiii).

What was critical about Hau'ofa's 1993 work, as with those of his peers and protégés that followed, has been the level of reaction provoked and the degree of penetration sustained since, not only evident throughout Hau'ofa's other writings but across disciplines and agendas within the region. Not all have been accolades, Teaiwa (1996:214) grouped early responses into "the celebratory, the cautionary, and the critical". Inspirational, catalytic even, though his call may be, it has been questioned and cautioned for its lack of practicability and romantic unreality. Veitayaki, for example, accused Hau'ofa of pandering to his students after years of telling them "the painful truth" (they're small, underdeveloped, and dependent) he tries to please them with a new perspective that is "mostly superficial and unrealistic, certainly severed from the situation in the Pacific" (Teaiwa, 1996:214).

How realistic was/is it to think that the enormous physical, practical, and economic challenges faced by the region can be resisted, even resolved, by something as simplistic as a change in thinking, in perception? Globalisation is, after all, the dynamic process of increasing interactions and interdependencies among people and systems, particularly economic systems (Sassen, 1998). Ellwood (2001) points out that this process has been one of entanglement, that it has been in existence for centuries, and that it has rapidly accelerated over recent decades. The result is a shrinking and all-persuasive world in which, surely, the tiny Oceanian enclaves must be subsumed by this tsunami.

But Oceania is no stranger to tsunami or cyclone or invasion. In opposition to this, Hau'ofa's theoretical intervention is an expression of metaphorical and literal decolonization: the refusal to think of continents as the mainland (Hall, 2009). Ultimately Hau'ofa concluded that it was

the maintaining of cultural identity and connection through expression of art in its broadest sense that provided the greatest fertility for a future Oceania and hence his great focus in his later years at the Oceanic Centre for Art, Culture, and Pacific Studies.

The debate continues to mature, even if slowly amongst external commentators. Confronted with this pervasive globalisation, Borofsky (2000:454) found responses from Gegeo, Hereniko, Teaiwa, Qalo, and Teaero and non-indigenous researchers Watson-Gegeo, Huffer and others, in applying indigenous epistemologies to social and economic development. Wanting to combat Eurocentric hegemony, they assert indigenous wisdom and acknowledge Oceanic ways of addressing problems, imagining solutions, resolving conflicts and contemplating future directions. "Research on locally valued ways of thinking, learning, and organising knowledge in Oceania has emerged over the last two decades led by Pacific Island scholars keen to affirm not only that indigenous epistemologies are alive and well, but also that they are relevant and useful to the societies and peoples to whom they belong" (Huffer and Qalo, 2004: 88). This is affirmation of the long tenure of Oceanic peoples and their continuing to flourish despite Oceania becoming an arena for superpower rivalry and posturing in the colonial and post-colonial era (Huffer and Qalo, 2004).

The academic and artist-voiced rebellion of consciousness led by Wendt, Hau'ofa, et al, is echoed today even at the political. At the 2012 Pacific Forum Cook Island's Prime Minster Henry Puna challenged other PIC leaders to consider a rethink of shared identity within the Pacific saying: "it is time that we break the mould that defines us too narrowly and limits us in any way". Puna called for a recasting of the current regional identity of SIDS to 'Large Ocean Island States'. "Our large ocean island states should demonstrate – now more than ever – renewed commitment to define our future, on our own terms. Our intimate and connected relationship is built from a deep spiritual bond and translated across an expanse of ocean in unique and traditional ways" (*Fiji Times,* 31/10/2012).

Inherent in this shift at the level of paradigm and epistemology is the re-assigning of labels. Plenitude and connection, not emptiness and distance; wide-spread instead of isolated; resilient and interconnected replace vulnerable; resourceful, adaptive, culturally-diverse and centred are alternates to dependent. Hau'ofa replaces a small-island 'Pacific' with a big ocean 'Oceania'. *Pasifika* was an earlier attempt to shrug off colonial and externally imposed categorization, first used internationally in 1970 by then Fiji PM Sir Ratu Kamasese Mara (Crocombe, 1976). Crocombe (1976:1) asserted that the phrase was accepted and well-used

because “it satisfies both psychological and political needs, in that it helps to fulfil a growing demand for respected Pacific-wide identifying symbols and for Pacific unity”. He was careful to point out that the phrase has never been used to imply homogeneity, the Pacific is home to enormous cultural diversity; rather, it has been developed and used when “the common interests of all island peoples can be served by collaboration”.

Within Oceanic ontology, sea-transport was always central, certainly prior to modern aviation and electronic communications it was ‘the’ connection, the interface, the facilitator between people and god, people and environment and of culture to culture. Sea-going vessels were the pinnacle of societal achievement. They were the ultimate line of defence. Their design and functionality was radically different from that produced from any continental paradigm, almost Zen-like in its approach to finding ultimate form in simplicity and from a minimal resource base. Terrestrial design and construction was not the primary role of craftsmen but what naval architects and shipwrights did in their downtime. Their vessels were the products of cultures where metals were not an available option, where swimming and walking were equally important, where survival at sea, more so than on land, was primary. And they were tested and refined through a process of attrition and natural selection. For every successful landfall and subsequent ‘story’ and culture that survived, it is unknown how many countless perished beneath the waves and have been left untold (Helu, 1999:114).

Concepts of centre and margin change radically when viewed from sea-level and not alpine peak or skyscraper. Size and space take on new and fluid definition. In Oceania the continents are peripheral, ascribed to the rim. If Hau’ofa brought islanders and island cultures to the centre of his analysis, Diaz sheets home that centre to the canoe at sea. “Grounding oneself in a canoe and an oceanic culture that survives the generative and transformative histories of colonialism, as well as the politics they beget, offers a particularly deep, substantive, and compelling vantage point with which to map and move what are after all the mobile coordinates of indigenous cultural and political consciousness” (Diaz, 2011:21-22).

In ‘Moving Islands of Sovereignty’ (2005) and related papers, Diaz questions whether conventional usages of scale are relevant to Oceania debate. Working from voyaging-based Carolinian cultural constructs of *etak* and *pookof*, islands are shown to be flexible, enormous simultaneously with being minute, sometimes temporary, or impermanent. Always mobile, islands, clouds, and even oceans can be moved relative to the stationary canoe. Land is

brought to the sailor not the canoe to the land. Such an Oceanic-based perspective "allows the concept that what appears physical and fixed can be made malleable – spatially and temporally" (Diaz, 2001:2). Distances in a sailing culture vary dramatically; an island that is 10nm away downwind can be far closer than one only a mile away but to windward. If such geographies and physicalities are ambiguous to a continental eye, then so too are the cultural and societal constructs that have followed since first colonisation of this ocean. In the same manner that an independent and unique discourse on vessels and seafaring has developed here over millennia, so have understandings and knowledge about community, culture, relationship, and development.

These traits, especially reciprocity, are reflected in the prosecution of the current Oceania debate itself. Prime Minister Puna, above, offers a Pacific approach as "our major contribution to the wellbeing of humanity". Diaz similarly offers that the lessons of survival and adaption from Oceanic voyaging may have elements of value to the wider global society in the same generosity of spirit that the Halapua brothers offer the 'gifts' of *talanoa* to the world's need for more civilised, measured, and inclusive conversation with the same humility that any Fijian villager will plead to serve you food and hospitality whenever you pass their open door. There is a love in Pacific conversation of the *double entendre* and such deference, such humility, should not be read down as subjugation. As Huffer and Qalo (2004:87) have coyly observed: "Pacific thought is like a dormant volcano: as long as it does not erupt, no-one notices it. When it does boil to the surface, it comes, to the many who would rather dismiss it, as an unpleasant reminder of its persistent existence".

In a world where modernity and post-modernity have mutated into hyper-modernity, a globalism fuelled according to critics such as Lettwak (2000) and Holloway (2010) by 'Turbo', even 'Crack' Capitalism, Diaz (2001) offers 'hypo-modernity' as an Oceanic survival strategy and suggests adaptation pathways may best be identified by looking through an Oceanic lens and positioning them within age-old Oceanic values.

In the hyper-modern world, Thomas L. Friedman (2000) argues for traditional social safety nets "to catch those who simply will never be fast enough or educated enough to deal with the Fast World," "trampolines - programs that can catch workers who fall behind in this rapidly changing environment and retrain them so they can bounce back into the economy" and "trapezes" that allow risk-taking entrepreneurs "to swing free and take crazy leaps". In this world, modern western free-market ideology is void of any moral anchor other than

Gekko's[20] commandment, 'Greed is Good'. "What is problematic about globalism is that it serves to empower the already powerful; perpetuates and even accentuates power asymmetries and social injustices rather than mitigates or alleviates them; raises up competition as the noblest human activity to the disparagement of cooperation; elevates machine-like efficiency as a deity to the detriment of human compassion; prizes the pursuit of personal wealth over the promotion of the common good" (Steger in Gangale, 2003:14).

In stark contrast Winston Halapua (2003:83) describes the epistemological underpinning of the hypo-modern world.

> "Waves express the rhythm of the *moana*. Waves embrace the diversity and differences of sizes and contours. In the eyes of Oceanic peoples the waves are linked to other waves. The waves, which dance to the generous rhythm of the *moana,* dance in company with waves over the horizon. Waves follow one after another. Unceasing, relentless, embracing, they give and give and give. Energy that is the result of constant interaction with the wind and the heavens is released freely. As metaphor the waves of the *moana* speak of immense generosity and reciprocity".

Diaz clarifies "the difference between hypo and hyper modernity – hinging on tempo – is not merely one of essential opposition but of context and situation, for both are forms of engaging modernity with materiality outside of it ... I dwell instead on those aspects of indigenity that not only precede, and exceed, but more importantly, choose ferociously to engage modernity, but on native epistemological and cosmological terms that privilege a steady, slow, deliberate pace" (Diaz 2001:1).

As Hau'ofa (2000:454) has already argued "in order for us to gain greater autonomy than we have today and maintain it within the global system we must … be able to define and construct our pasts and present in our own ways". This does not mean that all Oceanic heritage, traits, and characteristics are positive or empowering or of future value. But all need to be considered and given cognisance. Huffer and Qalo (2004:98) caution the wastage of past 'development' and aid programmes that failed to heed this basic advice of allowing recipient societies to take "the time and opportunity to articulate their own approaches to the world and its multitude of developments". Unaisi Nabobo (2002:45) found similarly within

[20] Gordon Gekko is a character in the 1987 film *Wall Street* and its 2010 sequel of the same name, both directed by Oliver Stone.

the field of education, suggesting that Pacific educators must "redefine paradigms of thoughts and explore Pacific worldviews and then take cognizance of these". She concluded, "The coconut tree must be allowed to live with the computer tiger", that is, the knowledge symbolized by the coconut tree with its multitude of uses, which considerably enrich the community, must not be discarded in favour of technological, economics-driven, and individualized or commoditised knowledge".

Oceanic temporal relationships also bear little relationship to western models of measured, steady, remorseless progression from historic but dead past to ever developing and more knowing future. Blaut (1993) has argued that such progressive, Eurocentric world-views are based on a diffusionist myth where only a very limited number of communities are inventive, and over the past millennium, the inventions that have counted historically have originated from Europe: medieval technologies, the state, capitalism, world discovery, the first industrial revolution. In this 'tunnel history,' everything dynamic comes from 'inside' Europe and the West. The 'outside' is passive and inert (Clifford, 2003).

In contrast, Oceanic knowledge of the past is continually used to adjust to cultural and natural changes (Liston, et al, 2011). Many Pacific cultures echo the Hawaiian view of time where the past is referred to as *Ka wa mamua*, or 'the time in front or before' whereas the future, when thought of at all, is *Ka wa mahope*, or 'the time which comes after or behind'. Such orientation is eminently practical, for the future is always unknown, whereas the past is rich in glory and knowledge (Kame'eleihiwa, 1992). Oceanic time has no single, violent direction, but loops resourcefully between present dilemmas and remembered answers (Clifford, 2003).

The suggestion that valuable lessons for the future can be learned through examination of traditional past Oceanic practice is not new to development literature, for example Clarke (1990), Overton (1994), and Couper (1973:247) who offered specifically in relation to sea-faring: "It is in turn essential for those who wish to help Pacific island communities, to acknowledge that they will achieve far more by seeking first an understanding of the social organization and social geography of Pacific seafaring than by continuing with policies based on Eurocentric ideas of the sea business, and virtually ignoring the wealth of the maritime heritage of the Pacific islanders".

More recently there has been a wealth of work exploring the role of traditional knowledge

across various disciplines. For example, Randy Thaman, whose lifetime work on relationships between western and oceanic ecological knowledge is legend, considers that "we need the knowledge of the past in order to see how things have really changed". Speaking in regard to current fisheries knowledge Thaman goes further than suggesting that traditional knowledge may be a useful adjunct to science. "Current scientific surveys are useful but cannot give accurate long-term data on what marine ecosystems and fisheries used to be and what they could become and traditional knowledge maybe the key to such understanding" (*Wansolwara,* October 2012).

Sea-transport, traditional knowledge, cultural pride, and understanding seem inextricably linked and are viewed as such within the context of this research. Every attempt has been made to explore and build on these linkages. None of the above should be read as an un-blinkered glorification of a perfect past record. And it is freely acknowledged that tradition and culture are undergoing change and modification at an unprecedented rate. Customary roles and duties are less clear and effective in Fiji today. The traditional tenure system and resource management strategies, for example, have experienced gradual erosion due to the impact of 20th century colonisation (Govan, 2009:25). While traditional roles and resource-use systems within the communities are still well-defined, leadership structures, protocol, respect, practices, and beliefs are changing and are increasingly questioned by the people (Vunisea, 2002). As the research reported in Section 6.4 demonstrates in regard to current Fijian cultural knowledge of *drua,* the status of traditional knowledge held culturally is fragile and highly vulnerable. Desperate urgency is needed if this knowledge base is not to be submersed forever beneath the growing tide of modernity and globalisation.

2.2. Adaptation as Priority, Resilience as Focus

> *"Adaptation and mitigation are among the processes that have underwritten the survival of societies of mid-Ocean islands like these for generations (Johannes 1981, Nunn 2007). They are not new"* (Nunn, 2010a:242)

> "*Pacific communities face no option but to adapt if they are to build a resilient future*" (Maclellan, 2012:6)

Responses to climate change are commonly grouped under two headings: mitigation, either

by sequestration of emitted material[21] or reduction of emission quantity or effect; and adaptation, measures to allow change to the effects of emissions. Both are considered in this section in the context of sea-transport, as is the related concept of social resilience, the ability of community (however defined) to maintain well-being in the face of change. Regionally relevant climate change approaches and programmes are discussed, highlighting the invisibility of sustainable sea-transport, and the Asian Development Bank's programmes used as a case study, given its prominent profile in resourcing regional infrastructure initiatives.

Sea-transport is central to most aspects and most levels of Oceanic society. Current options are increasingly unsustainable at all levels of sea-transport service but particularly at domestic and local levels (see Section 4.2). Sustainable sea-transport is currently invisible in the development literature of the region generally and in mitigation/adaptation strategies for climate change in particular. Despite the current profile (or lack of it), measures to encourage, provide or otherwise empower alternative sea-transport options for Oceanic communities, where these result in more effective and efficient service provision and especially if they result in community-based systems, are likely to have measurable positive effects on enhancing local resilience (see Sections 4.1 and 5.4).

This section embeds sea-transport within the climate change debate and argues that sustainable shipping initiatives, in the context of Oceania climate change response, should be viewed as adaptation measures as opposed to mitigation, the compartment to which they are generically consigned globally, if considered at all, by donor and development agencies. Labelling it in this manner obscures the real nature of sea-transport in this region and restricts the potential for effecting change in the industry. Rather than being considered a priority for attention, it is currently marginalised at best.

Others disagree with this view. Several recent reports consider mitigation of emissions should be pursued as an objective by Oceania countries. By way of example, UNISDR, UNDP (2012:iii) states: "while climate change mitigation initiatives undertaken by Pacific Island Countries will have insignificant consequences climatologically, they should nevertheless be pursued because of their valuable contributions to sustainable development" (see also ADB, 2010a; Burson et al, 2010). This approach is discussed later in this chapter.

[21] Sequestration is not considered further in this thesis.

This thesis contends that sea-transport is a 'cross-cutting issue' across regional development and climate change agendas. Increased sustainability of sea-transport is a key, albeit a poorly recognised one, to building community and national resilience. Consideration, followed by adoption if proved viable, of alternative technology options should be pursued as 'soft technology' or 'no regrets' adaptation interventions (as discussed in Barnett and Campbell, 2011:179; Elliot and Fagan, 2010:80; USAID, 2010:32). Reliable data with which to calculate the proportion of the region's fuel budget that is maritime bunker is not available; the best reference is that it is a 'significant' contributor to the 48% of the region's imported fossil-fuel used for transport (Mayhew, 2011a). For some Pacific countries it can be as high as 75% of all fuel used (Mayhew, 2011b). Regional and national fuel dependency and footprints are discussed in more detail in Sections 4.2 and 5.3.

It is argued in Sections 4.2 and 5.4 that external resourcing of an evolution in shipping technology for Fiji/Oceania will be necessary, initially at least until its economic viability can be practically demonstrated. In an Oceania context such viability requires cognisance of the current fleet being comprised largely of old, second-hand assets. A calculated risk investment in prototype models of new vessels and operational structures will be needed. It unlikely that either PIC governments or commercial interests will invest in the necessary research and development, let alone new asset purchase, without external assistance; at least until the technology and its application is proven and even then there will be hesitation[22]. International adaptation pledges to support a 'no regrets' adaptation presents as the most appropriate source of resourcing for this sector, although as described below, is difficult to access as such.

For evolution to sustainable sea-transport to be fully effected to greatest potential, a best case scenario, a region-wide, cross-sector, and cradle-to-cradle approach is required, incorporating all aspects of at least domestic shipping with sectors and assets supplied internally within the region wherever possible. This extends not only to the vessels and their trading enterprises, but construction, maintenance, training, shore services, support services and research.

Ideally the research programme needs to be across all shipping sectors (including freight,

[22] However, if they did this would be an example of 'autonomous adaptation' (see Table below). While there is recognition generally that most adaptation to date is 'autonomous adaptation' undertaken by individuals, households, communities, and businesses (USAID, 2010:33), there are unique barriers for any investment in shipping in this region (see Section 4.2).

ferry, and fishing) and involve aspects of economics, carbon balance, and marine/atmospheric pollution, sociology, governance, engineering, history, etc. Consideration of policy and regulatory frameworks at all levels will also be necessary. It is an ambitious agenda and one that is unlikely to be addressed through one-off or short-term pilot projects. A long-term coordinated programme involving multiple and diverse stakeholders is called for and this will continue to be difficult to achieve while local sea-transport continues to be ignored, viewed in isolation, or viewed only in terms of its contribution to global emission profiles.

Given the global inertia in sustainable shipping development, especially for SIS or developing world application (Section 4.3), there appears no reason at a conceptual level why Oceania should not be the first region to attempt to provide leadership, although numerous practical barriers exist. It can be argued that it is the region of greatest need even if quantitatively, relative to a global scale, that need is small. The case for why Fiji presents as the prime option to centre such an initiative is set out in Section 5.4.

Both the cost of and need for sea-transport are unlikely to diminish in the region; the greater the extent that both can be internally met sustainably, the greater the resilience built. The contention of this thesis is that sea-transport should be a priority target for adaptation funding in local, national, and regional responses. That it has not thus far been identified by Pacific decision-makers appears largely because it has never been fully researched and advocated for as an attainable option, and not because it has been demonstrated to be too high a risk or too low a priority. The failure to adequately characterise and prioritise it to date makes it increasingly difficult to do so retrospectively, as many donors, agencies, and governments have already determined their overall operating frameworks and priorities for intervention.

A short section is included below on the current trends in climate change adaptation funding in this region. Literature is thin but increasing and supports a picture of much of the dedicated funding now coming on stream as difficult to access for direct community and practical application for a range of rationale; including the complexity and range of the various institutions and related bureaucracies charged with both allocating and administrating or receiving such funding, the complex problem of matching regional needs and priorities with externally dictated objectives, and the difficulties with distinguishing between climate change prompted funding and more conventional assistance delivery. Despite being increasingly documented and identified, however, whether such illumination will translate into concrete actions is not so clear. Sustainable transport generally and sea-transport in

particular, has yet to make the cut.

2.2.1. Global Warming/Climate Change

This section is prefaced by clarifying the assumptions made with regard to climate change. Climate change is a generic term commonly adopted globally[23] as shorthand to describe the multitude of changes likely to eventuate as a result of the emissions of GHGs to the atmosphere, including sea-level rise, global warming, and ocean acidification. The overwhelming global evidence and consensus from scientists, researchers, and policy makers is compelling; climate change is real and happening now, is anthropocentric, and current IPCC projections of effect are likely to be conservative and understated. Climate change is current, cumulative, and increasing.

Extrapolating from the paleontological and biological record, Barnosky et al (2011:51) have well summarised the now apocalyptic potential of GHG emissions and global warming which combined with "habitat fragmentation, pollution, overfishing and overhunting, invasive species and pathogens (like chytrid fungus), and expanding human biomass are all more extreme ecological stressors than most living species have previously experienced. Without concerted mitigation efforts, such stressors will accelerate in the future".

Global warming is a symptom not a source. GHG emissions are simply the fumes from the exhaust pipe of the global 'development' engine that originates with European-led colonisation and industrialisation and has now culminated in our addiction to a resource-hungry and increasingly destructive consumption-driven and fossil-fuel powered global society which greatly privileges the wealthy and 'developed' over all others (see for example Sachs, 1992). Global warming and global inequity are linked, as global warming exacerbates poverty. As the Stern review (2006) noted, global warming is the historic responsibility of a few rich countries who have produced 70% of all carbon dioxide emissions since 1850.

The following four statements accurately summarise the current global situation:

a) "The basic matter, however, is not one of economics. It is a matter of morality – a matter

[23] Oreskes and Conway (2010) have detailed how the global signifier 'climate change' replaced 'global warming' as a softer label at the behest of a US neo-conservative agenda. I considered universally reverting to the early signifier throughout this thesis but like the term 'canoe' it is now such a universally embedded misnomer as to defy deletion.

of intergenerational justice. The blame, if we fail to stand up and demand a change of course, will fall on us, the current generation of adults. Our parents honestly did not know that their actions could harm future generations. We, the current generation, can only pretend that we did not know" (Hansen, 2011: 22).

b) "We have, at best, this decade to make critical decisions about decisive action" (Merson, 2010).

c) "Passionate corporate and conservative foes of curbs on greenhouse gases are right in asserting that a meaningful response to global warming would be a fatal blow to free markets and capitalism" (Klein, 2011[24]).

d) "The blunt truth about the politics of climate change is that no country will want to sacrifice its economy in order to meet this challenge" (Tony Blair, 2005[25]).

The issues are immediate and the global literature on climate change is broad and well-established and is not debated further here. Climate change is already having, and will increasingly have, severe and unique impacts on PICs. The people of these nations are among the world's most vulnerable to changes in ocean characteristics (especially levels and acidity), rainfall, and extreme weather events (Barnett, 2001; Barnett and Campbell, 2011; Burson et al, 2010). Maclellan (2012:12) advises that communities are already feeling the effects of climate change across Oceania in "food supply, nutrition, health, education, livelihoods, and social cohesion".

Whether one agrees with this pessimistic view of the global capacity to respond, even if global GHG emissions can be reduced, sequestered, or otherwise mitigated in the future, the effects of past emissions are unavoidable and therefore require adaptation to be taken now. I concur with Hansen, it is a moral argument, and the region of Oceania holds the moral high ground[26]. Oceania should not have to ask for a sustainable and locally affordable sea-

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[24] Naomi Klein quoted by Revkin, Andrew 'Naomi Klein's Inconvenient Climate Change Conclusions', *New York Times*, 7 December 2011.

[25] Tony Blair quoted by Revkin, Andrew 'On Climate Change, a Change of Thinking', *New York Times*, 4 December 2005.

[26] Especially when physical ground is only 3-5 metres above sea-level as is the case for countries such as Tuvalu and Tokelau.

transport future; the industrial and emitting world should offer whatever support is necessary. "In small island developing countries with very low emissions, such as those in Pacific, developed countries should provide all funding for mitigation actions" (Elliot and Fagan, 2010:69) and, it is argued in this thesis, adaptation.

The terms 'mitigation', 'adaptation' and 'resilience' have entered the climate change discourse over the past decade, as 'sustainability' emerged after the Brundtland Report in 1987 and the labelling as 'developed/undeveloped' following Harry Truman's coining in 1949 (see Sachs, 1992). As with those terms, these new signifiers have been borrowed from other theatres, are commonly used, but are often poorly characterised or agreed.

2.2.2. Mitigation and Adaptation

The IPCC considers 'climate change mitigation' as an anthropocentric action to decrease the intensity of radiative forcing in order to reduce the effects of global warming, generally by reducing GHG emissions and enhancing sinks through technological change and substitution. Adaptation to global warming, conversely, involves acting to tolerate the effects by reducing vulnerability of natural and human systems (Verbruggen et al, 2007). In broad terms, mitigation tackles the causes of climate change, adaptation the effects of the phenomenon.

From this broad base mitigation can be further dissected or categorised and each new report seems to have developed or adapted a new framework for doing so, but all are broadly similar. For example the OECD (Corfee-Morlot, 2009:6), break down mitigation support for developing countries to encompass both "mitigation specific" and "mitigation relevant", as well as private and public pathways of assistance. "Mitigation specific support" aims to achieve GHG mitigation in developing countries as its main objective whereas "mitigation relevant support" is defined to include funding for development in key sectors that will shape emissions in developing countries and thus mitigation potential. The IPCC also note that "regional differentiation is important when addressing climate change mitigation – economic development needs, resource endowments and mitigative and adaptive capacities- are too diverse across regions for a 'one-size fits all' approach" (Rogner et al, 2007:97)[27]. Because transportation and electricity energy networks are the two big global contributors to climate change, sea-transport, when considered at all, tends to be viewed as a 'mitigation issue'.

[27] This should be borne in mind when considering the ADB case study below. In a 'region' that includes much of continental Asia alongside all of Oceania, the only focus on shipping is in regards to inland waterways.

Other organisations have developed shorter working definitions of adaptation. For example, ADB defines adaptation as "adjustments to reduce costs and vulnerabilities, based on anticipated climate change impacts" while the World Bank defines adaptation as "efforts to protect against climate change impacts" (USAID, 2010:31). Adaptation can also be, and is, further categorized. By 2001 the IPCC was already distinguishing between anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation.

Adaptation strategies can be diverse in range and scope. At the extreme edge is the potential for migrations of entire Pacific nations to new (and potentially radically different) homelands (e.g. Burson et al, 2010). Barnett and Chamberlain (2010:54) raise the bar by defining adaptation to mean "a response to avoid or adjust to an undesirable outcome such that people are not worse off". To suggest that for adaptation to be successful or warranted it should achieve zero decrease in well-being appears a lofty but desirable ambition. And yes, global warning looks increasingly to lead to the loss of entire homelands, potentially within short timeframes. Such victims need and deserve priority attention and uninhibited support for what must be the greatest challenge for any culture short of genocide. But in the interim, and for non-atoll communities where the inability to maintain occupancy is unlikely to be as extreme, the need for reliable and affordable sea-transport can only be predicted to increase. While this thesis anticipates that successful adaptation intervention for shipping will lead to an overall increase in well-being and resilience at multiple levels, continuing to commit Oceanic communities to a BAU fossil-fuel propelled future can only lead to a rapidly decreasing trend.

The paradox of arguing for adaptation was well summarised by Sean Batten, Director Climate Change Policy for AusAID: "working with PICs, it is clear that climate change adaptation – if it is to be considered – must be integrated into concerns in priority sectors and development issues, which are rarely identified as climate related" (Lebel, 2011:25[28]).

Long-term integrated programmes of change for many critical sectors have yet to materialise. Some senior commentators have been blunt in laying the blame for this with the conservative nature of the powerful regional development agencies. The following by Nunn (2010a:233-234) is typical: "There has been a failure on the part of most regional agencies serving the Pacific Islands to develop proactive plans independent of either international or national

[28] Ironically but predictably, sea-transport is not mentioned in Lebel (2011).

agendas that take into account *either* the special needs of Pacific Island nations *or* the importance of developing adaptive solutions that acknowledge their singular cultural and environmental contexts. Instead such agencies have been largely reactive, uncritically imposing the priorities of international organizations on Pacific Island nations and focusing on short-term pilot studies rather than mainstreaming the lessons learned from these". I contend this trend includes sea-transport.

One of the traps of short-term projects is that there is seldom room for error or for learning from mistakes. A pilot project that set out to prove, for example, a particular vessel type or a particular situation or scenario – as we initially proposed for Solodamu – that then did not perform to expectations or failed outright runs a high risk of 'poisoning the well' for other related initiatives. The potential for learning by doing is highly restricted, if not lost, under a pilot project-by-pilot project approach.

Several key agencies have now developed adaptation strategies for the region. USAID (2010:32) provides a summary of the various nomenclature now in common use (Table 1).

Table 1 Adaptation Concepts (adapted from USAID 2010:32)

Planned adaptation	Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.
Autonomous adaptation	Spontaneous adaptation to address a specific vulnerability element, taken by the individuals or private entities uniquely impacted by the element.
No regrets adaptation	Adaptation options (or measures) that would be justified under all plausible future scenarios, including the absence of man-made climate change.
Maladaptation	An adaptive response, made without consideration for interdependent systems that may inadvertently increase risks to other systems sensitive to climate change (and important to social well-being).
Climate-proofing	Enhancing resilience to and reducing the risks posed by climate change; e.g, improving the ability of infrastructure to withstand floods and cyclones.
Climate resilience	The capacity of a system, community, or society potentially exposed to hazards to adapt by resisting or changing in order to reach and maintain an acceptable level of functioning and structure

The 2010 USAID report considers that adaptations can be divided into measures to reduce exposure and/or sensitivity and measures to increase adaptive capacity. They call for emphasis in the near term on 'no regrets' interventions which can be justified in terms of meeting development objectives and responding to climate risks. They are referred to as 'no regrets' because implementation is beneficial even if magnitude and timing of future climate change is different to that expected. I concur with both the approach and the emphasis.

2.2.3. Resilience

The term resilience is used to describe the capacity of a social-ecological system to deal with fluctuations or perturbations before shifting to an alternate state (Hughes et al, 2005) and has come to us from ecology. Resilience is discussed primarily in association with ecological resilience by related scientists and in regard to social resilience in terms of concepts such as adaptive management (see particularly Berkes et al, 2000). In ecology, resilient systems are adaptable, flexible, and prepared for change and uncertainty (Gunderson, 1999; Hughes et al, 2005). Despite the apparent appeal of resilience as a framework for sustaining human-environment relations and the theoretical advancements in the field (Gunderson and Holling, 2002; Holling, 1973; Olsson et al, 2004) natural resource managers do not explicitly apply this concept very often (Adger, 2000; Colding et al, 2004; Folke, 2003; Olsson et al, 2005), although it is gaining greater traction through climate change literature. Resilience is often complex, context specific, and highly dynamic, qualities that make it hard to develop general tools and methods of application (Berkes and Folke, 1998; Kallstrom and Ljung, 2005; Walker et al, 2002; as discussed in Burson (ed), 2010).

The Pacific's successful human history; millennia of colonization, founding and entrenchment and expansion of numerous cultures, and an extreme ability to survive and adapt (all in the face of sometimes minimal natural resources and regular environmental change) appears to challenge the widely-held view of islanders as dependent and passive. This history of adaptability and resilience has much to do with a common Oceanic attribute of not seeing culture divorced from nature or environment divorced from economics or politics. "In Europe the Nature-Culture distinction is an academic one. In Tonga the two aren't opposed. Rather there is an emphasis on their connection. Culture is a selection and a manipulation of Nature on a variety of levels, e.g. at the physical/natural level and at the behavioural/mental level. Considered at the second level, Culture is a transformation of natural elements to fit them to human needs, especially for economic and political human

interests" (Helu, 1991).[29]

Resilience has been used in relation to describing inherent cultural capacities of Oceanic communities now for some time. For example, from Bayliss-Smith (1988:283); "when viewed as societies rather than as ecosystems, the small islands of eastern Fiji have shown themselves to be exceptionally resilient". As Barnett and Campbell (2011:165) point out, that study reached the critically important supposition that "social and economic processes on islands are not distinctively different".

A generation later I came to the same conclusion in Solodamu (Section 4.1). While such communities are undergoing increasing change, matters of commerce and politics are still strongly culturally bound and all are intertwined. Various observers strongly suggest that maintenance of traditional knowledge and cultural structures are powerful resilience strategies that should be harnessed in light of the climate change challenge (e.g. Barnett, 2001; Barnett and Campbell, 2011; Maclellan, 2012). Nonetheless, the inability to adequately distinguish between or adequately accommodate both *vakavanua* and business imperatives, places such communities, for all their cultural and traditional strengths, at distinct disadvantages when it come to establishing commercially-viable transport services at a community level in a modern operating environment. While the greatest community of need can be identified as being at village level, the logic that intervention and solutions should therefore also be centred at this level, as commentators such as Barnett, Campbell and Maclellan strongly argue for, is not clear (see Sections 4.1 and 5.4).

2.2.4. Adaptation and Mitigation in an Oceanic and Sea-transport Context

Adaptation as the priority for Oceania has been clearly marked by commentators for at least the past decade. Barnett (2002:31) argued: "ultimately, environmental security for Pacific people requires human and institutional development policies that increase and complement the existing abilities of those people to do what they have always done with considerable success — adapt to change". There has since been the contribution of global voices such as the Stern Review (2006) that adaptation policy is crucial, under-emphasized and the only response available for the impacts that will occur over the next several decades. Delivery in Oceania is proving slow to arrive, difficult to implement and inadequate. The comprehensive Oxfam study of Pacific responses (Maclellan, 2012) confirms that there is only partial

[29] Helu, F, 1991, Lecture to Catholic University of Nijmegen on 1 November 1991.

coverage of the issues necessary to address, though paradoxically sea-transport again fails to rate mention in that study, even in the excluded response category.

In Oceania, Pacific leaders have identified climate change as the priority threat facing the region (see Section 4.2). "Pacific country leaders have long called for coordinated and concerted support by development partners. However, to date, the response has been limited and fragmented" (ADB, 2010b:v). Within the context of climate change debate (as with most other global contexts) Oceanic states are usually portrayed as small (minute), isolated, vulnerable, fragile and relatively powerless. Alternative perspectives, as discussed in the previous section, have largely yet to percolate outside of the region.

Much of the global concern about the climate change impacts in Oceania is based on the potential plight of atoll dwellers, a view that is often expanded as representative of the whole region. While such concerns are real and pressing, this narrow definition of the region ignores the wide diversity of Pacific islands and the nature of related effects, although it has proved useful as a means of leveraging global visibility and attention. Barnett and Campbell (2011) use a 'Davids and Goliaths' analogy and point out that any resultant support gained has yet to result in either global action to reduce emissions or large-scale action to provide effective adaptation strategies in Oceania. They further suggest that "representations of the Pacific Islands as extremely vulnerable may have created the illusion that adaptation is pointless, and have denied the resilience, agency, capacity, and potential that Pacific Island communities have and which could be useful elements of an adaptation response" (Barnett and Campbell, 2011:155).

Climate change is but one of a long list of environmental challenges facing the region (a list which includes a wide ambit of environmental degradation, invasive species, over-fishing, pollution of freshwater sources, etc), and effects of these are also large and priorities. Randy Thaman (2002, 2004, 2007, 2008) is currently at the forefront of a large choir of those who have regularly documented the region's environmental decline and increasing vulnerability and stridently called for action. But it is the scale and irreversibility of the effects of GHG emissions, combined with the total inability of any local measures to mitigate or reduce the problem that makes climate change a threat over and above all others. Whereas it can be argued that Pacific Islanders have historically shown strong resilience and adaptability traits in the face of environmental threat and change, the immensity and immediacy of the threats posed by climate change suggest these attributes will be insufficient to adapt (Barnett, 2002).

The impacts of climate change diminish human security by undermining rights to a secure life and livelihood, food, water, health, and shelter. Culture and traditional ways of life are also threatened. By failing to tackle climate change with urgency, developed countries are violating the human rights of millions of the world's poorest people, including people in the Pacific (HREOC, 2008; Elliot and Fagan, 2010:61). The uniqueness of the Pacific (ocean-centred, non-continental, scattered landmasses, village-dominated, culturally rich but economically poor) would suggest that such adaptations will need to be tailored to Oceanic needs and conditions to prove effective and durable. Barnett (2001) cautioned more than a decade ago that continental-centred or focussed solutions may prove inadequate or highly inappropriate here. The same failure is still causal today in Oceanic priorities, such as sea-transport, failing to be registered or addressed.

Some representatives of the SIDS in the Alliance of Small Island States have been critical of the increasing focus on adaptation in international negotiations, arguing that this downplays the need for urgent mitigation action by industrialised states to cut their GHG emissions and take responsibility for avoiding further, more extreme climate impacts (Elliot and Fagan, 2010:68).

I take a counter position. Mitigation surely is not a responsibility or a sacrifice that Oceania should bear, no matter its considerable propaganda appeal on the global stage. Speaking to the December 2008 global climate change conference in Poland, Tuvalu's Prime Minister Apisai Ielemia stated: "We need a new arrangement for least developed countries and Small Island Developing States to pursue a low carbon future. We need strong international assistance to allow us to develop and deploy renewable energy and energy efficiency technologies so that we are guaranteed energy security. We cannot afford to be held hostage to continual leaps in the price of imported fuels"[30] (see also Maclellan, 2009 for more detailed discussion). Ielemia makes no mention of requiring such assistance to reduce Oceania's minimalist GHG emissions; his concern is much more practically orientated. "Every PIC has an interest in the use of renewable energy to reduce the costs for government revenue and assist household budgets for rural villagers" (Maclellan, 2007:16)

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[30] Quoted in *Island Business*, http://www.islandsbusiness.com/islands_business/index_dynamic/containerNameToReplace=MiddleMiddle/focusModuleID=19703/overideSkinName=issueArticle-full.tpl retrieved 22/11/2012.

Oceania's contribution to GHG has been estimated by SPREP (Hay, 2012) at 0.03% of global totals, others claim 0.06% (Elliot and Fagan, 2010). Any steps taken by PICs to reduce their meagre emissions as mitigation to a global problem will be at best symbolic, not matter how successful. This may be a valid strategy in terms of highlighting and galvanising response, especially given that Oceania is likely to be more greatly and soonest affected. Although mitigation initiatives undertaken by PICs will have no impact globally, it allows full moral leverage to be gained when negotiating for either priority or financing. While PICs' access to resourcing proffered as mitigation assistance may be the most practical means of accessing climate financing, it is a roundabout and dishonest route. In an Oceanic context, and particularly when this is applied to domestic capacities, the rapid and priority introduction of alternative options for sea-transport to the current fossil-fuel ones should be correctly identified and addressed as adaptation measures.

Even if the above analysis is shown to be incorrect, sea-transport clearly fits within agency versions of mitigation strategies in any regard. The ADB (2010:3) consider three types of mitigation activities and investments can be targeted for PICs: (i) mitigation activities that have strong synergy with adaptation, or in which both adaptation and mitigation objectives are simultaneously advanced; (ii) those that contribute to the sustainable development of the country (particularly in energy and transport development) and mitigate GHG emissions, but which would not be financially viable unless proactively supported (for example, through facilitating access to carbon financing); and (iii) those that are capable of producing significant net benefits on their own, over and above any potential benefits to the climate, and thus are considered 'no-regrets' investments. Sea-transport clearly fits within all three.

It is the level of dependency on imported fossil-fuels, and related issues of price and security of supply (see Section 4.2), that make the region's use of fossil-fuels critical, not the consequences of their incineration on the environment. Paradoxically, reducing this dependency in the area of sea-transport, where all current options are fossil-fuel based, by adopting alternatives as a cost/dependency cutting measure appears likely best achieved through adoption of low-carbon vessels and technologies. Currently, globally sanctioned mitigation pressures to reduce sea-transport emissions are likely to ultimately penalise PICs. As seen in Section 4.3, IMO-led regulatory processes to reduce SO_X in bunker fuels will lead directly to greatly increased costs to PICs for no significantly measurable reduction in global emissions. While there have been commitments made by IMO at a policy level to develop a

compensation mechanism, it has yet to be designed or agreed and successful delivery is by no means guaranteed.

Furthermore, if sea-transport is a central need of many Oceanic communities and at all levels, almost any adaptation strategy that seeks to enhance local resilience or increase adaptive capacity of communities is going to be affected by the effectiveness, availability, and cost of sea-transport. There are few examples of adaptation related projects (or any aid, development, or conservation project for that matter) in any of the current agency strategies that do not include some aspect of sea-transport. For many, sea-transport costs are significant budget lines. There is a fatalistic nihilism and contradiction inherent in the suggestion that adding to global emissions is a necessary evil to implement programmes that will in turn allow communities to avoid or resist the worst consequences of increasing emissions.

2.2.5. Current Climate Change Adaptation Programmes

The remainder of this section examines briefly various relevant funding agency programmes. In addition to the mainstream bodies, such as ADB, UNDP, AusAID, EU, etc., most prominent NGOs also have climate change programmes of varying size. The literature is again thin; there is more written on identifying vulnerability concepts for islands than addressing the issues. The recent history of climate change response across the Pacific by governments, regional organisations, and the principal funders, including a synoptic summary of the various regional and country programmes is given in Barnett and Campbell (2010). The major regional development agencies have all commentated recently through various reports although their texts need to be read against the grain (see Nicole, 2006), given their associated institutional and political filters.

In summary, despite some rhetoric, the concept of adaptation-focussed programmes did not appear here in practice until around 2008 and have now gained traction to be the priority of regional programmes. SPREP, USAID, and ADB have all produced regional plans for addressing climate change that are then criticised for being top down and insufficiently community/recipient focussed. While all reference the Pacific Plan, the overarching regional blueprint adopted by the Pacific Forum leaders, no work has yet been done to demonstrate whether integration under this framework has been achieved by the various agency strategies. Sea-transport is unmentioned in any, except in passing within a broad context of transport or infrastructure more generally. In recent funding rounds AusAID have considered transport in a climate change related context to be mitigation and therefore largely unworthy of funding in

the Pacific. USAID and ADB both see adaptation measures as being concerned only with future-proofing existing and future transport-related infrastructure (specifically roads, ports, and airports). As processes for these agencies to prioritise expected climate change related funding are now largely framed, the potential for accessing resourcing for additional areas of activity (such as sea-transport) is severely reduced.

There are major issues to address. PICs are frustrated by their perception that processes are agency and donor driven and that there are high degrees of overlap and insufficient collaboration between them. Nunn's concerns were cited above. Maclellan et al's authored Oxfam (2012) report is strident, citing World Bank reports on climate and disaster resilience in the Pacific, that openly acknowledge the problems of institutional rigidity of donor organisations hindering cooperation and making partnership more difficult and the general lack of interagency collaboration. A 2012 AusAID-authored assessment of multilateral agencies agrees there is a need to reduce the duplication of programmes particularly in regard to climate change. The 2012 Pacific Forum in Rarotonga saw increasing rhetoric amongst donor nations on the desirability of cross-country/cross-agency programme delivery but, again, this has yet to translate into on the ground demonstrations. Conversely, donor organisations point to the lack of capacity of recipients to absorb available funding, lack of capacity to extend into new areas, lack of flexibility to expand programmes, and a lack of transparency and accountability by PIC based recipients (Barnett and Campbell, 2010).

2.2.6. ADB: a Case Example

ADB has long been the principal loan source for infrastructure in the Pacific. Its Asia-Pacific region encompasses a multitude of diverse countries with a catchment of 1.8 billion people (ADB, 2010a), many with differing priorities and objectives to Oceania. Transport is one of the main sectors ADB supports, comprising 27% of all projected loans in 2010-2012, mainly for roads and railways. Water transport attracts less than 1% of this US$3.4 billion (ADB, 2010b:2).

In ADB's definitions, adaptation options are divided narrowly into "measures to reduce exposure (such as climate proofing of infrastructure, land use zoning, sector-level best practices such as selection of climate-resilient crops) and measures to increase adaptive capacity (e.g. strengthening disaster risk management capabilities, implementation of early warning systems, and maintaining healthy ecosystems" (ADB, 2010b:2). This falls short of

any notion of adaptation as a mechanism for PICs to build resilience through using low-carbon alternatives to current options or strengthening of internal resilience (be it at regional or local levels) through decreased dependency on external resources such as fuel.

During 2008–2009, ADB developed the 'Climate Change Implementation Plan for the Pacific' (CCIP) to address PIC identified adaptation and mitigation needs "in close consultation with Pacific Island country leaders". The key recommendation of the CCIP is to mainstream climate change issues into ADB operations in the Pacific region and individual PICs, by ensuring that (i) climate-related risks and vulnerabilities are adequately reflected in the country partnership strategies of PICs, (ii) all projects in the ADB pipeline are screened in relation to climate-related risks, and (iii) all infrastructure and other relevant projects are climate-proofed. The Pacific Climate Change Program (PCCP) will serve as the main vehicle to implement the CCIP in the Pacific.

The principal objective of the PCCP is to ensure the continued economic growth of PICs in the face of global climate change, by reducing their vulnerability to its risks and impacts and comprises a three-pronged strategy, the first two of which are: (1) immediate attention to fast tracking and scaling up climate change adaptation and mitigation investment; and (2) promoting renewable energy through new technology, and research and development. Both might be considered inclusive of alternative-energy sea-transport issues. But when one drills further into the PCCP, transport is a subset of 'energy', the last of six priority sectors. Under this heading ADB will consider investment in transport, "consisting primarily of (i) climate proofing of roads, ports, and airports; (ii) reduction of GHG emissions from transport through the use of clean energy in vehicles; and (iii) limited investments in alternative and cleaner fuels (for example, biofuels development)" (ADB, 2010a:7). Sea-transport *per se* is never mentioned; in fact the use of the descriptive 'vehicles' does not strictly include 'vessels' as a subset and so could be read to exclude sea-transport. At best it has not been considered. A case could be made to the Bank that it would qualify under "limited investments in alternative/cleaner fuels" but this is a long bow and in any regards, is again couched in terms of mitigation, i.e. reduction of GHG emissions, not as an alternative to fuel dependency or cost. In a competitive funding environment with multiple demands and priorities, sustainable sea-transport is by default placed in a heavily penalized position under the PCCP.

In 2007, prior to producing the PCCP, ADB released a regional study on Pacific shipping, a broad overview that included a Fiji case study. In general terms, its findings are compatible

with the summary provided in Section 4.2. It found that international level shipping is reasonably well catered for but there are large issues to resolve at domestic and local levels, complicated by the region's unique maritime profile. The concept of low-carbon or alternative-energy shipping is not considered throughout. The regionally collaborative successes through the Pacific Forum Line and the Regional Maritime Programme run under SPC are highlighted. There is as much or more attention given to shore-side infrastructure and administration as to ships and shipping. No solutions are suggested for the domestic shipping crisis, except to recommend greater privatisation of services.

After release of the PCCP, ADB produced its Asia-Pacific region Sustainable Transport Initiative (STI) in 2010. In the next decade ADB estimate the countries of Asia and the Pacific will need to invest US$8 trillion in infrastructure by 2020, with much of this being for transport. The STI will guide ADB transport investment and is a cross-sector strategy spread across economic growth, sustainable development, and climate change. The STI defines a sustainable transport system as one that is accessible, safe, environment-friendly, and affordable and one that incorporates multiple overlapping dimensions of sustainability.

While the situation varies from country to country, ADB's support for transport modes other than roads and railways has been very limited historically. Urban transport is the major future focus of the STI. It is acknowledged that air and sea-transport and ports have grown rapidly in the region. However, in the early 1990's, ADB largely phased out its support claiming the private sector was already performing effectively in these areas. ADB did continue to support a small number of members, including PICs "where aviation and ocean transport have a unique role due to limitations in land transport, generally linked to factors such as geography and low population density". Overall, bicycles and pedestrian infrastructure get more attention than sea-transport in the STI.

2.2.7. Who Pays and to Whom?

"The challenge to the region is to adapt to sustain their needs and rights and values, and the challenge to the international community is to reduce emissions to the extent that such adaptation is able to be effective, and to support communities in the Pacific to adapt in ways that they see fit. This is possible, and anything less is unacceptable" (Barnett and Campbell, 2010:184, emphasis added). The worm turns on the ill-defined use of the term 'they see' in this quote. If it is referring to Pacific communities then, as argued above, it is questionable

that they have ever been provided advice that alternative options in sea-transport scenarios are potentially available and, if so, at what cost and effort. If the 'they see' refers to the international community, then it is also clear that when viewed through the lens of proxies such as the major development agencies, 'they' have not seen fit to invest in even exploring alternative approaches to sea-transport as a regional priority thus far.

At the Copenhagen summit in 2009, there were initial but naive calls for OECD countries to pledge US$30 billion 'fast start' climate finance from 2010-2012, and long-term finance of US$100 billion a year by 2020, to assist developing countries with mitigation and adaptation (Maclellan, 2012:12). It was strongly argued that such climate finance should be a different form of funding to aid and that it needs to be additional to the 0.7% of GNI already pledged for ODA identified as necessary to meet the MDGs (Maclellan, 2012:6). Most international appropriations to date have been for climate change mitigation and it is not clear what proportion will be available for adaptation (Maclellan, 2012:45).

It has been estimated that between US$290 million and US$530 million is required in the Pacific just to complete the most urgent and immediate adaptation actions identified thus far (McGoldrick, 2007). The A$35 million Australia was due to spend in 2008/09 in the Pacific would not even cover the most pressing adaptation needs of three of the region's most vulnerable and least developed countries – Kiribati, Tuvalu, and the Solomon Islands.

Accessing this climate finance poses major challenges for Pacific countries (along with other developing countries), not least of which is agreeing that it is actually there to be accessed. The 2008 economic recession through much of the developed world has had a strong knock-on effect to ODA funding commitments generally. Climate change pledges from international conventions will also suffer. With austerity comes greater demand from cheque writers for cost savings, often paralleled by increased calls for transparency and accountability. Finance providers must address the complex array of funding mechanisms and their lack of coordination and also want to see good practice in the effective use of existing resources before they guarantee further significant funds, including contributions to the newly created Green Climate Fund. The recent Oxfam report (Maclellan, 2012) found a major focus of government officials is meeting the complex array of reporting and accountability procedures to donors, as opposed to their own government and communities.

It is increasingly important to document what climate funding is drawn from ODA budgets,

and what is considered 'new and additional' funding. Adaptation financing is distinct from ODA because of the origin of the responsibility – the funding required for adaptation is owed as compensatory finance from polluting countries to those most vulnerable to the effects of that pollution. It is not a generous donation from a well-endowed benefactor. Treaties such as the 1992 UN Framework Convention and the 1997 Kyoto Protocol, state climate finance for developing countries will be "new and additional". This distinction between climate finance and aid is crucial to avoid reduction in funding available for poverty reduction and development. However the term "new and additional" has never been properly defined and the uncertainty is becoming a major sticking point in global negotiations.

And of course, all of the above must ultimately result in real change for communities if it is to have any real meaning. NGO representation, such as Oxfam, regularly argues for resourcing of basic resilience programmes at the community level and points to the large percentages soaked up in administrating and reporting on such funds. Elliot and Fagan (2010:82) consider a "central principle must be that adaptation programmes must be consistent with the values, needs, and rights of affected communities. It is vital local communities are asked what support they need, rather than being told what they should receive".

Barnett and Campbell (2010:178) consider that adaptation "to be successful, needs to operate at the scale at which most of the important decisions about social organization are made. In the Pacific, this most often means at the level of villages". They go on to conclude "that community-based approaches are likely to offer the most effective approach to adaptation, as these can avoid the pitfalls of externally imposed and top-down projects which underestimate local capacities and ignore local particularities" (Barnett and Campbell, 2010:178).

Such sentiment is laudable and this rationale was a large driver for the initial focus of this research programme at the village level. In terms of sea-transport, constructing an argument that village communities, particularly rural and remote island ones, are obviously the greatest community of need is straightforward. But the corollary advocated by Barnett and Campbell and others, that they are therefore the obvious target level for effecting intervention is not so easily demonstrated. A vessel, whether a 30m *tabetebete* constructed *drua* of 1850, an island 50 tonne cutter in 1920, or a small freighter in 2010, is a large asset for any village to acquire, manage, and maintain. Not anyone could own a *drua*; they were the preserve of chiefs with resources and a skilled labour force to command. That has not changed today. As seen in Sections 4.1 and 5.4 we concluded that encouraging or coercing Solodamu to attain

ownership of such an asset would probably come at an unacceptable social and political cost to village decision-making and structures, unless accompanied by considerable external support. Intervention in this area needs to come, initially at least, at a level of community above that of village. If a provincially or nationally led revolution leads to village benefit, surely that is benefit to community at each of those levels.

The broad themes explored throughout this section are reiterated throughout this thesis. The next chapter addresses the methodological basis used for the research and reporting phases.

Chapter 3. Action as Method

This inquiry has been action-research based, specifically centred on a Naturalistic Inquiry framework (Lincoln and Guba, 1985) influenced by Pacific derivatives of Participatory Learning and Research (e.g. Tawake et al, 2001; Veitayaki, 2003) and employing *talanoa* (e.g. Halapua, S., 2003; Halapua, W., 2008; Vaioleti, 2003, 2006) and literature/internet searches as the primary field research tools. This chapter provides an overview and summary of each component.

Naturalistic Inquiry sits within the 'house' or 'family' of action research. It is entirely a western construct. It is a methodology I was trained in prior to setting sail on this ocean and is one I have familiarity with and am comfortable with. It shares commonalities with an Oceanic epistemological approach, a connection that has been made previously by Vaioleti (2006) and Farrelly (2009). As with my Master's thesis (Nuttall, 1998), I have attempted to marry Naturalistic Inquiry with a second action research approach, Participatory Learning and Action (PLA) which has been successively adapted by USP-led teams for use here in the Pacific (e.g. Aalbersberg et al, 2005; Tawake et al, 2001; Thaman, 2002; Veitayaki and South, 2001; Veitayaki et al, 2003). PLA, in this context, is an Oceanic method that has evolved since the 1980's from applied geography/resource management in reaction to the shortcomings of more conventional Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA) methodologies commonly used throughout development sectors. It stresses a grounded/practical learning through rigorous analysis of actions taken, underpinned by an emphasis on locally-led collaboration of multiple stakeholders and a bottom-up, village-by-village approach with 'experts on tap not on top'. PLA has been used in Fiji, as throughout Oceania, to underpin the community action-based FLMMA programme of community-based marine management (see Section 7.2). It is an approach many local communities have been exposed to including Solodamu, the starting point for this inquiry.

Talanoa is literally 'to talk about nothing' (Vaioleti, 2006) and in doing so, in an inclusive and metered manner, culturally moderated and refined over millennia of ocean rhythms, everything. *Talanoa* is an Oceanic method of exchanging information, considering/assessing/analysing issues and informing decision-making. Although the word may not exisit, it is used extensively, formally and informally, at most levels of Oceania community. I claim no specialist knowledge of *talanoa*, bar the impressions gained by osmosis and immersion over the past two decades. Like Naturalistic Inquiry it is non-

positivist, emergent, reiterative, and flexible. In my opinion, *mana* regulates *talanoa* in like manner to the trustworthiness stressed by Naturalistic Inquiry. *Talanoa* is a culturally-based oral instrument in contrast to the academic and written core of Naturalistic Inquiry. PLA can be thought of as a hybrid, seeking to marry the best traits of both to provide a workable and contemporary approach.

3.1. Methodological Approach to the Inquiry

Naturalistic Inquiry allows for research to be 'inquiry' based. Lincoln and Guba (1985:226) state "no inquiry, regardless of which paradigm may guide it, can be conducted in the absence of a focus". The initial focus of this inquiry was to explore and understand the opportunities and challenges to commercially-applied sail technology becoming a reality. Section 1.2 discussed the reiterative phases of refocusing that occurred during the research.

At its centre, the inquiry is primarily industrial – what is the future practical application of a technology[31] and does it meet any criteria of sustainable adaptation in the face of changing environmental, social, economic, and political environs? Dick advises that in the Pacific "sail technologies must be commercially viable if they are to be any more useful than wings for flying pigs" (in Couper (ed), 1989:168). I contend that we must go further than just economic considerations. For an alternative approach to current fossil-fuel powered options to be successfully explored, the full scope of potential constraints and barriers needs to be assessed. For this to happen cross-sectoral analysis is required, and this thesis advocates for use of a quadruple bottom-line reporting framework (see Sections 5.4 and 7.2).

Our experience at the village level in Solodamu was sufficient to demonstrate that, while the concept might be economically rational and environmentally obvious, it was exposed to risk of failure because of other factors. At the meso level the economics, even at the basic level explored in this study, also seem to bear at least sufficient logic to warrant serious investigation. Yet implementation has not been seriously explored or even suggested to date.

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[31] I have distinguished between commercial sea-transport and water-based recreation/sport using sail technology and not considered the latter. The global use of sail within the recreation/sport industry is enormous, both in terms of scale of use, advancements, literature, and capital investment. There are various linkages between the two that warrant further inquiry. For example the sail technology being developed for the largest alternative power commercial designs by Dykstra are evolutions of the superyacht *Maltese Falcon* rig, in turn inspired by the Schetner rig developed for commercial sail 40 years previously (see Section 4.3.3).

This suggests that the barriers are more than economic or commercial, and, although alternative vessel design work is still barely emergent, I have come to conclude that technological issues are not a primary barrier and are sufficiently proven to progress.

There are few markers in this research field. I started with some initial assumptions but little hard evidence. Even the initial direction was unclear; should it prioritise the technology, the economic analysis and modelling, or the socio-cultural or political setting, or the institutional frameworks and paradigms? I was starting from the micro and committed to the concept that ultimate benefit of intervention needs to be measured with this as the denominator, but I was not wedded to that being the only, primary or necessary focus. In all fields the literature was thin and often obscured. From the outset it was a case of finding often only a single source and then tracing the references and linkages exposed.

The methodologies favoured, Naturalistic Inquiry, PLA and *talanoa*, all allow for such an 'emergent' form of research and are, I contend, the most appropriate for application in an Oceanic setting. NZ university trained I was birthed in the former; as a professional I have worked extensively with practitioners of the next; as a Pacific sailor I have come to love and esteem the latter. I have always had difficulty with the perceived need to categorise, even rank such approaches, or place them on some sort of evolving continuum of learning. Naturalistic Inquiry has been described as a 'post-positivist' approach, *talanoa* might be described as 'oceanic' or 'indigenous', and PLA potentially as a 'hypo-modern' hybrid.

3.2. Action Research

I consider that research must have both demonstrated need and application to be morally justifiable. Action Research has wide acceptance within social research disciplines and within the Pacific research community. The literature is extensive. The following is a typical description: "action research is known by many other names, including participatory research, collaborative inquiry, emancipatory research, action learning, and contextual action research, but all are variations on a theme. Put simply, action research is 'learning by doing' - a group of people identify a problem, do something to resolve it, see how successful their efforts were, and if not satisfied, try again" O'Brien (2001:ii).

Considered initially an experimental, almost fringe, departure from mainstream reductionist and positivist methodologies, various guises of Action Research have come to dominate in

the social disciplines. A variant broad description from Gilmore et al (1986:161) describes action research as contributing "both to the practical concerns of people in an immediate problematic situation and to further the goals of social science simultaneously. Thus, there is a dual commitment in action research to study a system and concurrently to collaborate with members of the system in changing it in what is together regarded as a desirable direction. Accomplishing this twin goal requires the active collaboration of researcher and client, and thus it stresses the importance of co-learning as a primary aspect of the research process".

I prefer to conceive of O'Brien's 'problems' as 'issues' or 'challenges' and I find Gilmore's 'researcher/client' descriptive of the relationship an austere, clinical one but, in the main, the boot fits. The agenda on sustainable sea-transport being explored in this thesis arrives from identification of a need, followed by reiterative interventions by a growing collective of research partners and collaborators. This thesis research, employing appropriate and tested methods of analysis and reflection, has acted as a catalyst to provide an umbrella of framework and monitoring which in turn fed back into the advancing/expanding *talanoa*.

3.3. Naturalistic Inquiry

Naturalistic Inquiry is emergent-design based. In contrast to the conventional inquirer, who usually approaches a study 'knowing what is not known'; the naturalist adopts the posture of 'not knowing what is not known'. It is in its outputs that Naturalistic Inquiry causes most difficulty for positivist or conventional methodologies. Naturalistic process does not set out to produce a 'finding', but to "resolve the problem in the sense of accumulating sufficient knowledge to lead to understanding or explanation" (Lincoln and Guba, 1985:227). "It is to be expected at the commencement of the research that end products are difficult to specify … probably all that can be promised is advance in that understanding will be increased".

In this thesis I do not consider I am presenting 'findings' or 'resolution'. I consider I have played a spotlight of sufficient intensity on a central and hitherto largely invisible issue of priority to Oceania to warrant further and future prioritised inquiry. I have left sufficient soundings of the various reefs I have charted to enable a little surety of safe passage for the next wayfinder. In this era of hyper-modernity, of changeable environmental and economic weather, and of unpredictable political and cultural sea-states, I trust this is sufficient.

Naturalistic Inquiry as method was developed by educational psychologists working in

depressed, multi-cultural, urban USA 25 years ago. However, its central tenets hold across disciplines and time. The process of Naturalistic Inquiry builds, in turn, on the works of (among others) Schwartz and Ogilvy (1979) as well as previous works of both authors (Guba, 1978, 1981; Guba and Lincoln, 1982; Lincoln, 1981) and the grounded theory methods developed by Glaser and Strauss (1967), later refined by Strauss and Corbin (1990).

Naturalistic Inquiry recognises at the outset that inquirer and inquiry are distinct but interdependent. It suggests "that the inquirer and the object of inquiry interact to influence one another; known and knower are inseparable" and "all entities are in a state of mutual simultaneous shaping so that it is impossible to distinguish causes from effects" (Lincoln and Guba, 1985:36).

Naturalistic Inquiry claims to be more than an alternative social science research framework; rather a paradigm shift from positivist approaches to research and understanding. It has close association with, for example, the post-positive, ethnographic, phenomological, subjective, case-study, qualitative, hermeneutic, humanistic doctrines, all of which it contends are separate doctrines of the same discipline in the same way that Catholic, Baptist and Lutheran are all subsets of Christianity.

Naturalistic Inquiry considers there are five central axioms of the post-positivist paradigm that separate it from positivist processes as follows[32]:

Axiom 1: the nature of reality (ontology). There are multiple constructed realities that can be studied only holistically; inquiry into these multiple realities will inevitably diverge (each inquiry raises more questions than it answers) so that prediction and control are unlikely outcomes although some level of understanding (*verstehen*) can be achieved.

Axiom 2: the relationship of the knower to known (epistemology). The inquirer and the object of inquiry interact to influence one another; known and knower are inseparable.

Axiom 3: the possibility of generalization. The aim of the inquiry is to develop an idiographic body of knowledge in the form of 'working hypotheses' that describe the individual case.

Axiom 4: the possibility of causal linkages. All entities are in a state of mutual simultaneous

[32] This list has been summarised from the methodology section of my Master's thesis (Nuttall, 1998), in turn adapted from Lincoln and Guba (1985).

shaping so that it is impossible to distinguish causes from effects.

Axiom 5: The roles of values in inquiry (axiology). Inquiry is value-bound in at least five ways, captured in the following corollaries: (1) inquiries are influenced by the *inquirer* values as expressed in the choice of problem, evaluand or policy option and in the framing, bounding and focusing of that problem, evaluand, or policy option; (2) inquiry is influenced by the choice of *paradigm* that guides the investigation of the problem; (3) inquiry is influenced by the choice of the *substantive theory* utilised to guide the collection and analysis of data and in the interpretation of findings; (4) inquiry is by the values that inhere in the *context,* and (5), with respect to the first four corollaries above, inquiry is either *value-resonant* (reinforcing or congruent) or *value-dissonant* (conflicting). Problem, evaluand, or policy option, paradigm, theory, *and* context must exhibit *congruence* (value-resonance) if the inquiry is to produce meaningful results.

Lincoln and Guba then supported these naturalist axioms with 14 characteristics of operational naturalist inquiry, justified firstly by their logical dependence on the axioms that underpin the paradigm and, secondly, their coherence and independence. They are:

1. Natural Setting: The inquirer (N) elects to carry out research in the natural setting and in a holistic manner.

2. Human Instrument: N uses himself, as well as other humans, as the primary data-gathering instruments due to the superior adaptability of the human instrument over others. All instruments are value-based, but only the human is capable of identifying and taking into account (to some extent) those resulting biases.

3. Utilisation of Tacit Knowledge. N claims the legitimisation of tacit knowledge in addition to propositional knowledge.

4. Qualitative Methods. N elects qualitative methods over quantitative (although not exclusively).

5. Purposive Sampling. N favours purposive or theoretic sampling over random or representative sampling.

6. Inductive Data Analysis. Inductive rather than deductive data analysis is preferred.

7. Grounded Theory. N prefers to have the guiding substantive theory emerge from (be grounded in) the data.

8. Emergent Design. N elects to allow the research design to emerge (flow, cascade, unfold) rather than construct it preordinately (a *priori*).

9. Negotiated Outcomes. N prefers to negotiate meanings and interpretations with the human sources from which the data has been chiefly drawn.

10. Case Study Reporting Mode. N is likely to prefer the case study reporting mode (over the scientific or technical report).

11. Idiographic Interpretation. N is inclined to interpret data (including the drawing of conclusions and identification of lessons learned) idiographically rather than nomothetically.

12. Tentative Application. N is likely to be tentative (hesitant) about making broad application of the findings.

13. Focus-determined Boundaries. N is likely to set boundaries to the inquiry on the basis of the emergent focus.

14. Special Criteria for Trustworthiness. N is likely to find the conventional trustworthiness criteria (internal/external validity, reliability, objectivity) inconsistent with the axioms and procedures of naturalistic inquiry. They are likely to define new, but analogous, criteria (credibility, transferability, dependability, confirmability) and devise operational procedures for applying them.

The issue of trustworthiness is crucial to the execution of the inquiry. Lincoln and Guba prescribe a thorough process where 'trustworthiness' is tested against the criteria of 'credibility', 'transferability', 'dependability', and 'confirmability'. In the case of my own programme, I have attempted to meet these criteria in several ways. I have lived, worked, and visited Fiji intermittently for nearly two decades and sailed much of its waters. I have existing networks of Pacific academics, resource management, and cultural experts who have provided introduction, guidance, tuition, and friendship. My family has spent many months at a time anchored off villages, including Solodamu. We had been invited into Solodamu to assist them in their planning for the future. We have shared joy and sadness. We have tried

to be honest and transparent about our activities, thoughts, fears, and plans at all times. We have never taken money, a factor that always complicates trust. We have tried to the extent possible to revisit the same subjects in multiple *talanoa* with a variety of stakeholders/participants in order to look at issues in a multi-facetted manner, the equivalent if you will of the historians' or navigators' use of triangulation.

Having established trust in one place, as the *talanoa* on sailing spread and took us to other communities, we took that trust with us. We have taken every opportunity to report back to all who have shared with us. We have also encouraged participation throughout the process of local participants as partners, preferably dominant ones.

To summarise; Naturalistic Inquiry is defined, not at the level of method but at the level of paradigm. Heavy reliance is placed on the human as instrument. Conventional positivist research tends to begin with a defined objective, follow a predetermined research strategy and analysis, and terminate either in reaching an intended objective, or explaining why it did not. The concept of a Naturalistic Inquiry, on the other hand, anticipates a paradox. While a focus is the starting point, the inquirer fully expects this focus to change as the research unfolds. At its heart, theory and method emerge from Naturalistic Inquiry; they are not *a priori*.

Similarly sampling and other data collection is not undertaken to achieve representation but in a contingent and serial manner, the objective being to maximise the scope and range of information gathered. Data analysis is open-ended and inductive: "what is at issue is the best means to 'make sense' of the data in ways that will, first facilitate the continuing unfolding of the inquiry, and second, lead to a maximal understanding (*verstehen*) of the phenomenon being studied in its context" (Lincoln and Guba, 1985:224-225). It is assumed that the inquirer has accepted the stance suggested in the axioms listed above and it is strongly recommended that the inquirer engage in prior ethnography to provide a springboard and benchmark for the more formal study.

3.4. Participatory Learning and Action

A successful example of action research adapted and adopted in Oceania is Participatory Learning and Action (PLA). PLA is widely used in development programmes and projects, primarily in the 'developing world' where the method has been championed by IIED since the late 1990's (where it has become synonymous with the extensive work of Robert

Chambers et al). PLA is primarily concerned with providing tools that allow communities to develop their own practices and processes for effective management of resources and environment. As discussed above, the methodology was picked up at the outset by Pacific geography/natural resource management academics and researchers. PLA as used here was a distinctly Oceanic adaptation to action research and underpins the FLMMA programme. There are multiple strengths that combine to create the PLA recipe, several, I suspect, inherent to the individual and collective cultural and intellectual skill of its designers and practitioners. While LMMA is its current flagship, the PLA process is rooted in early USP physical geography and resource management fieldwork across the Pacific, in particular programmes led by Thaman, Aalbersberg, South, and Veitayaki. At its core PLA is a geography-based analytical process that evolved from the RRA/PRA methods of assessment, in reaction to the heavy emphasis in each on a top-down, external expert-led process that did not gel well in Oceanic operating environments. "The need to learn from our mistakes and to improve participatory methods results in the 'birth' of PLA" (Tawake et al, 2001:4).

Central to the focus on PLA in this inquiry is the underlying principles that make up the "Social Contract", the flexible 'glue' used to bind the various FLMMA partners together collaboratively rather than competitively in their emergent and infancy stages. If, as initial findings indicate, further consideration of implementation of sail-based trading craft is worthy of now being prioritised, collaboration between a range of stakeholders with various, and potentially competing, interests is likely to be required. The FLMMA learning portfolio model is a locally known and proven vehicle for such collaboration. I discuss the lessons that might be applied from this to a sustainable shipping agenda further in Section 7.2.

I have been guided by Ravuvu and Tabunakawai (2002) on the lessons they drew from their participation[33] in Fiji and regional community management and planning programmes and projects and that offer sound advice and salient warnings. Ravuvu and Tabunakawai (2002:67) conclude that the "process of empowerment is effective if communities recognise the worth of their social and natural capital, and have the ability to deal with the demands placed on these in a balanced and sustainable way. Each step of the intervention process

[33] Both are highly experienced and leading Pacific practitioners of Action Research at community level, particularly in regard to resource management matters, Ravuvu with UNDP and Tabunakawai as Regional Programme Manager of WWF-SPP. Nabobo-Baba (2004, 2006) also provides further relevant examples of lessons and analysis from Pacific project experiences.

must recognise the characteristics outlined earlier, and every step must be not only be walked through, but talked through. The supportive role of outside players as catalysts and facilitators is important, but those in these roles must build into the project design strategic exits from the community from the beginning".

3.5. Talanoa

> *Fofola e fala ka tau talanga (Let us spread out the mat so we can start the process of conversation*) Halapua, 2007:9.

In this thesis *talanoa* was increasingly adopted as a primary field research and data exchange tool; as the most appropriate method of contextualizing, gathering, filtering, transmitting, and analysing information/data. *Talanoa* was used extensively and at all levels in this inquiry, from informal serendipitous meetings with individuals to regional workshops; on remote islands with full cultural protocol and in inner-city conference rooms in a Western setting.

Talanoa is now well documented (e.g. Halapua, S., 2003, 2007; Halapua, W., 2008; Helu, 1999; Helu-Thaman, 1998; Nabobo-Baba, 2006, 2007; Vaioleti, 2003, 2006) and increasingly used in various social science research processes (e.g. Farrelly, 2009; Nicole, 2006; Tawake, 2001). *Talanoa* is "a derivative of oral traditions. Under the control of appropriate researchers, it allows contextual interaction with Pacific participants to occur that creates a more authentic knowledge, which may lead to solutions for Pacific issues" (Vaioleti, 2006:23). It is an ocean-wide practice but each culture claims its own variations. In Fiji, it is a method proposed to disseminate information by local government departments, NGOs, village representatives, business representatives, and local agencies. It is also recommended for collecting information from villages, leaders, and different government agencies (Morrison, Vaioleti and Veramu, 2002).

Talanoa is far more than a research methodology or tool. *"Talanoa* is a heritage and part of Oceanic culture today. *Talanoa* is an Oceanic gift and contribution to the whole quest for more listening and dialogue. In the very word itself is the notion of giving grace and space to each another and one another. When people share they are not isolated. To engage in *Talanoa* is to recognise the breadth of a community. Above all, *Talanoa* honours and celebrates belonging and diversity" (Halapua, W., 2008:54). Sitiveni Halapua (2007:9) contends it has many facets, including that "*talanoa* does not have a preconceived agenda. *Talanoa* is an activity that is oceanic, communal, and oral in nature. It requires face to face

encounter".

Superficially, *talanoa* can be referred to as a conversation. "*Tala* means to inform, tell, relate, and command, as well as to ask or apply. *Noa* means of any kind, ordinary, nothing in particular, purely imaginary or void" (Vaioleti, 2006:23). "*Talanoa* allows more *mo'oni* (pure, real, authentic) information to be available for Pacific research than data derived from other research methods and requires researchers to partake deeply in the research experience rather than stand back and analyse. *Talanoa,* then, is subjective, mostly oral and collaborative, and is resistant to rigid, institutional, hegemonic control" (Vaioleti, 2006:24).

Winston Halapua (2008:64-67), considering *talanoa* from a theological plane, considers there are four gifts *talanoa* offers to the wider world. In so doing he situates *talanoa* centrally within a voyaging ethos:

> "Space – the space provided is not for some to seize or dominate, rather that space is a creative space set aside to enable the welfare of all.
>
> Justice – No one story has more space and value than any others. Every story, long or short, individual or collective, important for some and perhaps irrelevant for others, should be accepted. No storyteller [*tasitala*] should leave feeling excluded or unheard. Diversity enriches.
>
> Listening – *Talanoa* is about the sacredness of listening. *Talanoa* is about sensitive and intentional listening. In listening there is room for silence ... the profound contribution of silence, beauty, and serenity. Powerful interaction happens at a time of silence. The ability to listen is an art. In order to be able to function together in the *vaka* (canoe) on the voyage, the honouring of space of each other was vital. The vaka would not arrive if some of the waves were heard seriously while others were suppressed or undermined.
>
> Dialogue – *Talanoa* is a sacred space for dialogue in which all are valued and have profound contribution to make. There is hospitality given – hospitality is at the very root of the formation of community. Dialogue is a sacred process through which we uncover and reveal our human grandeur. Dialogue withers when our hearts are closed to the infinite possibilities of the other and we assume we already know all we need to know. Dialogue flourishes when it is conducted in an open-minded spirit of discovery based on compassion, on the desire to build on what we have in common and transform our

differences into resources of value".

Talanoa then shares its origins in the unique social cauldron created by voyaging, in the need for communication methods between relatively small crews/communities and between independent but related fleets of vessels. Such methods needed to be able to maintain effective information transmission amongst the complement while still allowing for an unencumbered chain of command. Helu (1999:117) found similarly for the origins of concepts of reciprocity, another central pillar of Oceanic cultures. Times of abundance are the time for hoarding, times of want, for example when food supplies run low and land is not in sight, are the time to ensure everything is shared communally to avoid conflict and individualism usurping the wider needs of sea-borne communities.

Talanoa does not cover all knowledge, only that available to the 'ordinary' or 'common'. According to Helu-Thaman (1998), there were two types of knowledge: communal knowledge necessary for day-to-day living and the specialist and often *tapu* knowledge. Special knowledge was *koloa* (*taonga*, treasure), belonging to specific groupings and kept *fakamolumalu* (sacred) by *tufunga* (*tohunga*/learned people). My research has been concerned with the former. Where it had broached the realm of the latter, I have employed measures to ensure that this research and my learning is insulated from such knowing (see Section 6.4).

Farrelly also used *talanoa* extensively throughout her research into Bouma National Park (Farrelly, 2009) following the research approach prescribed by Unaisi Nabobo-Baba's (2007) 'Vanua Research Framework'. She considers the *talanoa* processes presented in her thesis as a potential tool for political agency. "*Talanoa* became my primary methodology because it is synonymous with the phenomenological approaches that I had set out to use in the field: it requires an emotional engagement between all parties; it necessitates a space where all parties can speak freely; and it requires shared knowledge" (Farrelly, 2009:42). Likewise Vaioleti finds parallels with *talanoa* and the phenomenological research family. "*Talanoa's* philosophical base is collective, orientated towards defining and acknowledging Pacific aspirations while developing and implementing Pacific theoretical and methodological preferences for research. *Talanoa* removes the distance between researcher and participant, and provides research participants with a human face they can relate to" (Vaioleti, 2006:25).

Talanoa differs from a conventional or positivist approach with its reliance on preconceived

hypotheses and using pre-formulated questionnaires and leading questions. *Talanoa* requires a personal relationship between the researcher and the participant. "The interactions are guided by approved ethics, but these are based on different thinking from that of Pacific peoples. The disparity between the objectivity base of much traditional research and the subjectivity of the participants is often not recognised in Pacific research contexts" (Vaioleti, 2006:22). "Researchers whose knowing is derived from Western origins are unlikely to have values and lived realities that allow understanding of issues pertaining to knowledge and ways of being that originated from the *nga waima* (spirits) and *whenua* of Samoa, Tonga, Fiji, Tuvalu or the other Pacific nations" (Vaioleti, 2006:22).

Talanoa is an open-ended process. While, as the researcher, I might request to *talanoa* on a given subject, the pursuant conversation, should the request be accepted, cannot be controlled in the way a structured or semi-structured interview is. Outcome will depend on who is present, usually also undeterminable prior to the *talanoa,* and on what each brings to the conversation and the manner of exchange. "The *Talanoa* will end when it loses its *malie* or starts to revisit areas covered already, since then it is probable that no more new points will be added to those that have been co-constructed. It is a respectful, reciprocating interaction" (Vaioleti, 2006:26). It is a shared space. And what is not said is usually as important. Nabobo-Baba (2006:94) echoes Halapua above in stressing that silence is not empty. "There is eloquence in silence … a pedagogy of deep engagement between participants". Again, such cultural assets are at the core of Diaz's (2001) analysis of hypo-modernity.

Talanoa has a strong compatibility with Naturalistic Inquiry, in particular the notions of trustworthiness as regulator and mutually shaped learning for both researcher and informer. Both Vaioleti and Farrelly found a similar connection. "Perhaps what Lincoln and Guba (1985) suggest; that is, to replace validity and reliability with trustworthiness and its components, is more fitting" (Farrelly, 2009:32). Vaioleti (2006:26) stresses the "reciprocity embedded in *Talanoa* will raise the expectations that researchers and participants have of each other, promoting mutual accountability, which adds to the trustworthiness and quality of the research. The effect of reciprocity is such that when people give *koloa* (in this case, time, and knowledge) they will expect it to be respected and honoured, and to be used well. Developments will be followed with interest" (Vaioleti, 2006:26).

Trustworthiness becomes central, especially in my own case as a *kaivalagi*, an external agent, seeking to interact in an Oceanic cultural setting. Credibility must be built and maintained.

"It is vital, then, for researchers and their sponsors to fully appreciate the essential cultural underpinning for the context in which special knowledge is gifted to them. That is, the knowledge is given on the age-old premise that it is to be used for the betterment of the *fanau* and not only for personal gain, such as a degree qualification or for building intellectual capacity or commercial interest. Pacific research must advance Pacific peoples directly" (Vaioleti, 2006:29).

My research focus and status as a sailor, a seaman, a '*kaiwai'*, gave me an affinity with many of those I sought knowledge or learning from. For those of us who have saltwater running in our veins the sea provides an empathy that transcends many cultural boundaries. I believe there is a natural mutual respect between all those who have ever stood a storm at sea that is not easily explained to a 'lubber' or '*kai vanua'*. There is an unspoken empathy in which we each know we have at least once stared deeply into our own souls.

Talanoa requires more than just following a prescription. "Researchers are encouraged to be cautious, respectful and to see, not just look; to hear, not just listen, and to observe; to know the culture and context they are engaged in and then behave accordingly. Requirements include not dominating" (Vaioleti, 2006:30). I have tried to follow such advice as broadly as possible. Because it was not known in advance the direction the research would take, I sought to not only search out information in *talanoa* but to seek guidance as to what information I should be looking for and where and how to look for it. Often a *talanoa* with one community would result in being guided to another *tanoa* and the *talanoa* would recommence to be reordered and reshaped by new participants. Over time, I ended up revisiting various *tanoa* repeatedly – especially within the three communities introduced in Section 1.3. These became my equivalent of a compass and log on a ship, a means of knowing and reflecting on course and distance covered.

I think now that *talanoa* is as important as a means of 'making learning' as a means to finding or uncovering knowledge. *Talanoa* is not a process of determining what is 'right' or 'wrong' in the positivist sense. It is one concerned with allowing understanding to accompany knowledge and for such learning to be mutually attained. *Talanoa* as a research method is unlikely to yield similar results over time. Learning from *talanoa* means that people's reasons and ideas about an issue or topic will change. Reliability as it is understood in experimental research is not appropriate (Vaioleti, 2006). *Talanoa* is not a universal method, it has limitations, and I have attempted to engage with it in full cognisance of these.

> "*Talanoa* research methodology is a challenge. The use of disempowering traditional research on Pacific peoples has not yielded significant advancements for them. *Talanoa* can be just as rigorous as existing research approaches, although in a different way. It will allow Pacific peoples to help identify issues, and then co-create knowledge and solutions for themselves. Implementation of findings based on *Talanoa* research methodology should be more trustworthy, relevant and widely supported by Pacific peoples, because they will feel that they have had meaningful engagement in the research processes" (Vaioleti, 2006:33).

3.6. Research Participants

In addition to the three communities introduced in Section 1.3, I have, largely informally, targeted a number of 'clusters' of human datasets. A ripple effect has led over the course of the research to an ever-widening collective of informants (or more correctly co-participants). This included, in the first season of field work, staff from provincial councils, the KYMST (the district support team to the Kadavu FLMMA network); agencies involved in Fijian sea-transport (e.g. MSAF, FNU Marine Division); the range of organisations that make up the FLMMA network (Ministry of Fisheries, WWF-SPP, USP Marine Studies and Institute of Applied Science, etc.); groups with an interest in or knowledge of traditional and modern sailing technology in Fiji, Fiji Museum staff, Fijian boat builders; those coordinating research and policy initiatives in regard to climate change, adaption strategies and renewable energy at USP, FNU, SPC, and Ministry of Environment.

Preparations and reporting for the Lau *drua* research programme in 2011 (see Section 6.4) saw the net widen to include, for example, various Lauan communities, the Lau Provincial Council, Fiji Arts Council and *iTaukei* Affairs as well as staff at the Oceanic Centre for Art, Culture and Pacific Studies and the History Department of USP. At the time of writing, that particular piece of research and the on-going research agenda being pursued by FIVS has lead to us being contacted by ANU offering to provide all possible assistance for an extended archaeological and cultural history research programme on *drua* and related culture.

In similar vein the research programme, and in particular preparations for the USP-hosted 2012 'Sustainable Sea-Transport Talanoa' (SSTT) (see Section 7.1), has led to contact with organisations involved in alternative shipping technology in Japan, UK and Europe (e.g. Greenheart, B9 Shipping, Modern Merchant Sailing Ships, Fair Transport, Germanischer

Lloyd). A number of international universities are now peripherally involved. In Fiji, the community of interest includes various government departments, development agencies, consulates, regional authorities, and industry participants. What started as a small discreet conversation in one small remote village has certainly spread and blossomed. With this thesis I hope I have discharged my responsibilities to report back faithfully on what I have learned to the community to which it is of most relevance.

3.7. Literature and Internet Searches

The fieldwork, a largely organic oral process, has been supported throughout with a more conventional process of literature search and review. While time has been spent prowling the library shelves, increasingly this part of the programme has been electronically based.

Other data collection processes used to collect data for the 'thick descriptive' prescribed for Naturalistic Inquiry data collection (Lincoln and Guba, 1985) included maintaining a standard ship's logbook (the equivalent of the terrestrial journal), scrapbooks of newspaper articles, etc. A ship as a research platform has inherent constraints, space and electronic reception being limited and we are increasingly adopting a 'paperless where possible' modus.

As well as web-searching for known and individual sources, I have maintained a watching brief on a variety of websites covering a diverse range of subjects from proa design (http://www.proafile.com; http://proadesign.com) to Polish based sailing-eco-anarchists (http://sailingforsustainability.net) to Richard Branson's Carbon War Room (http://www.carbonwarroom.com) to the official site of the IMO (http://www.imo.org) and leading industry commentators (http://shippingefficiency.org). Email and Skype have increasingly been used to maintain and expand a virtual *talanoa* with participants and collaborators now spread across the globe.

3.8. A Note on Gender

Seafaring, sailing, and ship-building are, and historically have been, an almost entirely male-dominated and testosterone-ruled industry. Oceania is not alone in this regard, it is a global phenomenon. My skipper's father is the caricature of a retired Welsh Chief Engineer with most of his working career bluewater on large vessels. He served with only three signed female crew in that time, all of them stewardesses. In regards to Oceanic sea-faring, the issues of sacredness, of *tabu*, associated with all aspects of historical relationship with sailors

and Oceania have reinforced this trend and it spills over today to dominate the modern age. The most recent Oceanic voyaging re-creation, the '*Waka Tapu'* voyage of two New Zealand Maori sailing *waka* to Rapanui has seen *Te Aurere* only 'manned' by a male crew in deference to the ordained '*tapu'* nature of their odyssey.

Such total male exclusivity cannot have been historically accurate and cannot have been an exclusively engendered tradition. Obviously if voyages did not include women then colonisation would have been restricted to survival of a single generation without breeding partners. So women must have sailed in some capacity in some situations but there appears little doubt that men have dominated the industry. Diaz (2008:11) has well summarised the exceptions to the rule, including Teaiwa's valourising of her adopted ancestress, Nei Nim'anoa as "one of only a few female figures in the male-dominated field of Pacific Island navigational traditions". He points to the danger of men continuing to attempt to dominate this space and concludes that continuation of the deep-seated and chauvinistic view that traditional seafaring is essentially "a man's thing" leaves them open to needed criticism.

The literature record of women's participation in this field is thin. There are some tantalising hints that Fijian culture may not have been as exclusively male dominated as other parts of Oceania, in particular Polynesian cultures. Both Williams (1858) and Wilkes (1845) reference the 'travelling Levukians', the seafaring traders of the eastern Fijian seaboard at the time of sustained contact, having women sailors as ordinary seamen [sic] and even that it was the women that initiated and controlled the exchange processes associated with their trading. As Couper (2009:55) summarises "women sometimes led the trading parties on both sides and made sea voyages for marriage and mortuary occasions and major ceremonies such as the solevu". More recently the role of women in martime activies has been revisted (see D'Arcy 2008) with Huffer (2008) detailing the record in myth and story of Oceanic women sailors and navigators, pointing to references from Tahiti and the Marshall Islands.

Within traditional ship construction, gender roles were heavily segregated. The universal trend is that men built boats, women made sails, but all the community came together to make the *magimagi*, the cordage that bound the vessel together and controlled its operation. This is an interesting vignette and might be read to imply that men were the artisans and women the engineers, given the role of the sail as primary propulsion. Our research into *drua* culture in southern Lau (see Section 6.4) potentially uncovered previously unrecorded knowledge about *laca* suggesting the sails of the *drua* were incredible pieces of technology, as sophisticated as any modern sail. The last vestiges of this knowledge are held by women. Such glossing of a

tradition of gender separation but equilibrium in canoe construction is poetic but fanciful. It always has been and remains today a sector where men and maleness dominate. I contend that such domination is a primary contributor to the current extremely conservative nature of the industry.

My own experience as a sailor has been tempered by my last 12 years as crew aboard a bluewater vessel owned and skippered by a female. It is a rarity; we have met only one similar example in this time. It causes raised eyebrows, less so in my own country, but after a while is generally accepted and within 'our' communities of Solodamu and Korova, 'their' female 'skipper' is now a matter of respect and pride. After more than a decade, I would now find it incredibly difficult to serve under a male command. My entirely subjective opinion is that women make better captains, they are more team-orientated, more decisive and intuitive. In today's seafaring world, intelligent skill is of far more import than brute strength. As Helen Sampson, Director of the Seafarers International Research Centre at Cardiff University commented in the SSTT 2012, there is no reason women cannot fill any role in the modern seafaring industry and their failure to do so is attributable to simple sexism. Our experience with training youth in Solodamu and other parts of Fiji is that women cadets learn more quickly and are less constrained by the natural competitive nature of the men. The experience of *Uto ni Yalo* and the other vessels of the *Te Mana o Te Moana* fleet, all of whom have had a minority women complement, would tend to reinforce this opinion.

It is not my place or role, as a *kaivalagi* visitor within Fijian or Oceanic culture to pass judgment on the mores used to maintain a male dominance of the Oceanic seafaring industry and the current cultural revival. I will simply repeat Diaz's (2008:20) warning. If our attitudes do not change quickly, "the balls that risk being kicked are our own".

Chapter 4. Plotting the Inquiry

This chapter uses three lenses to view the current sea-transport scenario, starting with the micro as represented by the *koro* of Solodamu, a typical rural coastal village in Fiji. In Section 4.2 magnification is decreased to the meso level to look at shipping in Fiji and Oceania. Sea-transport is first contextualised within a summary of the unique key regional characteristics that affect the industry, necessary to fully understand the critical role sea-transport plays in the region. This concludes by narrowing to an overview of shipping in Fiji and summarising its development over time. Section 4.3 considers the macro, the global level at which shipping is a juggernaut industry, shifting 90% of the world's goods and resources in up to 100,000 commercial vessels. Particular attention is paid to the place of shipping within the global context of current climate change debate and the effects that both measures to mitigate the industries poor GHG emissions record and related emerging technologies are likely to play in reshaping shipping options in the immediate future.

4.1. The Micro in the Macro: Solodamu – One Village's Need

The *koro* of Solodamu and its environs were introduced in Sections 1.2.1 and 1.3.1. The current sea-transport scenario for the village provides a case study it is contended is representative of the issues faced by many Oceanic remote coastal communities.

The case study underscores the contention that coastal/island communities that are reliant on externally controlled and determined transport are heavily restricted in their development options. Non fossil-fuel powered options offer an economically viable alternative that would, in my opinion, increase the range and control of community over transport and thus increase community resilience. However, substantive and entrenched obstacles exist to realising this, some of which pose challenges to existing socio-cultural norms within the community.

The village has been a leader in community conservation initiatives. While all in the village claim it is their desire to protect their environment for future generations that is the primary driver, it is also apparent that an economic trade-off was envisioned where their sacrifices would somehow be rewarded by a low-level and sustainable eco-tourism income stream. The unrealistic nature of this desire (Kadavu is not a tourist destination of any scale and establishing a commercially viable tourism venture would have social costs the village is not prepared to countenance) and growing frustration of the youth at the lack of economic alternatives was the subject of the original workshop described in Section 1.2.1. A number of

commentators, especially those involved over recent years in biodiversity protection, have made the linkage between meeting conservation imperatives at community level requiring mutual satisfaction of communities' economic and social aspirations (see in particular Veitayaki et al, 2003, 2011; also Aalbersberg et al, 2005, Morrison et al, 2002).

Despite several village-initiated attempts to find such an economic balance - including building a visitor centre and viewing platforms, cutting and maintaining 7km of coastal walking tracks, preparing signage - it remains illusory. The 2006 *talanoa* was held in this context. There focus shifted from eco-tourism opportunities to examining current demands on village expenditure and past village enterprises, one of which was a village launch. A shipwreck in front of the village some years previously had provided materials; the Methodist Church had paid for a *mataisau* from Suva and the result was a 35' plywood cabin boat driven by a 30hp outboard. With this the youth committee[34] made a small income 'chartering' the vessel for community use – school visits, weddings, market days etc - along the coast of Kadavu. It is unlikely the vessel was ever formally registered as a commercial vessel and its business use was ad hoc. When I first arrived in Solodamu the launch was beached and derelict beyond economic repair.

Figure 5 The Solodamu Village Launch

I was struck by the notion that a plywood and epoxy sailing catamaran, the same materials used for the launch, could provide a village-based service between Kadavu and Suva without the fuel costs that had been a large overhead in previous operations. The idea gestated until

[34] Most Fijian villages have a youth committee comprising all the young men who undertake communal projects (fixing the school, painting the church, building footpaths, fund raising etc), generally at the direction of the *bosenikoro*. This is a practical expression of *vakavanua*.

our return to the village in 2008 when we more systematically explored the concept and its suitability for Solodamu. In this period a friend built a low-cost 46' catamaran to professional standards on a beach in New Zealand and then put some 20,000nm under its keels giving us a good baseline of overall costs, construction processes, and performance. Other designs were also readily available. Technology did not appear to be a barrier. Our own experience in regularly sailing the Kadavu-Suva route, later supplemented by the *Na Mataisau* data (see Section 5.1) combined with inter-generational local knowledge gave us the basis for good wind-route planning. This was in the main favourable and reliable.

Human capacity in terms of sailing, commercial management, boat building and maintenance, and business/financial planning within the village was limited or non-existent. All the youth were competent fibre operators and fishermen. Several of the older men had deckhand experience on bluewater tuna vessels, the village chief having once voyaged to Japan on a fishing vessel. One of the *qase* had been a deckhand on a Kadavu-Suva launch in his youth. None had sailed in the sense of sail power. The oldest man in the village could remember one visit to the bay by an indigenous craft. While he recognised instantly pictures of an oceanic lateen sail he couldn't remember if it was a *drua* or a *camakau* (see Chapter 6). There were no *mataisau* resident in the village although all men were competent 'bush' carpenters and sawyers.

Figure 6 *Wakataitea*, a 46' ply/epoxy Catamaran

The research involved three parallel processes: a survey of the village's transport needs; a series of workshops with the village to find out if the idea was realistic and if so how best to

prepare for it (the latter culminating in an agreed business plan); and research into the existing transport options.

Following protocol and meetings with the *bosenikoro* and the *turaganikoro* and several all-village workshops facilitated by Bogiva, the *koro* set up a working party for the 'project' comprising both visiting sailors and representatives of each *mataqali*. I use the term 'project', but an inquiry or investigation would be more accurate. We, the external *kaivalagi,* were clear from the outset that we were available to assist the village with researching, planning and training but we were not there as an 'aid' or 'donor' group, and that the concept would need to be run on sufficient commercial lines to meet both regulatory standards (survey, qualifications, etc) and economic viability. We were prepared to assist constructing a business case that involved options of micro-finance, loans, or leases, but were not prepared to assist in writing applications for donors to simply gift a vessel. Although I suspect many hoped this situation would change, we proceeded on this basis.

Reasoning for this approach comes from a full understanding of why the old launch had failed. It illustrates the tension between commercial practice and *vakavanua*. The launch as an asset had in effect cost the village little except some labour. Cash earned from operating the launch had immediately been seconded for village and *vanua* needs, there was little or none set aside for maintenance or other operational costs. When problems arose, e.g. the motor died through lack of care and service, this was dealt with at the time as best as possible. When maintenance reached a critical need the youth had tried to introduce a business plan with reinvestment of earnings into maintaining the asset. But in a small village, with few earning opportunities, and a seeming endless call on the collective for *soli* for church, school, scholarships, *koro, tikina* and *yavusa* obligations, the youth were not able to resist the customary and social pressures placed on them in order to maintain their business plan. This had resulted in tension between some of the youth and the *qase* and between *mataqali*, tensions that several years later were unvoiced but still simmered below the surface. The result was the vessel was beached and quickly deteriorated. This analysis was both salient and sobering. I suspect it is far from unusual and other researchers have found similar issues (see for example Farrelly's 2009 research into community enterprises in Bouma). For a commercial vessel to be owned and operated at village level an accommodation between commercial and *vanua* imperatives would need to be found.

Throughout this phase every attempt was made to adopt and use best PLA practice and

process (see Section 3.4). Until his death in 2010 Bogiva, a respected facilitator and staff member of USP working on governance issues through the FLMMA programme, was our constant guide and mentor[35]. We also informally re-established a previous reference group of PLA expertise from various in-country NGOs and USP to act as sounding board and mentor.

4.1.1. The Current Transport Scenario

Kadavu is serviced by air and sea-transport, with daily flights from both Suva and Nadi on small twin-engine aircraft and a weekly Ro-Ro ferry service from Suva to the port of Vunisea, approximately 8km to the east of Solodamu. The village can connect with this node by either foot or vehicle over a dry weather road or a 30-minute fibre[36] ride by sea.

Figure 7 Ro-Ro ferry departing Vunisea, Kadavu

Fibres are used periodically to travel from Kadavu to the mainland but this voyage is a hazardous bluewater passage and is only likely to be attempted in favourable weather or when prompted by high cultural need (e.g. to attend important funerals). The high cost of air transport means this mode is only used locally as a last resort. Village transport within the island then is almost exclusively by outboard motor power and off-island by large and aged MDO-fuelled ferries. When specialised loads or events require shipping to come directly to a village the only options are to charter large vessels from Suva or pay an 'anchoring fee' for

[35] An extensive record has been kept throughout the interaction with Solodamu and can be accessed at www.sailingforsustainability.org

[36] Open fibreglass longboats, commonly known as "fibres" are typically 23 or 26 ft long, narrow, planing craft powered by 25 – 60 hp outboard motors.

the ferries to divert and anchor off the reef so that loads or passengers can be lightered ashore. For example, when the Richmond Area School burnt down in 2010, an additional charge of FJ$5,000 was levied for the ferry to divert to Richmond to unload building supplies. Such costs are borne by the community.

Figure 8 The 'Fibre', Powered here with a 40hp Yamaha Outboard

4.1.2. Establishing Solodamu's Transport and Fossil-fuel Usage

We were unable to find any record of previous transport surveys of comparable communities in Fiji and so the working party began by undertaking a village-wide survey of transport use. At the time the survey was undertaken no vehicles were owned or stationed in the village[37] and three households owned fibres. As Solodamu had just installed a government-subsided diesel generator (which provides power for 2½ hours per evening) the transport survey was combined with a parallel one on village fossil-fuel use. The generator was the result of five years planning and fund raising by the village, its commissioning a cause for great celebration seen as step towards 'development'. The cost of FJ$5/week/household to pay for the fuel used places considerable strain on meagre incomes. The electricity is for basic household use only and is insufficient to allow use of appliances such as freezers, washing machines, and irons. A summary of the survey findings is provided in the following tables[38].

[37] This situation prevails at time of writing (October 2012).

[38] A more detailed report on the survey methodology and limitations is available at www.sailingforsustainability.org

Table 2 Number of One-way Trips made by Solodamu Villagers to/from Suva/Nadi (2008-09)

	Suva	Nadi
Ferry	183 (57%)	N/A
Plane	60 (19%)[39]	6 (100%)
Yacht[40]	76 (24%)	N/A
Fibre	0	N/A
Total no. of 1-way trips	**316**	**6**

Table 3 Number of One-way Trips made by Solodamu Villagers within Kadavu (in September 2009)

	To/from Vunisea	To/from Other Village
Ferry	0	0
Fibre	194 (49%)	8 (57%) (Richmond)
Yacht	0	6 (43%)
Truck/4WD	153 (38%)	0
On foot	52 (13%)	0
Total no. of 1-way trips	**399**	**14**

Table 4 Visitor Transport to Solodamu from outside of Kadavu (2008-09)

	No. of Visitors from Suva	No. of Visitors from Nadi
Ferry	82 (57%)	0
Plane	46 (32%)	2 (100%)
Yacht	17 (12%)	0
Total no. of visitors	**145**	**2**

[39] Nearly 90% of the plane flights to Suva are attributable to one individual who is required to fly to Suva fortnightly as part of their employment with the Provincial Council.

[40] There have been a variety of yachts visiting Solodamu since 2006 and these have been used advantageously for transport between the village and Suva.

Table 5 Visitor Transport to Solodamu from within Kadavu (in September 2009)

	No. of Visitors from Vunisea	No. of Visitors from Other Villages
Ferry	0	0
Fibre	24 (43%)	18 (100%) (Richmond)
Yacht	0	0
Truck/4WD	24 (43%)	0
On foot	8 (14%)	0
Total no. of visitors	**56**	**18**

Table 6 Cargo from Solodamu – Suva/Nadi (2008-09)

	Cargo (kgs) to Suva	Cargo (kgs) to Nadi
Ferry	7283 (91%)	0
Plane	590 (7%)	611 (100%)
Yacht	105 (2%)	0
Total cargo	**7978**	**611**

Note: Of the above 3780 kg (47%) was yagona.

Table 7 Cargo from Solodamu to other villages within Kadavu (in September 2009)

	Cargo (kgs)
Ferry	0
Fibre	625 (39%)
Yacht	0
Truck/4WD	981 (61%)
On foot	0
Total cargo	**1606**

Note: Majority of this is taking village produce to the weekly market in Vunisea. Tides have a large influence on choice of transport on any given day.

Table 8 Cargo into Solodamu from Suva (2008-09)

	Cargo (kgs)
Ferry	6030 (98%)
Fibre	0
Yacht	6 (0.1%)
Plane	100 (1.9%)
Total cargo	**6136**

Note: Of the cargo 5305 kg (86%) was hardware (building supplies, clothing, etc) and 631 kg (10%) was food and household groceries.

Table 9 Cargo to Solodamu from within Kadavu (in September 09)

	Cargo (kgs)
Truck/4WD	419 (44%)
Fibre	540 (66%)
Total cargo	**959**

Note: Of the cargo brought into Solodamu, every 3 weeks 455 litres of fuel comes from Vunisea for resale for general village use and the 2 fibre operators bring in a total of 189 litres/month for fuelling their outboards.

Table 10 Village Fuel Use (in September 2009)

	Fuel (litres)
Village generator (diesel)	135 (20%)
Individual generator (petrol)	174 (26%)
Lighting (kerosene)	108 (16%)
Outboard motor (petrol)	225 (33%)
Primus stove (kerosene)	36 (5%)
Total volume of fuel (litres)	**778**

Note: In addition to the communally-owned generator 10 households have their own generators. 3 households own outboards. 5 households are using solar powered lighting.

The survey gave detailed data for the month of September and more generalised annual data. It does not show monthly or seasonal variation. Off-island travel is known to have marked seasonal variation with the Christmas period and national events being drivers of increased transport use, for example Diwali when there are large sales in Suva and the annual Methodist conference (see also Sofer 1985, 2009). Solodamu has been regularly visited by a small number of international yachts, villagers making use of these for transport of people/goods to and from Suva. It is not known to what degree this has skewed "normal" village movement patterns.

Local sea-transport is the single largest user of fossil-fuel within the village. Off-island transport is critical for Solodamu. Combined with coastal movements, it makes sea-transport crucial to every aspect of well-being.

Fossil-fuel is an increasingly expensive commodity. After a period of relatively stable prices, the cost of pre-mix petrol[41] increased during the 2008 world oil price hikes to over FJ$3/l for a period. These prices have fluctuated since this extreme and at the time of the survey was retailing in the village at around FJ$2.50/l. Although regulated under the government's franchise scheme, costs of off-island transport, both air and sea, were also reported to have risen steadily. The franchise scheme is discussed elsewhere and is currently under review by the Fiji Commerce Commission.

Such price rises have considerable effect socially and culturally, as well as economically. Fijians are a highly mobile people; maintaining family connections is a paramount concern and there is considerable travel between kin throughout Fiji. Any increase in transport costs immediately impacts maintenance of cultural ties. Price increases for pre-mix were observed to have other impacts. In the Kadavu district of Kavala in 2008 we heard reports of the district health nurse having to halve her usual village calls because of increasing fuel costs. On the neighbouring island of Ono villagers brought their children home early from boarding school because of the transport cost of supplying the school kitchens. Those planting a cash crop of pineapples or melons to sell in Suva to pay children's school fees think twice when the transport cost takes an increasing share of any profit. The example of Bogiva's death provided a poignant example. He died in Suva and was buried in Ba. As we had three sailing ships in Solodamu at the time we were able to transport 17 villagers, half a tonne each of *dalo*

[41] 50:1 oil/petrol mix suitable for outboard motors.

and cassava*, yagona* and mats to the mainland at no cost. Had this option not been available the village might have been able to send two or three representatives and some mats by air at a return cost of more than FJ$300 per passenger. By 2012 this would have cost more than FJ$500 each. Transport has a direct relationship to *mana* and fulfilment of cultural obligation.

Solodamu is the second smallest of the six villages in Tavuki Bay. Multiplying the survey results by six gives a crude, but conservative[42], gauge of fuel and transport needs of the *tikina*. It is only an approximation and completely conservative to note that if Solodamu comprises around 1% of Kadavu's overall population then the island as a whole is consuming more than 67 tonnes a month (800+ tonnes per annum) of fossil-fuel supplies (excluding road vehicles and urban fuel use in Vunisea). Using similar arithmetic to extrapolate there are at least 30,000 one-way trips made annually at household level to and from the mainland.

Using this data supported by counts of fibres passing the embayment, observations of passenger and freight movements on 'ferry day' and *talanoa* with other villagers in Tavuki and along the coastline, we were able to construct a range of business scenarios for a working catamaran capable of carrying passengers and cargo both within Kadavu and between Kadavu and Suva. From an economic view, the concept of a locally-operated, small-scale vessel clearly made commercial sense. For an asset investment of approximately FJ$200,000 a conservative gross annual return of between FJ$80,000-150,000 looked eminently feasible. With only minimal fuel as an operating overhead; operational costs could be substantively reduced compared to options. There appeared sufficient demand to support at least one vessel just for Tavuki Bay. But, as discussed below, economic and commercial imperatives, although absolutely critical, are just one factor to be satisfied.

The working party met regularly, held several village *talanoa,* and proceeded to map out first a business case and then a detailed business plan. This used a quadruple bottom-line, looking at primary and secondary benefits and costs across economic, environmental, social, and political well-beings, with encouraging results. For example, almost all money currently spent on transport disappears from the local economy immediately, either to externally owned

[42] That there are no vehicles in the village makes this even more conservative.

transport, fuel, or finance companies[43]. A locally owned and operated non-fossil-fuel powered vessel would see the reverse, with local payments then circulating further within the island economy. If six crew were employed, this would translate to sustainable incomes supporting six village households resulting in the retention of the children of these households on the Tavuki school roll[44].

The currently available options mean off-island shipping requires transhipment through Vunisea[45]. A villager wanting to travel to Suva or to ship crops or goods to or from market must pay both the ferry costs and then the fibre costs from the port. For Solodamu the fibre costs FJ$50 for a one-way a trip, similar to the cost of one passenger on the ferry (but not including their baggage or freight). In the case of Nabukelevu, the western-most village on Kadavu, the fibre hire will cost around FJ$300. But a shallow draught catamaran would be able to work directly out of almost all the embayments along the coast and from there direct to Suva without the need for associated shore infrastructure. A surveyed vessel capable of carrying up to 4dwt was envisaged, sufficient for carrying loads from purely passengers to root crops, building materials, concrete blocks, sheets of plywood, etc. The modelling strongly indicated it could profitably operate at a significant discount to current charges. It would therefore remove or reduce a significant economic inhibitor to producing excess crops or any other commodity for export to Suva and reduce the cost of imports.

Various colleagues offered to come to help if we got to construction stage. We began to discuss matters, such as surveying, licensing, and qualifications with the relevant authorities. Youth were sent to train on *Uto ni Yalo* and at FNU in Suva. We started running practical courses, building the women's committee a 20' wooden sailing dory for fishing, teaching basic seamanship, navigation, radio and safety, etc and using our own ships to give the villagers the experience of sailing vessels and to train the youth[46]. Serendipitously, or so we

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[43] Although no detailed investigation has been undertaken, it is strongly suspected a large proportion of this, particularly the fuel component, also quickly exits the wider Fijian economy.

[44] See Figure 43 on Page 204 for further discussion of primary and secondary benefit.

[45] There are two ferry ports on Kadavu, Vunisea in the centre and Kavala at the eastern end. Each has a rock jetty and associated roading and a priority of Kadavu development is construction of a road network to link coastal villages to these (Kadavu Strategic Plan 2007-2012, Kadavu Provincial Council).

[46] Both my skipper and myself were qualified NZ commercial coastal skippers and our crew included experienced boat builders.

thought at the time, FIVS negotiated with their German sponsor to provide a vessel for testing the Kadavu route, which sadly failed to eventuate[47].

The research and planning phase identified a wide range of risks that would need addressing or resolving. We worked through these and developed strategies to counter them. For example, the real danger of 'brain drain'. If village crew were trained to commercial maritime standards, then there was strong likelihood they would be quickly lost to the wider industry, within Fiji or internationally. Three counters were suggested. Firstly, married men and women with young families more likely to remain in the village could be targeted. Secondly, the costs of training could be bonded with the candidates required to serve their bond time on the village vessel. Thirdly, more crew than were needed just for village use could be trained and a rate of attrition accepted.

However, the research also identified a number of 'game-breakers', issues which required resolution before a trial could proceed further with a realistic chance of success. These can be divided into two groups: institutional barriers and political challenges.

On the institutional side, the most critical difficulty was insurance. Marine insurance in Fiji and throughout the Pacific is difficult to arrange and expensive. For an inexperienced village-level operation with no track record it would be almost impossible without external guarantors and even then probably prohibitive due to cost. Without such cover, the venture becomes extremely high risk, with all eggs literally in one vessel and any accident prone to losing the entire asset. External financing for an uninsured vessel becomes nigh impossible and to ask the village to risk what would be their most expensive asset on such terms unthinkable. While other matters, for example meeting surveying, licensing, and qualifications barriers, could all be planned for, the insurance issue appeared insurmountable.

Regardless of the institutional barriers, the tension between commercial and *vakavanua* imperatives also loomed large. The *qase* were adamant that the village in the name of the chief would own the vessel. Others, although not able to say so outright, were convinced this would lead eventually to a similar fate to the old launch. The business plan developed by the working party and subsequently adopted by the *bosenikoro*, set out a structure that clearly separates ownership and management functions and the profit distribution formula includes

[47] See the Okeanos case study in Section 5.1.

community and *vanua*. Although discussed, debated, and finally agreed by the *koro,* the business plan remains a paper agreement, an external intervention. It is unlikely today (and possibly for the foreseeable future) to have the same weight as decisions made orally and in accordance with *vakavanua* at the *tanoa.* Like marine survey regulations for fibres, it is likely to be viewed at best as no more than a guideline. That a new vessel would be more strictly controlled commercially than the old one once it started earning income is not a given, regardless of the level of preparation and safeguards.

The issue appeared in other more subtle ways. The venture would depend entirely on the support and custom from local communities. But all communities in Kadavu operate on kin and cultural relationship linkages underpinned by reciprocity. If, for example, one youth was trained as captain, the pressure on them to accept the *kerekere* of family and friends to travel free or at reduced cost would be extreme. If they could not respond with free passage they would be expected to subsidise the same though their earnings. To not do so would put unrealistic pressure on them within the social and culture context they were trying to operate commercially in. There was no easy or obvious answer to this issue, being deep-seated and difficult to discuss directly within the community. The problem is a historic one: Couper (1973, 2009) pointed out that in the past commercial vessel-owning chiefs had regularly resorted to hiring captains without local connections or *kailoma* to run the vessels, accepting the subsequent loss of a substantial portion of profit to avoid internal conflict.

Claiming that accommodating such cultural imperatives is a historical and handicapping legacy in a modern age is to ignore the strengths of such cultural resilience. Such matters are central to the development debate in Fiji and Oceania. I deduced, as with the institutional barrier of insurance, that it was unrealistic to expect one small village to be a guinea pig without much greater external support and a much broader and deeper research base.

As discussed further in Section 5.4 we began next to explore the issues from other perspectives, widening the lens to consider a managed fleet of vessels operating in a number of localities where communities (or members of communities) such as Solodamu could participate under some form of lease-to-buy or franchise scheme. The serendipitous arrival of partners such as Greenheart and B9 Shipping (see Section 4.3.3) allowed us to increase the scope of technology and research options for consideration. A sustainable sea-transport option for Solodamu is still on the radar screen, although whether the village collective is the best provider for that is still a matter of on-going debate.

Regardless at what level the inquiry proceeded, it was increasingly obvious that a far greater understanding of both the wider Fijian transport scenario and the context in which it operates regionally was required. It was essential the lessons from the wider context and from previous experiences were garnered.

4.2. Pacific Shipping Profile: A Regional Context

A modern fleet of ships does not so much make use of the sea as exploit a highway.

Joseph Conrad

The previous section examined sea-transport use and issues at the micro-level through the lens of Solodamu. This section provides a profile of current Pacific shipping issues facing SIS[48]. To provide context it is prefaced with a summary of key Oceanic development issues relevant to sea-transport (size, population, economy, development issues, energy dependency, etc). Of the multitude of issues facing SIS sea-transport is a common thread and linkage in most, although seldom identified or prioritised as such. The second part of the section gives current information on the region's shipping with an emphasis where possible on Fijian case studies. Finally a summary of Fiji's commercial shipping history is provided and emphasis is placed on searching out relevant lessons learnt to apply to the core research focus.

Sea-transport is arguably a higher priority need for this region than any other. Expensive air links aside, and these are not universally available (e.g. Tokelau) and not capable of carrying sufficient loads economically in any case, sea-transport is essential to maintaining connectivity. Sea-transport is a constant and increasing burden which can only be forecast to increase in light of future challenges facing Oceania. The region's contribution to the industrially-created phenomena of climate change has been miniscule to the point of irrelevance and yet Oceania will be one of the first and most heavily affected. As 80% of the region's population is coastally situated, provision of sustainable and affordable sea-transport technology, by default, needs to be an essential cornerstone to all adaptation strategies for ensuring and empowering resilient future communities. To date, this issue has been ignored.

Across Oceania, sea-transport is essential at all levels of society from fishing and local transport needs of small isolated islands and villages to inter-regional shipping needs of

[48] Politically the island groupings in the Pacific are described variously as SIS, SIDS, PICs, and PICTs. There are important differences, I have not standardised but quoted the descriptive as used in the source material.

nation states. Currently all options are fossil-fuel powered and increasingly unsustainable. The literature is thin and, historical analysis aside (Couper, 1968, 1973, 2009; Bayliss-Smith, 1988; D'Arcy, 2006, 2008), restricted largely to a few development agency reports. All concur that it is the intra-country domestic services that are in most dire need (AusAID, 2008; SPC, 2011; UNESCAP, 2010). Generally such shipping services are restricted to an aging[49] and inefficient fleet. The marginal returns, especially for domestic services, means most operators are trapped in a cycle of replacing old ships with old ships or waiting for donated (and sometimes inappropriate) vessels. Governments are required to subsidise or otherwise provide for the most uneconomic routes, with ever increasing costs. The region's transport issues are unique; tiny economies scattered at the ends of some of the longest transportation routes in the world and arguably the most challenging network to maintain per capita and per sea mile with the resource base available to support it.

4.2.1. Oceania: an Overview

It is necessary to understand the unique nature of the region in which transport operates to fully appreciate the role of the industry and the nature of the challenge. The Pacific Ocean is the greatest natural feature on the surface of our planet. Covering one-third of the earth's surface it is one of nature's greatest active carbon sinks (UNESCAP, 2010:9). Eastern Oceania was the last region on Earth to be explored and colonised by people, starting from Asia around 6,000 years BP and ending with Polynesian ancestors reaching Hawai`i, Aotearoa, and Rapanui during the past millennium or so (e.g., Howe et al, 2006; Irwin, 2006).

The ocean is the dominant feature of the region. Land area is less than 2% of the total; less than 0.4% if PNG is omitted. PICs maintain resource access rights and management responsibilities over an ocean area of 28 million square kilometres, equivalent to the combined land areas of China, Canada, and USA. There are at least 11 square kilometres of ocean for every coastal Pacific Islander (Anderson, 2003:2). PICs form one of the most remote regions in the world (AusAID, 2008:1).

[49] The average vessel age of all vessels registered in, and owned by nationals of the SIS was 18.3 yr in 1995 - Anderson, et al (2003:2-5).

Figure 9 Map of the Pacific Region

Source: Anderson et al (2003)

The Pacific, a region of Small Island Developing States (SIDS): The Pacific is a diverse region made up of countries and territories with varying land size and type, population, natural resource base, economy, and cultures. The region contains 15 SIDS: the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea (PNG), the Republic of the Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. This grouping also usually includes Timor Leste. All are members of the Alliance of Small Island Developing States and, except for Timor Leste, the Pacific Islands Forum[50]. Some of them are amongst the poorest and weakest segment of the international community, with Kiribati, Samoa, Solomon Islands, Timor Leste, Tuvalu, and Vanuatu currently classified as Least Developed Countries. The main economic sectors in the region are tourism, fisheries, forestry, and agriculture (UNESCAP, 2010:4). PICs are characterised by extremes in physical geography and remoteness. There is a high degree of economic and cultural dependence on the natural environment. SIDS suffer from

[50] Fiji is currently suspended from the Forum. Additional to the above mentioned states are the French and US territories: French Polynesia, New Caledonia, Wallis and Futuna, American Samoa, etc.

diseconomies of scale in production and exchange of goods and services, remoteness from export markets and a high vulnerability to natural disasters and climate change.

Population: The population of island Oceania is numerically minute in the global scale, with a total population of 8.7 million people. PNG has the largest population with 6.5 million (74% of the region's population). Just over half the countries have populations of less than 100,000, and of them, several have less than 10,000 residents with Niue being the smallest with 1,625 inhabitants (UNESCAP, 2010:9).

Economy: The combined value of the Pacific SIDS GDP is around US$15 billion. PNG has the largest with a GDP of US$8.2 billion in 2009, more than twice the size of the second largest economy, Fiji (US$3.5 billion GDP in 2009). PNG and Fiji account for 80% of the region's GDP, the remaining Pacific SIDS, particularly the Polynesian and Micronesian countries, having very small economies ranging from Samoa with GDP of US$523 million to the smallest Tuvalu, US$15 million, in 2009 (Tuisolia, 2010 quoted in UNESCAP, 2010:7).

Gibson and Nero (2007:1) caution on the underlying assumptions for calculating such economic performance, referencing the growing literature in this area and noting that "external assessments generally miss or undercount food production and its related generation of cash standard statistical account assessments focused upon the market economy concur that Pacific economies perform poorly. For example, Sampson (2005) finds that after controlling for OECD membership and whether a country is an oil exporter, the Pacific states grew more slowly than countries in any other region of the world over 1995-2003".

AusAID (2008:3) concluded that the Pacific region will not come close to achieving the Millennium Development Goals (MDGs) by 2015: "many are unlikely to achieve the targets of universal primary education, reducing child mortality by two-thirds and halving the proportion of people with access to water and sanitation". The MDG framework has been criticised, in spite of its adoption at government and civil society levels across the region, for not recognising "key underlying determinants of well-being such as family and societal cohesion" and "neglecting the importance of economic development and the private sector" (Coates, 2009:29). Coates and others have highlighted the exclusion of the contribution of women and the failure to account for subsistence production of primary goods.

Poverty is reported as increasing. More than 80% of the region's population lives in the four poorest countries: Kiribati, PNG, Solomon Islands, and Timor Leste. Data on poverty in the

Pacific is limited, but alarming. For example, data from three National Income and Expenditure Surveys in Fiji shows that poverty has risen steadily since independence from 11.4% in 1977 to 25.4% in 1990, and then 34.4% in 2002. Recent data shows rates of underemployment of 22% for males and 35% for females. These numbers increase to 26% and 45% respectively for men and women in rural areas; and to 45% and 67% for young men and women under the age of 20 (AusAID, 2008:3).

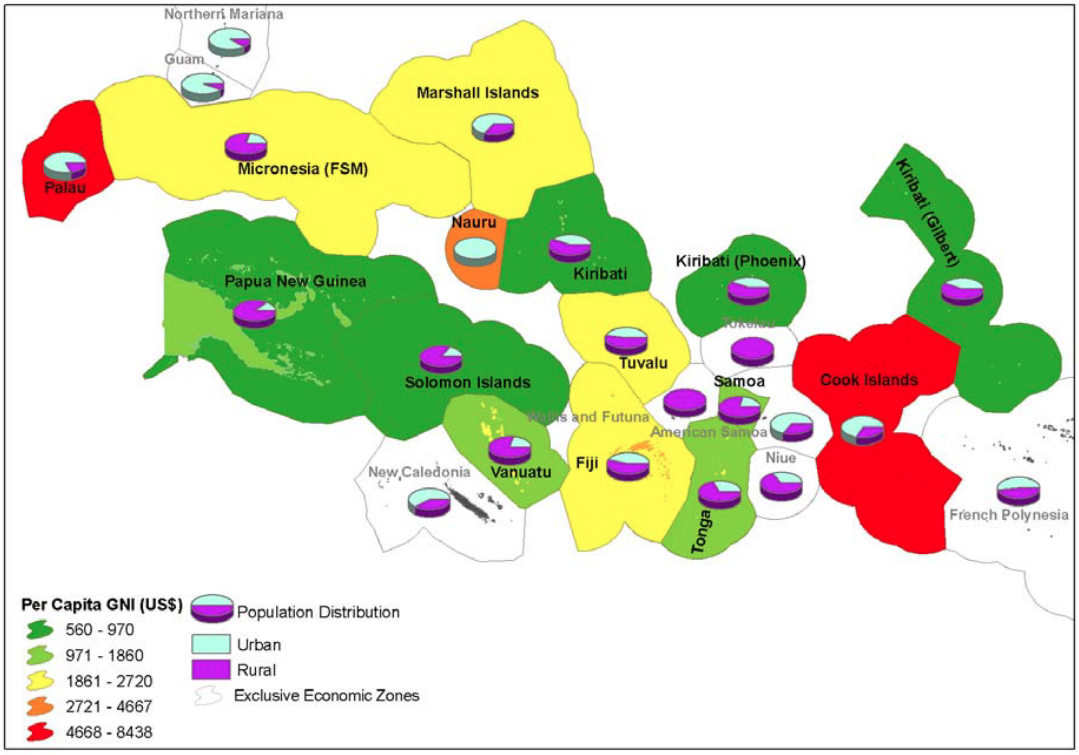

Figure 10 Gross National Income per capita, Population Distribution, and EEZs

Source: Gibson and Nero, 2007:11. Shows Gross National Income per capita (US$), Population Distribution and EEZ boundaries. EEZ geographic data: SOPAC; Population data: SPC; Economic data: ADB)

Development agencies consider that growth is critical if the Pacific is to combat these. AusAID, (2008:4) states that growth alone will not solve the region's challenges, but without faster growth the Pacific will be unable to halt rising poverty and achieve the MDGs. The Pacific Economic Survey (2008) documents that faster growth is possible, and is starting to be seen in some countries. The absolute centrality of transport to this debate is obvious. "Safe, secure, reliable, and affordable domestic transport services are vital for rural development, access to health and education services, trade, population movement, tourism and national economic development" (SPC, 2011:4).

Gibson and Nero (2007:11) draw attention to geography "as a fundamental growth constraint that Pacific Island countries have little control over" adding "economic growth rates may depend on the growth rates of nearby countries. This spatial autocorrelation can arise because nearby countries have unobserved factors in common (e.g. climate, topography, institutions) and because of interaction between one country and another (e.g. through common customs borders, cross-border flows of goods and labour, and shared use of key assets) so that growth depends on the growth rate of neighbouring countries".

Remoteness is not the only issue faced. Populations and land area are much smaller than for other states and limited domestic markets may reduce their income (Redding and Venables, 2004). They are also less open to international trade, due either to protectionist policy choices or to their greater remoteness causing transport costs to be a larger source of 'natural protection' (Gibson and Nero, 2007).

Climate change and natural disasters: At a global level Oceanic voices are almost unheard, drowned out by a cacophony of larger states, superpowers, and alliances whose consumption-based development and security interests easily outweigh any Pacific voice. The failure to gain international consensus on solutions at Copenhagen, Mexico and Rio +20 reinforce the futility of these margins awaiting global response at any serious level. Unfortunately, the same Oceanic states, along with indigenous communities at the poles, will be in the front-line of the increasing threat posed by climate change not of the Pacific's design or making (Barcham, 2009; Merson, 2010).

Climate change is the biggest challenge to the Pacific.[51] The most recent assessment by the IPCC (2007) highlighted the special vulnerability of SIS. Climate variations and extremes have regularly disrupted food production, water supply, and the economies of Pacific countries. Projections for the future, although coarse for islands, are bleak. The primary food sources (agriculture, fisheries, and forests) and water will all be impacted and, in most cases, these impacts will be negative (UNESCAP, 2010:10). Pacific SIDS rank among the most vulnerable in the world to natural disasters. Between 1950 and 2004, extreme natural disasters, such as cyclones, droughts and tsunamis, accounted for 65% of the total economic

[51] The UNESCAP Port Vila Outcome Statement (9 February 2010) recommendations from the Ministers and officials commences with: (a) Climate change remains the greatest challenge as current and predicted impacts serve to undermine progress towards development and, for some of the Pacific SIDS, threaten their very existence.

impact from disasters on the region's economies. Ten of the fifteen most extreme events reported over the past 50 years have occurred in the last fifteen years (UNESCAP, 2010:10).

SPC (2011:23), while considering that the international maritime industry is firmly committed to playing its part in reducing emissions GHG[52], notes that this requires huge capital investment, which may not be feasible for PICs due to low volumes of ships and cargo. Even if new technology can be introduced globally, it is unlikely this will be available to Pacific operators at an affordable price for many years, if not decades, as second (third, fourth and fifth) hand vessels become available.

Vulnerability and isolation: Perceptions relating to signifiers such as 'isolation', 'vulnerability', 'small', are discussed elsewhere, in particular in Section 2.1, and the corollary of adopting Helu, Hau'ofa and Diaz's epistemologies of seeing oceans as central, stable and adaptable, a breeding grounds of resilience, strength, observation and patience where depth of culture provides a counter to Western phobias such as 'small man's syndrome'. In terms of modern sea-transport need and demand, however, it is difficult to look past the enormous obstacles posed by long distances, tiny populations, and minimal resources. The latter paradigm is still prevalent within most official development literature as the sources quoted below testify.

ADB (2007) considers that, despite their differences, Pacific SIDS have one thing in common: their vulnerability. The sentiment is echoed by others. "Events during the last decade have demonstrated that vulnerabilities remain high and efforts to build resilience have been insufficient" (UNESCAP, 2010:10)[53].

Remoteness has significant economic, environmental, and social impacts. Large distances, high fuel costs and low economies of scale makes the cost of developing and maintaining infrastructure, such as transport, relatively high. Small populations tend toward a narrow range of resources and skills, limiting institutional capacity. Narrow markets for local

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[52] This statement should be read in context of the following chapter's overview of the current global perspective on shipping.

[53] ADB fails to recognise a huge number of other commonalties – such as cultural strength. Coates (2009:30) wryly notes that much of the external academic research (he singles out Hughes, 2003 as a prime example) has focused on the Pacific's perceived failings and ignored its uniqueness and strengths preferenced by Pacific academics.

products and dependence on international trade creates vulnerability to global developments as well as fewer employment and livelihood options. Trade in remote locations is limited by high freight costs leading to increasing urbanisation (UNESCAP, 2010:11).

SPC concurs with ADB in regard to vulnerability, noting that for shipping it adds to "costs through high insurance premiums faced by transport operators and increased regulatory costs that impact the industry more generally. All of these (combined with sparse services along routes with low volumes, long distances, slower adoption of new technology, limited resources and general inefficiency) distort the market, impacting negatively on SIS economies. Low volumes of imported cargo and very little outbound export cargo result in high freight rates and irregular services. These are compounded by the high fuel costs, high port costs (generated by large infrastructure development and maintenance costs) and inadequate port facilities" (SPC, 2011:6-7).

Gibson and Nero (2007:10) prefer the label of remoteness to isolation which they have assessed "in relationship to proximity to neighbouring countries, weighted by the neighbour's GDP … Out of 219 countries in the world with available data, the Pacific Islands as a group are the most remote". Gibson and Nero (2007:15) also consider that if the Pacific is the most remote in terms of 'geographical distance', then 'economic distance' is even greater and they use airfares to examine this. Again, PICs appear more remote than island countries in other parts of the world. "While the PICs are, on average, 40% further from the locations of world GDP than the island states in the Caribbean, they are much further away in terms of airfare-based measures of distance".

Fossil fuel dependence: PICs are precariously dependent on imported fossil-fuels, which account for 8-37% of total imports raising critical issues of fuel price and security of supply (Woodruff, 2007a). The Pacific is the most dependent region in the world on imported fuels at 95% dependency (99% if PNG and Fiji are excluded). By comparison, the next most dependent region is the Caribbean (82%). Imported petroleum products account for an average of 40% of PICs' GDP. Fuel imports average 14-20% of foreign exchange earnings (AusAID, 2008), for Fiji they totalled US$340 million in 2005 (Woodruff, 2007b) rising to FJ$1.2 billion in 2008 (*Fiji Sun*, 6/8/2011). In 2010 Fiji spent 32% of the value of all its imports on petroleum products (*Fiji Times*, 20/9/12). Such reliance represents a major drain on economies, a barrier to development, and a source of vulnerability (Jafar, 2000) and has seen PICs suffer the full impact of the recent global fuel crisis (AusAID, 2008). Fossil fuel

dependency is recognised as having a crippling effect on national budgets and revenues and impacts on key productive sectors in the region such as fisheries, agriculture, and tourism (UNESCAP, 2010). In 2011 this situation led the Fiji government to call for a $100 million cut in the national fuel import bill over the next 3 years (*Fiji Sun*, 6/8/11). The Fiji Transport Department presented to the SSTT 2012 on its impressive remote island based bio-fuel programme as a major component of achieving this goal.

As development continues the demand for fossil fuels increases, especially for transportation and electricity production. Given the distance between markets and metropolitan centres, and the dispersed multi-island characteristic of many PICs, transportation remains central to development. Fuel costs for transport to remote islands are especially high, contributing to price inflation of domestic goods and services, including food, even where government subsidies apply.

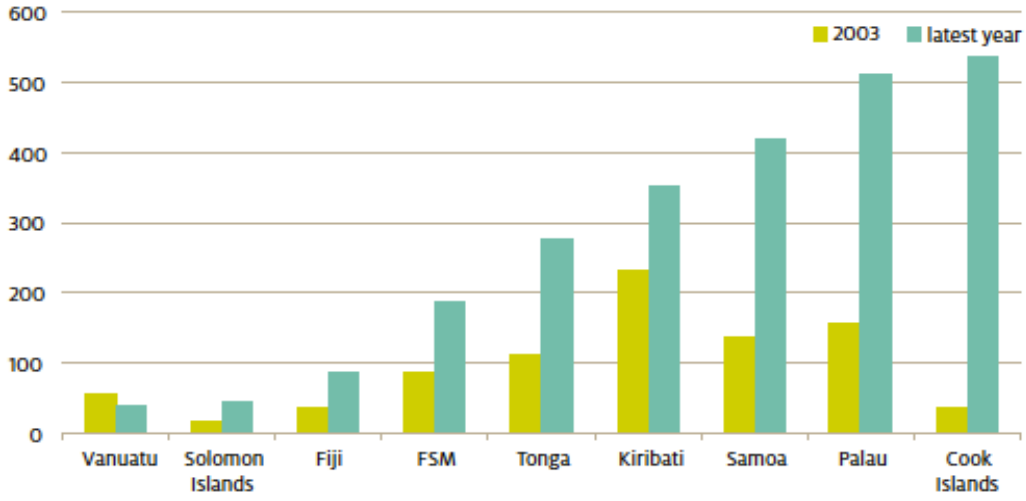

Figure 11 Oil Imports as % of Merchandise Exports

Source: ADB (2007) in AusAID (2008)

AusAID (2008:15) found that small Micronesian and Polynesian economies, with their very limited export bases and reliance on aid, remittances, and tourism, have been most affected by high fuel prices. There has been a rapid rise in oil imports relative to exports and a negative impact on incomes. While there is nothing PICs can do about the global price of oil, they consider there is much governments can do to offset recent price increases.

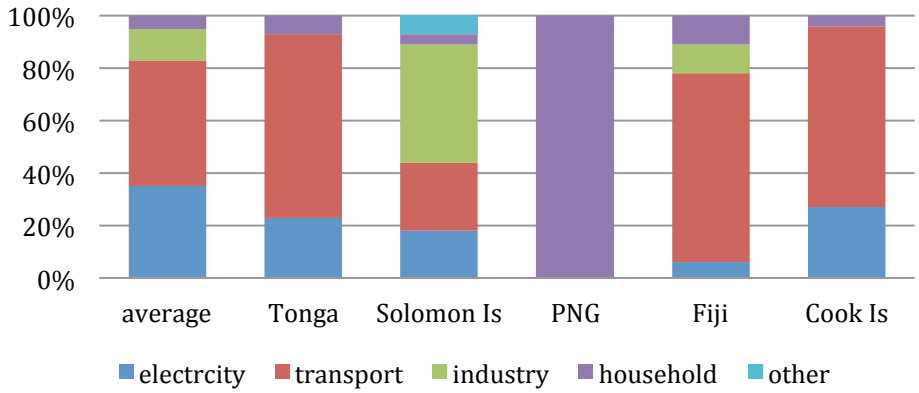

Figure 12 Energy Sector End Use

Source: Adapted from Mayhew (2011a). Data from Pacific Regional Energy Assessments, World Bank and ADB (2002)

4.2.2. Pacific Commercial Transport Issues

Shipping is the Pacific's lifeline. It plays a critical role at all domestic and international levels. Given that the vast bulk of commodities and manufactured goods are transported by ship in the Pacific, and that much domestic travel is by sea, the cost and quality of shipping immediately affects the welfare of the poor as consumers and producers (AusAID, 2008).

The provision of safe and secure regional transport services is affected by numerous geographical, socio-economic, and technical factors including population mobility, susceptibility to natural disasters and other effects of climate change, national policies and regulations, and international instruments. Additional factors include appropriate vessel/craft operation and maintenance, route profitability, existing petroleum supply (quantity and quality), level of infrastructure, technical capacity, proximity of maintenance facilities, as well as mandatory safety and security auditing services (SPC, 2011:3).

The marginal nature of the industry has always meant that financing shipping investment, either for governments or private operators is difficult. The current global economic environment has only exacerbated this with industry advisors pointing to the finance market becoming increasingly cautious of such investments. "Given the underlying economics of oversupply and the current day [freight] rates, the banks are more cautious. If they are going to put money into a project, it is on very particular terms" (*Fiji Sun*, 28/9/2011).

Politically, transport is a priority area for Pacific Forum Leaders under the Pacific Plan and its

importance as a facilitator of economic growth is recognised as are the gaps and barriers. "Continued focus through regional and sub-regional approaches to improve shipping and aviation services, aviation liberalisation, safety and security as well as the supporting infrastructure remains essential for all Pacific SIDS" (UNESCAP, 2010:59).

In 2004 Forum Leaders endorsed the Forum Principles on Regional Transport Services (FPRTS) in recognition that the provision and maintenance of regular, reliable, and competitive air and shipping services is crucial to Pacific SIDS. It recognised changes in the transport sector, e.g. increasingly competitive markets and new international safety and security requirements as well as the limited technical support in-country for most PICs. The FPRTS contains six principles promoting good governance, transparency, and accountability, and aims to serve as a guideline to Pacific SIDS in their pursuit for greater service delivery to improve the efficiency, effectiveness, and sustainability of both air and shipping services (UNESCAP, 2010:59).

At their ministerial meeting in Nuku'alofa, Tonga (May 2009) Pacific Ministers of Transport further recognised that internationally compliant transport services are imperative for economic growth and human development (SPC, 2011:1) and instructed SPC to produce the resultant *Framework for Action on Transport Services 2011-2020*. Although the political leadership being shown in marine transport regionally, on paper at least, is commendable, especially in light of the resources available for implementation, it still has some way to go. The 2010 UNESCAP report highlighted the regional commitment to developing a Green Growth Strategy for sustainable production and consumption and the sub-regional project on environmentally sustainable transportation in the Pacific Islands for land transportation (UNESCAP, 2010:61). However, green technologies for marine transport have not thus far been included and are not mentioned in SPC's FATS or their 2011 *Framework for Action on Energy Security in the Pacific.*

International Shipping

The literature on current Pacific shipping is sparse and again limited to development agency reports. The following is a synopsis primarily taken from AusAID (2008) and gives a recent picture of shipping trends in the Pacific. It should be noted that the AusAID report was produced before the current global economic recession began to bite. Other sources are referenced accordingly.

Unlike telecommunications and aviation, the international shipping market in the Pacific has always been competitive or at least contestable. There are four main routes: east–west and north–south, where ships sometimes stop at PICs; to and from Australia and New Zealand; and intra-Pacific. Entry is not generally regulated by inter-governmental agreements and the fixed costs of entry are relatively modest. The sector is predominantly the province of the private sector (the significant exception is the Pacific Forum Line[54]) and there is competition, or at least contestability, on many routes.

International sea freight prices are high due to low cargo volumes and the long distances travelled. Many PICs import more goods than they export, which means importers pay for the empty space on ships going out through higher freight rates. Shipping lines usually add a surcharge for delays and extra supervision, which can be one-third of the freight rate.

Shipping services at this level are considered to be of a reasonable standard. The Regional Transport Study (AusAID, 2004) found that in general terms international services in the region are considered to be adequate; container shipping services to and from PICs are reliable, vessels adhere to published schedules and offer sufficient space for the needs of importers and exporters.

Actions to implement the FPRTS have seen institutional and regulatory reforms throughout the region, albeit at varying stages, and have seen significant success in two areas: strengthened ports and administration standards and improved shipping services to the region's SIDS. SPC (2011) confirms that maritime services, safety, security, and international standards in shipping are gradually improving and highlights Kiribati Shipping Services Ltd commencing a regular feeder service from Suva to Nauru and Tuvalu with potential for expanding this service to include Wallis and Futuna. The success of this initiative has not gone unnoticed at higher political levels with PIC Maritime Ministers at their third meeting in Tonga directing work to assess the possibilities of commencing similar services between Samoa, Tokelau, Cook Islands, Niue, and American Samoa.

The Pacific's network of twelve maritime training institutions is a successful, regionally-led, vocational training system. The network has enabled international seafaring to become an important source of employment and income for the region. In 2003, an estimated 4000

[54] PFL has generally been held up as a regional success story. However, at time of writing, it has just been announced PFL is no longer viable and has been sold to the Samoan government.

Pacific Island seafarers engaged in international shipping remitted approximately US$19 million in foreign exchange to their countries (AusAID, 2008:78).

SPC is currently spearheading regional consideration of increasing inter-state transhipments within Oceania. While this is highly dependent on development of more appropriate mechanisms for regional trade, including complex political issues of tariffs, etc, the logistics of such trade are essential. SPC compared costs for shipments from Fiji to Nauru and other SIS finding that the current arrangements which require transhipping through Australia add an increased cost to consumers of US$50 per ton than if it had been shipped direct. SPC also found that Fiji makes the logical intra-regional hub, partly because of its geographical position, partly because of its existing shipping infrastructure and services and partly because of the increasing range of product Fiji now supplies to its neighbours (SPC, 2009:11-12).

Domestic Shipping

Given that international shipping is already competitive, the policy priorities in shipping lie on the domestic front; in improving domestic shipping and strengthening ports (AusAID, 2008:71). Inbound freight is typically shipped to trans-shipment centres and then distributed using smaller domestic vessels. There are an estimated 2,100 domestic ships providing services at various levels in PICs (SPC, 2011:19). As will be seen in Section 4.3, it is this level of shipping globally that is the greatest contributor to GHG emission per ton of vessel with initial analysis indicating vessels of less than 10,000dwt contribute approximately one-quarter of all shipping emissions.

Remote communities in the Pacific, particularly in rural areas and outer islands, often live without basic or regular services. Informal services provided by small craft are often the only transport between remote coastal villages and towns. Regular links to the main island or capital city by air or sea, although a lifeline, are time-consuming, expensive, unreliable and/or uncertain. So too is the ability to communicate easily with other parts of the region and beyond. Most islanders use shipping services for their personal transportation needs. The price of airline services makes it an extremely expensive option where it is available.

Providing adequate, efficient, and reliable domestic shipping services is one of the most difficult challenges for PICs. Many routes are commercially marginal and a significant proportion simply unviable. The ships used are sometimes unsuitable and often old, badly maintained, and in poor condition (ADB, 2007). Many vessels used for domestic shipping do

not meet recognised safety standards, and arguably should be banned from service. However, they provide essential services to remote communities, so this step is rarely taken (AusAID, 2008:71). Shipping disasters directly attributable to substandard ships are regular events, the *Princess Ashika* in Tonga with loss of 74 lives in 2009 and the *Rabual Queen* in PNG in 2012 (more than 200 lives lost) are only two examples. Small-scale coastal shipping operators have problems accessing finance for repair and replacement. Commercial banks do not find coastal shipping attractive for lending because of the high risk and lack of adequate collateral for loans. A study of domestic shipping in Solomon Islands noted that "under the present circumstances the shipping sector is locked into a situation where old vessels are replaced by other old vessels and there are no prospects of reducing the high average age of the fleet" (EC, 1999 quoted in AusAID, 2008:71).

Coastal and inter-island shipping services are generally operated by governments or small, independent shipping companies. Delivering such shipping through a government operation is fraught with peril; most schemes have proved immensely costly and incapable of delivering adequate levels of service (Bayliss-Smith, 1988; Couper, 2009). In many cases services of the quality expected by remote islanders are not commercially viable. Nevertheless, delivery of these services is a political, social, and economic imperative. Service schedules are frequently poorly maintained, and it is not uncommon for services to be suspended for many months (SPC, 2011:21).

ADB's Pacific transport approach was profiled in Section 2.2 and it typifies the agency response to these complexities of Pacific domestic shipping when it repeatedly recommends increased privatisation of shipping services as the (ADB 2007, 2010a). But even if competition is maximised, and private-sector participation encouraged, some important routes governments want to see serviced will only be operational if they receive government support. Good design and implementation of such assistance may make the difference between success and failure. In the Marshall Islands, private operators focus on services to nearby islands, while the government runs a service to remote communities. Faced with increasing costs, the government introduced a franchise scheme for services to some remote islands, but it has struggled to secure private-sector interest. In Fiji, domestic shipping services operate on a commercial basis. The main Viti Levu and Vanua Levu routes are subject to competition, including from aviation. Many smaller outer islands depend entirely on shipping but do not generate sufficient revenue to support commercially viable operations.

Fiji's Shipping Franchise Scheme started in 1997, and is now overseen by the Fiji Shipping Corporation Ltd., which reports to the Minister for Transport. The corporation does not itself own or operate ships, but competitively auctions subsidies to private-sector operators (routes are allocated for three years through a tender process which considers vessel safety and cost). Successful bidders receive a subsidy worth about 40% of the assessed operational cost of each route and keep all collected revenue. The subsidy is not provided to reduce the cost of fares and freight, but to make uneconomical routes commercially viable and ensure regular services. As a result, monthly shipping services are provided to remote locations and passenger numbers were reported to have increased by more than 60% and cargo volumes by 80% since 2005 (ADB, 2007). While there have been concerns over the operation of the scheme, it has been recommended as the type of approach other PICs could consider as a framework for shipping subsidies (AusAID, 2008:72)

While the franchise scheme may have initially had some success, it is now unable to keep pace with current stresses. The *Fiji Sun* (9/7/2011) reported that local shipping companies were unable to provide services without increases in subsidies given the increasing fuel prices affecting their operations. The figures quoted were that the Government provides a 42% subsidy, worth FJ$1.5 million aimed to encourage private shipping operators to service 11 uneconomical routes under the scheme[55]. One private operator with a fleet of two small coastal ferries reported an annual fuel bill of some FJ$3 million with a 30% increase in 2011 and fuel now making up over 70% of operating costs. Reducing passage speeds from 17 to 12 knots and slower, is the only available fuel saving measure short of cutting routes entirely. In 2012 the Fiji Commerce Commission announced a review of the Franchise scheme and has called for public submissions. Working with FIVS and their network I drafted and submitted to this process on the basis of the research used for this thesis.

I return to the potential that alternative energy shipping offers in Section 5.4. The remainder of this section summarises Fiji's shipping history to preface that analysis. Again, the literature is thin with the previously cited (Bayliss-Smith et al, Couper, D'Arcy and Sofer) providing the bulk of the commentary. The principal reason for providing this summary is to underscore that although some threats may be new and dominant (fuel price and dependency, climate change, etc) many of the issues facing the sector are consistent historically.

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[55] At the SSTT 2012, Fiji's Ministry of Works, Transport and Public Utilities reported there were 9 routes under the Franchise scheme (Tavai, 2012).

4.2.3. Sailing Heritage and Changes in Sea-transport: a Short History

This section gives an overview of Oceanic shipping history, narrowing to a Fijian focus. Past ancestors of today's Pacific Islanders found, explored, and colonised all known islands in the world's largest ocean, arguably the greatest technological, intellectual property right of Oceanic peoples. By exploiting learned knowledge of navigation, ship design/construction and particularly the ability to sail to windward on an apparent wind they made this ocean their home.

Despite some initial academic debate in the latter half of the 20th century (Sharpe, 1956) it is now generally held that such voyaging was widespread, diverse in use of technological adaption, and deliberate. Finney (1994, 2003), Irwin (1992), Howe et al (2006), D'Arcy (2006), Couper (2009) and many others have extensively documented this amazing legacy, made on a variety of vessels, employing a wide range of approaches to vessel design, construction, and operation. Such technology was highly developed, diverse, and readily available. It was totally indigenously designed, constructed, owned, operated, and regulated.

The Pacific was an ocean of sails, sustainable transport technology built out of renewable resources and exploiting advanced knowledge of physics and aero/hydro-dynamics to use wind energy as primary motive power. Not only were large vessels used for ocean exploration and naval domination across vast distances, but sailing and sail technology were integral parts of daily life (spiritual, social, political, and economic), essential for all levels of social interaction, transport, warfare, trade, and fishing. The sheer volume of vessels needs to be appreciated, with early European reporters encountering fleets of hundreds of vessels carrying thousands of people. The seas were bridges. The sheer volume of movement attests to Islanders willingness and ability to travel (D'Arcy, 2006:64; Hau'ofa, 1994:54).

Couper (1973:229) notes that when western colonialists first came to this ocean "the sea-transport systems of the European nations were only beginning to draw significantly ahead of those of many of the societies that they were about to overwhelm … There was a complex spatial component in the economies of the pre-colonial Pacific, demanding considerable planning, extensive geographical knowledge and a relatively high degree of technological skill".

The fleets of great Lauan built *drua* or *waqa tabu* found throughout central Oceania were the most technologically advanced of these bluewater ships, some over 100' long, carrying

complements of more than 200, capable of speeds more than 15 knots and of sailing within four points of the wind. John Twyning of the whaling brig *Minerva*, which was wrecked in Fiji in 1829, describes the process of building a large ship at Lakeba in the Lau Islands, where he and others were given refuge. He concluded that the design and the building of the ship would have received "the admiration of even the most skilful and scientific naval architect in Europe" (quoted in Couper, 2009:28). The Fijian *drua* and related craft and culture are the subject of Chapter 6.

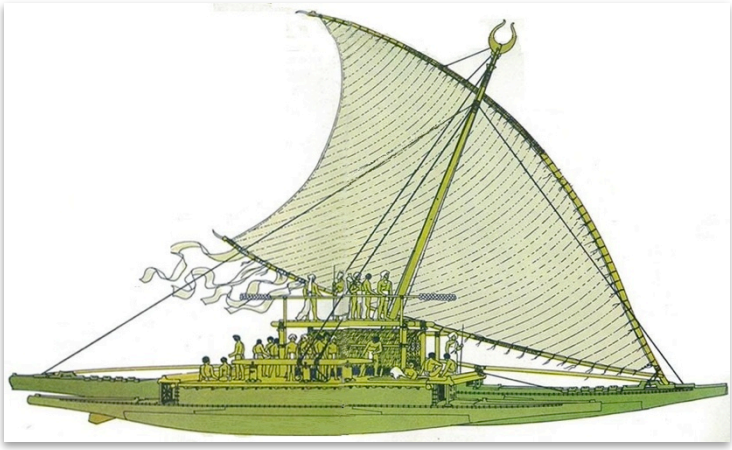


Figure 14 Drua

Source: Detail of Herb Kane (1974) illustration in Discoverers of the Pacific, *National Geographic Magazine*

Sophisticated internal transport and trading systems were well-embedded prior to European contact in Fiji. Commander Erskine (1853:269) on patrol on the warship *Havannah* in 1849 reported, "Feejeeans have a decided turn for commerce, a constant internal trade being carried on in their own canoes, which we constantly saw either arriving or sailing, heavily laden with bales of cloth, rolls of cordage, and quantities of earthen pots". Thompson (1940), Sahlins (1962), Tippet (1968), Lessin and Lessin (1970), Hage and Harary (1996) have characterised these trading and political networks in detail, with Hocart (1952), Kappler (1978), Couper (1967, 1968a, 2009), D'Arcy (2006, 2008) and others providing wider sub-regional and regional context. The first Europeans found established complex networks of trade linking the archipelagos of Fiji, Tonga, and Samoa. Within these island groups were complex local trading chains that operated through intermediate villages and even through professional middlemen (Couper, 1973:230-232). Hau'ofa concurs: "Fiji, Samoa, Tonga, Niue, Rotuma, Tokelau, Tuvalu, Futuna, and Uvea formed a large exchange community in

which wealth and people with their skills and arts circulated endlessly" (1994:54).

European technology and commerce did not immediately displace local trade in Fiji as it did in other parts of the Pacific. "The penetration of capitalist relations of production into Fijian community life was carefully regulated by chiefs ... The system of inter-island economic interdependence which evolved in southern Lau to support the ship-building industry goes far to explain the lack of interest by the paramount chiefs, especially the *Tui Nayau* based in Lakeba, in trade with Europeans. Many of the desired trade items were obtained from Tongans and other Fijians who wanted the drua" (Bayliss-Smith et al, 1988:57).

Despite this strong self-sufficient heritage, by the early 20th century indigenous ownership and control over all but very small-scale domestic shipping was to disappear in Fiji as it already had in much of the Pacific. As Couper argued as early as 1973 (p.229), "the attributes of island culture should have been a basis for successful participation in the maritime trade which arose from the introduced commercial economy. But this happened only partially and with a record of failures that far outran the successes. Islanders who were demonstrably able to marshal and distribute resources over large areas in the indigenous economy have often failed in their efforts to participate in modern trading systems"[56].

There is limited published historical analysis of commercial sea-transport in the Pacific generally. "The community of world history scholars largely ignores trans-Pacific trade prior to the twentieth century … It turns out that trade history is intimately intertwined with epidemiological, ecological, demographic, and cultural histories. None can be properly understood without consideration of the others" (O'Flynn and Giraldez in D'Arcy et al, 2008:xiv)

Snapshots have been provided on discreet areas or times in Pacific shipping history such as Maude's (1968) assessment of the pork trade between the emergent settlements in Australia and Tahiti in the mid 1800's. The histories of the major commercial Pacific shipping lines in the late 19th century have been documented, particularly the Australian Burns Philp & Company, the Union Steam Ship Company of New Zealand, and the American Matson Line (Buckley and Klugman, 1981; McLean, 1990; Worden, 1981) as well as studies of the steamship era. More recently, Silk (1990) recorded the Cook Island experiences in the post-

[56] The examination of the reasons for this is complex and I am indebted to Professor Couper. Many of the same questions he puzzled with then are as relevant now in places like Solodamu.

war period. Couper provides an overview of Fiji commercial domestic shipping issues in a series of articles (1967, 1968a, 1968b, 1973), when planning began for the modern era of Ro-Ro based intra-island transport, as well as important insights of the indigenous *solevu* trade. Bayliss-Smith et al (1988) also contribute important pieces of this jigsaw for eastern Fiji in the modern era and Sofer (1985, 2009) provides a short vignette of Kadavu shipping. D'Arcy (2006, 2008) covers the period from 1770-1870 in a wider Oceanic context.

In Fiji toward the end of the 19th century the *waqa ni tikina* (vessel of the villages and provinces) were controlled by the *buli* (government official), and numerous small craft were increasingly owned and operated by *mataqali*. From the 1880's onward there was a marked revival in commercial trade, with schooners and cutters owned by communities in many outer islands where chiefs once again became enthusiastic for their own ships. The introduction of steamship services saw many small, unproductive nodes ignored as European companies with their expensive vessels sought economies of full loads, concentrating on the shortest distance, highest producing areas leaving the more remote islands marginalised (Couper, 2009: 157).

By European standards this boom in local shipping represented a gross oversupply of vessels beyond the needs of most islands. It appeared a waste of time, resources, and capital and was considered by officialdom as a process leading to impoverishment not development (Couper, 2009:158). That such rivalry had been a prevailing cultural determinand for at least several generations by then was ignored. Bayliss-Smith (1988:65) agrees that in this period in Fiji a "major item of expenditure, usually at the level of the community but occasionally an individual enterprise, was on sailing boats to service the growing trade in commodities between the eastern islands and Levuka. The potential for control over transport made possible by the proliferation of Fijian-owned boats was seldom realised, however, because the boats ran at a loss".

Couper (1968b:54) considers the sharp decline in Fijian-owned ships commences from 1912 onwards and advises that European-owned and controlled small, commercial cutters and itinerant trading schooners were plentiful and relatively cheap in the period leading up to WWII. Large-scale shipping had been the domain of a small number of trading companies across the Pacific since the end of the previous century, notably On Chong & Co, Burns Philp, Jaluit Gesellschaft, Henry Marks, Donald & Edenborough and Brown & Joske (Couper, 1968a:266).

In Fiji, as elsewhere in the Pacific, local participation in shipping was not surrendered passively. Couper and D'Arcy both instance the impoverishment of whole island communities through ill-fated attempts to build or purchase vessels for local and international trade. There were various attempts to establish cooperatives to control local trading to the exclusion of expatriate commercial interests, including the example of the Viti Company in Fiji. "Not only did [Pacific islanders] have their own indigenous trading systems, which continued to endure and to re-distribute the new 'European' goods, but they made repeated attempts to participate in the commercial trading systems of the Europeans and even to usurp entirely role of the alien traders" (Couper, 1968a:263).

Numerous factors conspired to sink such ventures, including missionary intervention, industry duplicity, and blatantly racist colonial administration regulation. Space limitations restrict addressing these factors in detail here (it is arguably a thesis subject in its own right), but the conclusions remain relevant for future application of locally-controlled alternatively-powered vessels. Firstly, European operators increasingly came to monopolise the import and export channels to PICs. "At this stage the role of entrepreneur becomes institutionalised as belonging to aliens … Cash transactions, the complications of book-keeping, the various social obligations in island society and commercial, religious and political opposition led to the failure of most of these [indigenous] enterprises" (Couper,1968a:272).

Secondly, the entrenchment of port towns on key islands, which led to more open radical networks focussed on the ports, began quickly to replace the closely-woven island networks. This alteration in spatial relationships reflected the changes that came about in the economic basis of island life (Couper, 1973:233). The 'ship' in this era had changed in nature, from artefact and icon to asset and load-bearer and shifted from the realm of indigenity politics to western economics (Tippet, 1968).

Ultimately, local enterprises were defeated from without. Erosion of seafaring skills and reduction in crew employment of Pacific peoples were some of the results of commercial and colonial policies. In this period seafaring became more nationally homogenous to the countries of ship owners and elements of racism entered into the relationships of multi-ethnic seafarers. By 1890 Governor Gordon's successors had decided that the *solevu* was a burden on the people, and in any case "had lost much of their native character". Attempts followed to curtail large-scale inter-island exchanges in Fiji including localised bans on using traditional craft (Foye, 1917:384). It was much the same story in several other parts of the

Pacific (see for example Maude, 1968 in regard to the Gilberts). The decline in local enterprises is bound to the change in technology with foreign-owned steamships increasingly prevalent by the turn of the century. Larger and more mechanical vessels were "beyond the everyday experience of most Pacific islanders" (Couper, 2009:147).

Among other effects were the actions by Australasian and American maritime trade unions in defence of their members against the use by ship owners of cheap labour on their national flag vessels. This saw most Pacific seafarers confined to employment on small inter-island traders within specific colonial territories (Couper, 2009:4).

Government subsidies were used since the beginning of colonial administration in various guises and Couper (2009) summarises their effect. The Fiji Shipping Commission of 1915 had some misgivings about the pattern of subsidized shipping and trade in Fiji and recommended that subsidies should not be granted to firms or companies trading as merchants in the colony. Nevertheless, subsidies remained and the merchant companies continued to be the major beneficiaries. The Fijian *waqa ni koro* still amounted to a substantial tonnage in this period [1906-1927], but other owners of small cutters were emerging, especially those of mixed European and Fijian parentage ... the entrepreneurial role of the part-European sector was increasingly becoming the ownership of small shipping companies. The reality was that some administrators could not appreciate that island ships owned by communities had important functions that were beyond the criteria of efficiency as measured by Western economics. They fulfilled a dual role; serving social as well as economic needs (Couper, 2009:159-162).

Couper (1973:247) concludes that "the assumption that Pacific Islanders have failed in commercial shipping and trade because of the complications of such enterprises will not stand up to examination: indigenous trading systems were far more complex, and even large-scale organization was achieved by the early Pacific monarchs before their states were overwhelmed by power from without and undermined by disease, depopulation and despair from within … while [Pacific Islanders] have achieved some measure of adaption to this situation ... the effect has been that large areas of maritime enterprise have remained open only to foreign entrepreneurs".

The global pre-WWII depression saw the copra market, on which the outer islands relied almost exclusively, crash and commercial shipping virtually cease. Thompson (1938)

reported that this had a positive effect in reviving local canoe building and inter-island trade, along with other forms of local economic activity in the Lau group.

After WWII there was a shortage of shipping and costs increased markedly (Couper 1968b:54). By 1967 the typical transport from the outer islands to Suva ranged from launches to vessels of 200 tons, with the most common being wooden cutters and schooners of 10-50 tons. Trade at that time was unsafe (with common overloading), always expensive and time consuming. Couper at this time advised Fiji and other PICs to centralise and establish more formal shipping services to achieve economies of scale. He considered such rationalisation would reduce the dominance of Suva as the only centre by stimulating the growth of outer-island centres, a more logical strategy for an archipelago state (Couper, 1967: 203-207).

This period coincided with increased interest in the newly emerging independent island states for establishing national and regional shipping capacity. Sea-transport costs always represented a major element in the economies of PICs, but because of the inelasticity of demand for primary products the ocean-freight rates were seldom passed on to the buyers of Pacific exports; they tended rather to be deducted from the returns to Pacific producers. On the other hand a proportion of the freight rates on imports was passed on to Pacific island consumers as higher prices (Couper, 1973:244).

Internationally since the 1970's, small freighters had been replaced with large container ships of about 20,000GT travelling routes between continental ports with calls at major island distribution centres (Forsyth and Systo, 1999; Heathcote, 1996). The movement of standardised containers brought increased efficiency and dependability of service, but container lines only called at appropriately-equipped larger ports where there was sufficient volume to make a stop economic (Anderson et al, 2003). This served to increase the distinctions between internationally and domestically serviced nodes.

Such improved technology had a knock-on effect on costs throughout the transport network. "Marine freight rates within Fiji increased by between 150 and 199% between 1972 and 1982 even allowing for the effect of a subsidy introduced in 1973" (Bayliss-Smith et al, 1988:107). The dependency on fossil-fuel in secondary towns was also increasing by this time, and it had to be transported. "In Fiji as a whole the outward cargo carried by inter-island shipping substantially exceeds inward cargo, by as much as 172% in 1983. However, this excess consists almost entirely of petroleum products, together with general cargo carried on the

Suva to Labasa service" (Bayliss-Smith et al, 1988:248). In the more remote areas such as the Lau transport services were declining.

Regionally in this period a number of country and regional shipping lines were established, with varied success, including the Forum Shipping Line, Kiribati Shipping Services Ltd and the Cook Island, Nauru Pacific, and Tongan Lines. Governments, including Fiji, also started to invest in domestic services and/or to bring in franchise or subsidy schemes. The concept of a marine transport network based on Ro-Ro shipping had been suggested for Fiji for some time, with both Couper (1973) and Bayliss-Smith et al (1988) initially advocating for it to be government led, especially through the provision of the necessary infrastructure, in particular connecting roads and ramps. Bayliss-Smith et al (1988:271) were strongly advocating at this stage for a joint public-private venture basis for eastern Fiji shipping. "The sea as a road offers special problems which the state cannot possibly resolve for the operators. Should not government therefore provide its aid to transport in other ways, where this is needed?"

In the end the initiative was taken by a private Fijian company. In 1983 one of the larger local shipping companies initiated a service between Viti Levu and Vanua Levu with a second-hand 900 ton ship, and later a second, smaller ship. A second company followed with a Ro-Ro vessel between Suva and Savusavu (Bayliss-Smith et al, 1988:271).

The Fiji Government entered the field of commercial sea-transport in a variety of ways. In 1988 Bayliss-Smith et al reported that there was regulation and partial subsidy of freight rates and substantial government investment in basic terminal facilities. Government ships competed with private concerns carting cargo and passengers, but also provided a range of essential services such as water cartage during droughts. In 1983 the total commercial Fiji fleet, government and private, included 58 ships of varied size, type and age. In 1980 there was a total domestic cargo of 140,000 tonnes, 51% between Viti Levu, Vanua Levu, and Taveuni. A tug-and-barge service operated between Suva and Labasa since the early 1970's. From 1983 private local companies began extending their Ro-Ro services to other large islands: Taveuni, Koro, Gau, and Kadavu.

The Lau continued to decline economically with shipping and air services following suit. "The structure of business comprises a number of small to medium entrepreneurs, mainly Indo-Fijian or Euro-Fijian, three small local shipping companies and a number of single ship operators, the co-operative movement and large body of Fijian farmers most of whom are

smallholders and most of whom operate within the village system" (Bayliss-Smith et al, 1988:251).

To return to the present. Anderson (2003:2-5) summarises the regional picture at the turn of the 20th century: "Freight or mixed passenger/freight vessels may carry a limited number of containers to remote islands. Distances may be very large, even amongst the islands of a single nation. Cargo volumes are small, and often of marginal value per tonne. Many of the national and regional shipping services are subsidised or owned by the countries served ... Many of the vessels in local and regional service are in poor repair, largely because revenues can seldom support new construction".

In Fiji, the same basic pattern illustrated by Bayliss-Smith continues, albeit that some of the players have changed and shipping has undergone various fleet replacements. The private sector provides erratic services on fleets of varying ages and standards, with service of uneconomic routes entirely dependent on an over-stretched government franchise system which has not been substantively reviewed since 1997. The government provides basic end of node infrastructure, at a much higher cost than Bayliss-Smith et al envisaged, and backstops shipping for its own and community demand when the private sector fails entirely.

Today there are 940 Fijian registered vessels of all types of 10m or more LOA (Tawai, 2012). The inter-island fleet is largely small to medium, aged Ro-Ro's and various sized landing craft and barges. At the local level almost all demand is met by 'fibres' and longboats. Tourism companies flourish, operating a wide range of vessels up to small bluewater cruise liners, generating growing local construction of good quality vessels in the 8-15m range. However, privatisation of the Government shipyard and associated infrastructure following the 1980's coups has seen any medium scale construction activity curtailed although foreign fishing fleets and domestic shipping are still serviced locally. Hard data on current Fiji domestic shipping is hard to come by. Increasing fuel and operational costs continue to make the industry highly competitive and close-mouthed. The Fiji Commerce Commission's recent inquiry into fares, freight rates, and franchising will, hopefully, release a wealth of information but unfortunately its results will come too late to inform this inquiry.

4.3. A Global Perspective

Sea-transport locally and regionally has been characterised in Sections 4.1 and 4.2. In this section both are placed in a global context, primarily in assessing the publicly available

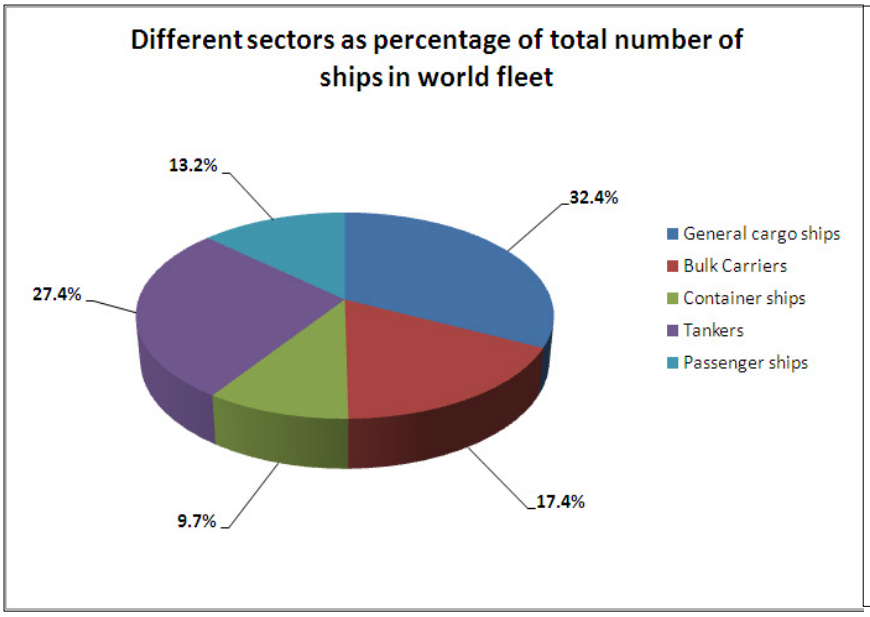
literature pertaining to the effects that global shipping has as a contributor to GHG emissions and thereby to climate change, described previously as the greatest threat to PICs, and in relation to global shipping's claim to be the most efficient mode of transport in the world. Again, while this section seeks to provide context to a Fiji/Pacific inquiry, it also illustrates lessons from the macro to provide *verstehen* for the micro. At the end of the section examples of alternative shipping initiatives currently on the global horizon are outlined and their potential impact for Oceania discussed.

4.3.1. Global Shipping: the Handmaiden of Global Commerce and Consumerism

Oceania's share of global shipping is so minute as to be virtually immeasurable. Oceania's capacity to influence trends in shipping technology is equally negligible as is its contribution to the adverse side-effects of the activity. Reliant as it at all levels, but especially the domestic, on aging vessels imported from the rest of the world, any advances in efficiency in new vessels are unlikely to be seen in Oceania for at least two decades and costs of retro-fitting existing vessels with alternative technologies are likely to be prohibitive to most government and private shipping service providers in the region.

At a macro-level, commercial shipping is arguably the most international of the world's industries; immensely powerful and valuable. The size of the global fleet is disputed; ICS stating "over 50,000 merchant ships trading internationally, transporting every kind of cargo. The world fleet is registered in over 150 nations, and manned by over a million seafarers of virtually every nationality"[57]. Others put the figure at 90,000 ships (e.g. *The Guardian*, 9/4/2009). Buhaug et al (2009:13) state: "the world fleet in 2007 comprised more than 100,000 ships of more than 100 GT, of which just less than half are cargo ships. However cargo ships account for 89% of total gross tonnage". To some extent it depends which ships are being counted by whom, but there are systemic issues with international maritime industry data collection (see Buhaug et al, 2009; Corbett et al, 2010; Faber et al, 2009).

[57] http://www.marisec.org/shippingfacts/worldtrade/index.php, sourced 9 July 2012; see also Figure. Marisec is maintained by the International Chamber of Shipping on behalf of the Round Table of International Shipping Associations.



As of 31st October 2010, the world fleet was made up of 50,054 ships.

Figures in brackets are numbers of ships, by sector.

General Cargo Ships (16,224)

Bulk Carriers (8,687)

Container ships (4,831)

Tankers (13,175)

Passenger ships (6,597)

TOTAL (50,054)

Figure14 Different Sectors as Percentage Total Number of Ships in World Fleet

Source: http://www.ics.org.uk accessed 9/7/12

The financial value of the shipping asset is gargantuan with a single container vessel costing US$10-100+ million[58]. To this must be added the operational costs (fuel, maintenance, crewing, etc), infrastructure (ports, railheads, bunkering, shipyards, slipways, breaking centres, etc) and all the related secondary and tertiary industry (from container manufacture to insurance).

Quantities of volumes moved are equally large, the ICS website stating more than 8.4 billion tons were transported in 2012, more than 1 ton per head of global population[59]. No-one quite knows exactly how big or valuable global shipping really is but most sources cite that it moves 90% of all goods and raw materials globally (IMO; ICS; Ribeiro et al, 2007). Buhaug et al (2009:10) suggests "about 80%" quoting from UNCTAD derived data.

Buhaug et al (2009:11) use various industry sourced data to calculate an "annual turnover for marine activities of US$1.3 trillion in 2004 with an 8% increase compared to 1999 … about one-third is related to merchant shipping," but notes also that other studies "value the world marine market at US$2.7 trillion, with the shipbuilding industry as the largest global market value. The United Nations Conference on Trade and Development (UNCTAD, 2006)

[58] Compare this with the annual income for a single Pacific state, (Section 4.2).

[59] Buhaug (2990:35) estimates total shipping emissions in 2007 to include 1,050 million tonnes of CO_2.

estimates an economic contribution to the global economy of US$380 billion in freight rates deriving from the operation of ships".

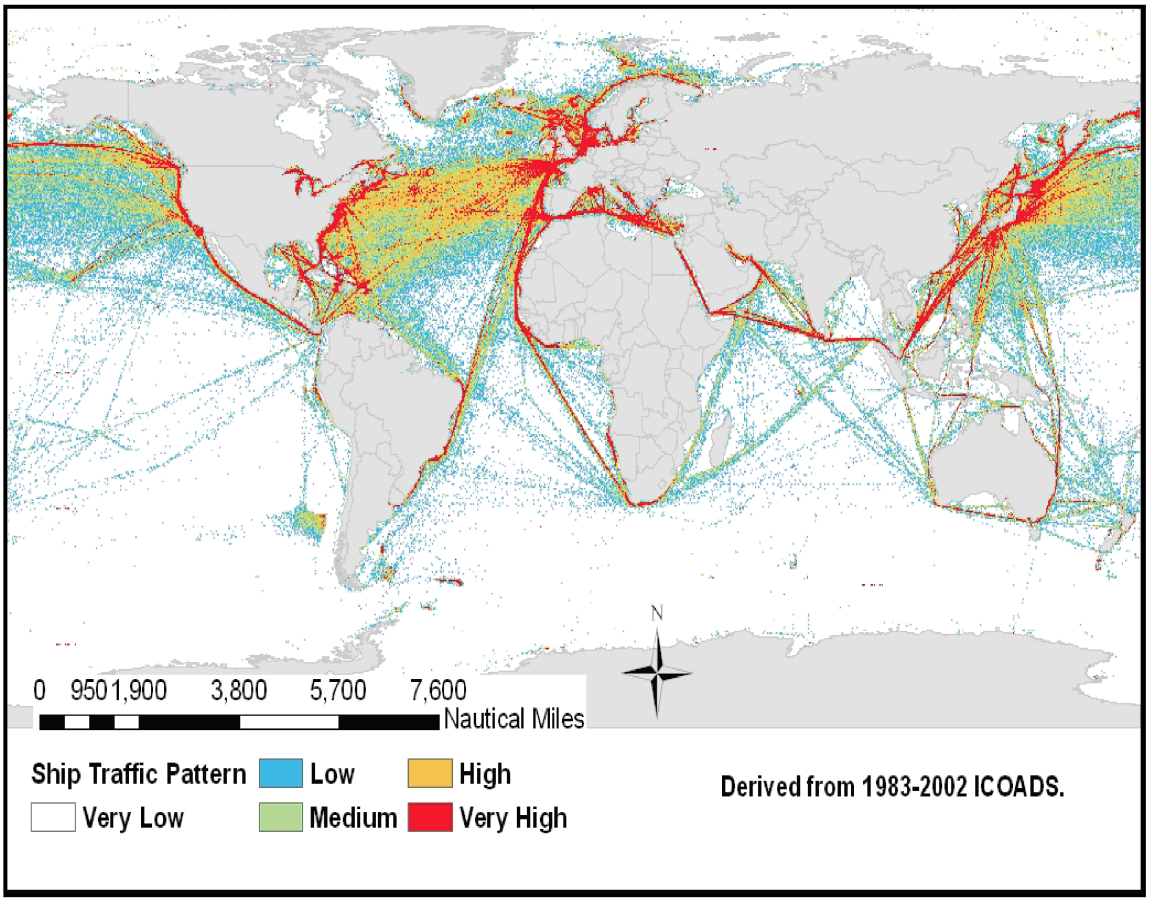


Figure 15 Approximation of ship traffic distribution

Source: Based on ICOADS data in Buhaug et al (2009:13)

It is essentially a monopoly industry (Ribeiro et al, 2009:335). The industry is controlled by cabals of ship-owning magnates, shipping service providers, marine insurance underwriters, and bunker-fuel suppliers. As the industry operates in an international environment, with the flag registration of a ship being easily changed and often bearing no relationship to the country of ownership or service, regulating and enforcing standards of shipping is complex and logistically difficult. "The ownership and management chain surrounding any ship can embrace many countries and ships spend their economic life moving between different jurisdictions, often far from the country of registry" (http://www.imo.org, accessed 9 July 2012). In the 'developed' world, merchant navies are the strict preserve of private enterprise with governments performing regulatory functionality.

4.3.2. Shipping and Emissions

The IMO was established in 1949 as a specialised UN agency whose primary purpose is to "develop and maintain a comprehensive regulatory framework for shipping and its remit today includes safety, environmental concerns, legal matters, technical co-operation, maritime security and the efficiency of shipping" (http://www.imo.org accessed 9 July 2012). Prior to 2008, prosecution of the environmental mandate was largely restricted to issues of oil spillage, polluted water discharges, ballast waters, and biosecurity matters.

Although the harm caused by shipping emissions has been clearly flagged for some decades, IMO has only just begun an audible debate on GHG emissions from shipping, reflecting the political complexity of enforcing nationally-ratified policy and regulation at the international level. The First Intercessional Meeting of IMO's Working Group on Greenhouse Gas Emissions from Ships took place in 2008, tasked with developing the technical basis for the reduction mechanisms that may form part of a future IMO regime (http://www.imo.org accessed 9 July 2012). The IMO interest was finally forced through the international accord reached under the 1997 Kyoto Conference that left all control of international shipping emissions to the IMO. This was "in recognition of the unique nature of the shipping industry, as well as an acknowledgement that the universal application of the IMO rules is the appropriate means of tackling greenhouse gas emissions from ships" (Faber, 2009:14). Getting internal agreement for IMO to act took more than another decade.

Progress has been predictably slow, especially as the global recession and its enormous economic implications for shipping, the world's transporter of consumerism, continues to bite and divert attention from any long-term climate change focus. Even today, hard information, as opposed to industry-sanctioned statements, is difficult to access or assess. The Second IMO GHG Emissions Study 2009 (Buhaug et al, 2009) remains the authorative report: "the report quantified emissions and made projections for the future, examined potential climate impacts, and reviewed potential technological and policy options for emissions reductions" (Faber, 2009:64), and most subsequent reports rely heavily on its data calculations for their own modelling. Contrast this with the plethora of data, analysis, and reports publicly available for terrestrial transport!

The rationale for IMO failing to act earlier and act decisively on emissions clearly comes down to its international nature, a failure by nation members to achieve consensus and the

self-interest of the industry. The IMO official account is "IMO's original mandate was principally concerned with maritime safety. However, as the custodian of the 1954 OILPOL Convention, the Organization … assumed responsibility for pollution issues and subsequently has, over many years, adopted a wide range of measures to prevent and control pollution caused by ships and to mitigate the effects of any damage that may occur as a result of maritime operations and accidents. These measures have been shown to be successful in reducing vessel-sourced pollution and illustrate the commitment of the Organization and the shipping industry towards protecting the environment" (http://www.imo.org/OurWork/Environment/Pages/Default.aspx accessed 9 July 2012).

The trends in reduction of oil spills, etc. are admirable and desirable achievements and are what is being referred to in this statement. But IMO leadership on the issues of emissions has been tardy. Regardless of the above explanation, IMO has had mandate for dealing with all shipping discharges, arguably since its inception and at least since the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78) which covers not only accidental and operational oil pollution but air pollution. However IMO elected not to act on this mandate and waited until 1997 to enact the Regulations for the Prevention of Air Pollution from Ships with the aim of minimizing airborne emissions from ships, and until 2005 to give effect to it (http://www.imo.org/About/Pages/Default.aspx, accessed 2 July 2013). Real cuts in sulphur content, a major shipping pollutant, do not take full effect until 2020. The publicly available reports and submissions produced by IMO and listed on their website favour maritime safety, piracy, and oil spill control by more than three times their output on climate change. The evidence set out below is that smokestacks create continual environmental harm on a scale of magnitude far greater than any oil spill in history.

It is generally recognised by the industry that, historically, fuel efficiency has not been a motivating factor for the world's shipping industry and increased fuel charges are simply passed on to the consumer. This is changing, albeit slowly, with rising fuel costs, international pressure, and an increasingly competitive industry. Despite this, IMO do not expect this to transform into any quick or large changes to the status quo. Its background papers regularly contain statements such as: "by 2020, a combination of regulatory, design and operational measures might possibly deliver a reduction of around 17 to 32 per cent in the fuel consumed by ships per tonne/mile of cargo transported. However, it is important to

stress that work on these complex issues is still continuing, that more efficient and sophisticated ships will be more expensive and that many measures may not be cost-effective for a range of ships and trades" (Buhaug et al, 2009:6).

World transport predominantly relies on a single fossil resource, petroleum, that supplies 95% of the total energy used. Shipping is estimated to use 9.5% of the world's transport energy budget (Ribeiro, 2009: 325,328). Globally, sea-transport is a major contributor to GHG emissions (Buhaug, 2009:44). Large ships are essentially unregulated power stations burning the by-product of refining cleaner fuels for terrestrial transport and aviation (HFO), and arguably the dirtiest petroleum fuel on the planet. Emma Maersk, the world's biggest container ship in 2009, has 109,000 hp engines that weigh 2,300 tons and burn 1,660 gallons of HFO per hour. A mid-range 7000 TEU container ship will burn about 217 tons per day[60].

As terrestrial fossil fuel use grows slowly cleaner, the contribution of pollutants from sea-transport increase as a proportion of global totals. Official estimates of total shipping emissions vary, again reflecting systemic issues of data capture, with sources to 2010 regularly reporting it to be between 1.8 and 3.5% of all GHG emissions, making the industry an emitter on the scale of Germany and on par with aviation (IMO, 2009; www.carbonwarroom.com)[61]. Mid-range emission scenarios from this era suggest that, by 2050, in the absence of reduction policies, ship emissions may grow by 150-250% (compared to 2007 emissions) as a result of the growth in world trade by 2040[62]. "If the climate is to be stabilized at no more than 2^{o}C warming over pre-industrial levels by 2100 and emissions from shipping continue as projected … they would constitute between 12% and 18% of the global total CO_2 emissions in 2050 that would be required to achieve stabilization with a 50% probability of success" (Buhaug et al, 2009:1).

Others consider the level of emissions to be much higher. A *Guardian* by-line (Vidal, 9 April 2009): "15 of the world's biggest ships may now emit as much pollution as all the world's 760 million cars", caught widespread media and internet attention and the related article cited

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[60] By contrast I conservatively estimate the marine fuel bunker to service Tokelau from Apia to be in the region of 500-900 tonnes/yr of MDO.

[61] The Marisec website states international shipping contributes "a small amount, less than 2%".

[62] Although the volumes of cargo fell in 2008 (but only to 2002 levels) the overall increase looks like tracking in spite of the recent economic downturn.

statistics from "confidential data from maritime industry insiders based on engine size and the quality of fuel typically used by ships and cars". These suggest shipping is responsible for 3.5% to 4% global CO_2 emissions; 15-30% of global NO_x emissions; and 9% of global SO_2 emissions; that ship bunker fuel has 2000 times the sulphur content of diesel fuel used in US and European automobiles; and 70% of the ship emissions occur within 400km of land.

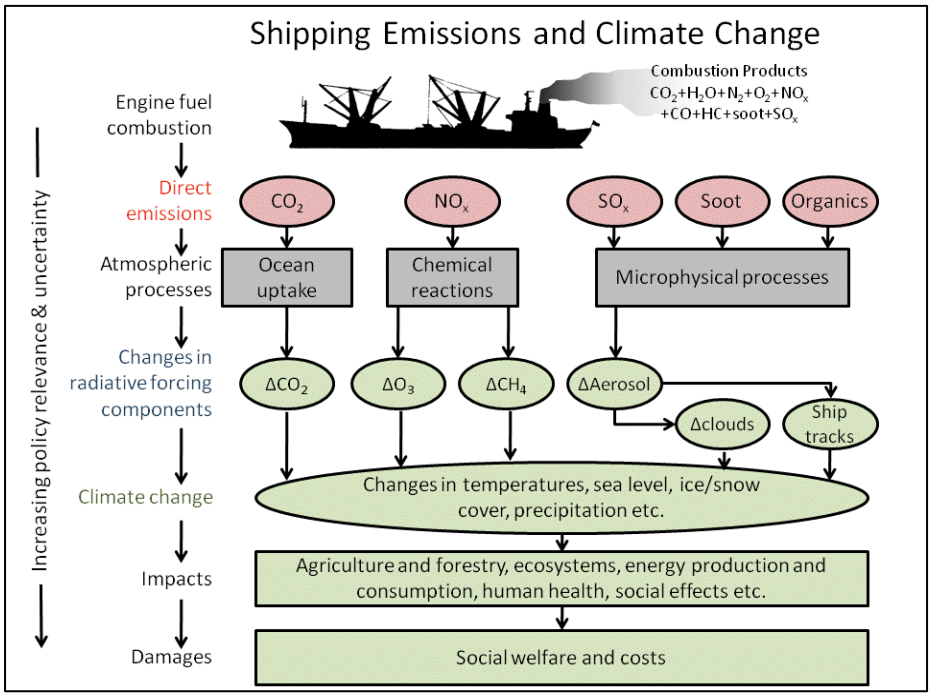

Figure 16 Shipping Emissions and Climate Change

Source: Faber (2009:94)

A related article (*Guardian*, 31 March 2009) cited research by National Oceanic and Atmospheric Administration (Corbett et al, 2010) which claims that "pollution from the world's 90,000 cargo ships leads to 60,000 deaths a year in the US alone and costs up to $330 billion per year in health costs from lung and heart diseases". The article states this is supported by recent Danish studies showing that Europe has dramatically cleaned up sulphur and nitrogen emissions from land-based transport in the past 20 years but has resisted imposing tight laws on the shipping industry, even though the technology exists to remove emissions. "Cars driving 15,000 km a year emit approximately 101 grammes of sulphur oxide gases (or SOx) in that time. The world's largest ships' diesel engines generate roughly 5,200 tonnes of SO_X". Corbett is quoted by the Guardian as concluding that "ships were perceived as a small source that could be neglected … we've been regulating cars for 30 to 35 years".

April 2008 saw IMO finally approve a reduction in sulphur emissions. In a stepped

programme, by 2020 all shipping has either to use distillate fuels with a limited sulphur content of 0.5% or use scrubbing technology to clean their exhaust gases. Both industry and regulators point to the steady reductions in ozone damaging refrigerant emissions and modelling for projected amounts of SO_X under MARPOL agreements as evidence that the IMO-led regulatory process has capacity. The cost of MDO compliant with these standards is currently 60% higher than current fuel in Oceania. Fuel is currently ~40-60% of Pacific ship operating costs depending on the type of vessel and operation (pers. com., Cpt John Rounds, 2012) so the cost of this global mitigation strategy means an imminent increase of ~24-36% in the cost of shipping for PICs regardless of any other factor.

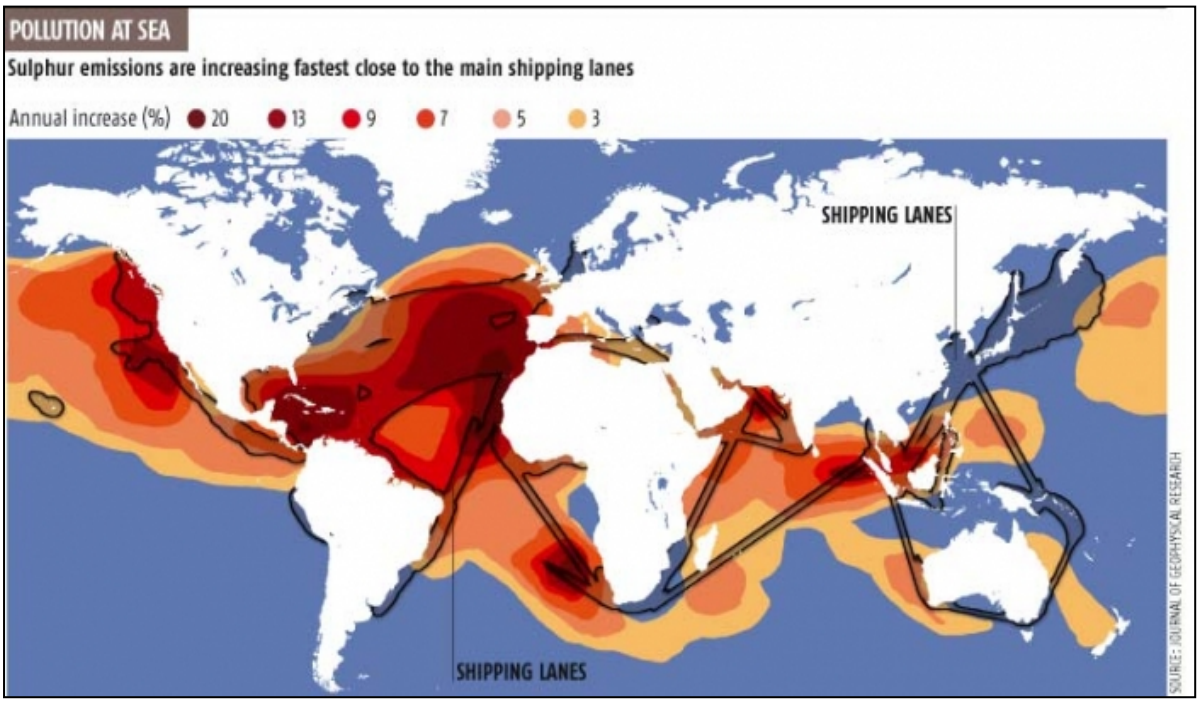

Figure 17 Annual Increase in Sulphur Emissions in the World's Shipping Lanes

Source: The Environmental Science and Technology Journal (2007)

Both the US and the EU are implementing national legislation for low-emission marine zones that have been criticised for being minimalist in area and level of control. "Ship pollution affects the health of communities in coastal and inland regions around the world, yet pollution from ships remains one of the least regulated parts of our global transportation system" (Corbett quoted in *Guardian,* 31 March 2009). Expanding such zones outside of Europe and US is politically impossible to achieve.

Even these minimalist gains have already taken years. The BBC's Roger Harrabin (*BBC Environment Report*, 8/30/2004) had been reporting on these issues five years previously

when the projections were that 40% of air pollution over land would come from ships by 2010. At that stage the promise by European politicians to attend to the issue was 6 years old and NGOs had been lobbying governments for more than 20 years.

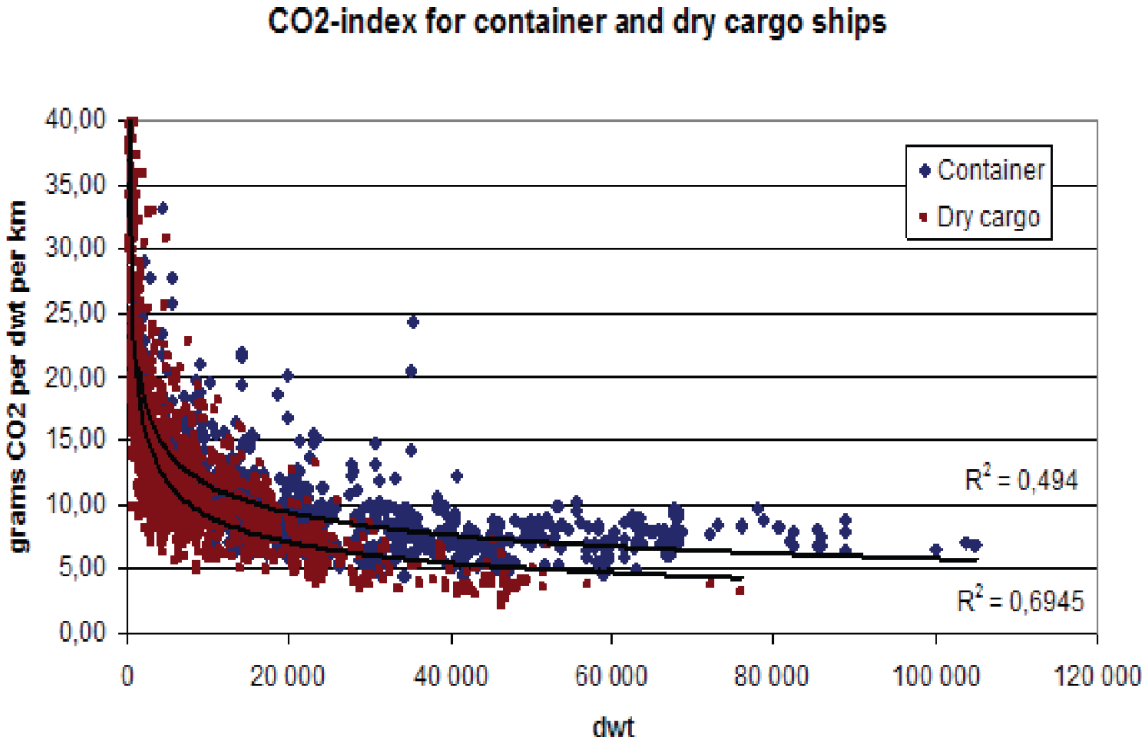

Figure 18 Effect of Ship Deadweight on CO_2 Design Index

Source: Buhaug et al (2009:63)

Averaging effects of global shipping across the industry tends to disguise the reality that larger and newer vessels have lower proportional rates of effect and that it is the smaller domestic and older ships, the type most common in Oceania, that are the worst offenders as shown in Figure 18. Preliminary analysis of IMO data undertaken by UCL for B9 Shipping shows that vessels of less than 10,000dwt carry only about 4% of global cargo but contribute around 25% of all shipping emissions or approximately 1% of global totals (Gilpin D., email, 19/12/2012). But, as shown below, almost all activity is not targeted at this sector.

Claims that shipping is a dirty business and has done little to effectively clean up its own operations are strongly refuted by the industry and related agencies. The defence is based on two principal lines of argument: firstly that it is less polluting and far more efficient than any other form of transport per tonne of goods moved; and secondly, that emissions are mitigated by the positive contribution the industry makes to 'sustainable development'. The following quote from the ICS website (accessed 9 July 2012) is typical of the industry position.

> "In the overall context of sustainable development, shipping is a very powerful and positive force, making a major contribution to global trade and prosperity in a way that has only a relatively small negative impact on the global environment. Shipping … is, statistically, the least environmentally damaging mode of transport, when its productive value is taken into consideration. The vast quantity of grain required to make the world's daily bread, for example, could not be transported any other way than by ship. Moreover, set against land-based industry, shipping is a comparatively minor contributor, overall, to marine pollution from human activities".

The IMO website describes shipping as "carrying huge quantities of cargo cost effectively, cleanly and safely". Marisec's homepage advises "without shipping the import and export of goods on the scale necessary for the modern world would not be possible. Seaborne trade continues to expand, bringing benefits for consumers across the world through competitive freight costs. Thanks to the growing efficiency of shipping as a mode of transport and increased economic liberalisation, the prospects for the industry's further growth continue to be strong." Further in the same source Marisec claim "Sea-transport is one of the least environmentally damaging modes of transport and, when compared with land based industry, is a comparatively minor contributor to marine pollution from human activities"[63]. ICCT (2011:1) consider that because "ships are by far the most energy-efficient means of moving goods, shipping-sector emissions are expected to continue to grow even as rising oil prices encumber growth in other transportation modes".

But despite the industry rhetoric, this is a far cry from saying that shipping is as efficient as it can or should be. As discussed above, GHG emissions from international shipping have proven difficult to calculate and more difficult to allocate to parties in international climate agreements. In the absence of policy intervention shipping CO_2 emissions are predicted to increase over 2005 levels from 0.26 Gt C/yr by 1.3 – 3.8 fold (0.34 – 0.98 Gt C/yr) in 2050 (Faber, 2009:46). IMO predict that tonne-miles of goods moved globally will increase 2% to 4% annually between now and 2050. This substantial industry growth translates to a near tripling of GHG emissions over this period. It is estimated that GHG emissions from international shipping contribute 870mmt of CO_2 to the atmosphere, with an additional

[63] The Marisec website gives a wealth of detail to defend the industry record, both as an emitter and a responsible innovator.

180mmt attributable to domestic and inland ships in 2007, for a total of 1050mmt[64]. At current rates of increase, shipping sector CO_2 emission is expected to climb to between 2,500 mmt and 3,650mmt by 2050" (ICCT, 2011:2[65]).

Industry representatives to international congresses on GHG and climate change have steadfastly reiterated the industry's ultra conservative position, as the following extract from the ICS Position Paper (2011) illustrates: " ... (1) The future efficiency of the world's fleet can best be ensured, in the first instance, by the adoption of legislation at the UN International Maritime Organization (IMO) on technical and operational measures for the reduction of CO_2 emissions from international shipping … (3) ICS is confident that international shipping will reduce its CO_2 emissions, per tonne-kilometre, through technical and operational measures that will deliver improving ship efficiency, by more than 20% by 2020 (2007 baseline) … (5) The global shipping industry has a preference for a Market-Based Mechanism that is levy/compensation fund based … (6) ICS believes that CO_2 emissions from international shipping cannot be reduced effectively and meaningfully through the incorporation of shipping into any regional financial instrument". (http://www.shippingandco2.org/ICS%20POSITION%20ON%20GREENHOUSE%20GAS%20MARKET%20BASED%20MEASURES.pdf accessed 2 July 2013).

The section thus far provides a summary of the size and scale of the global problem. What, if anything, can be done? An ICCT assessment examined data for 50 ship efficiency measures and concluded: "by 2020 the industry's growing fleet could reduce annual CO_2 emissions by 436mmt, or 33% of the projected annual total. Of that amount, 340mmt (26% of the total) could be achieved for a net negative cost after fuel and other savings are accounted for" (ICCT, 2011:1). Regulatory proposals before the IMO in 2011 could have significant impact on these projections, either by increasing the overall efficiency of the shipping fleet or by increasing the tonne-mile cost of goods. But to meet ambitious CO_2 reduction goals, even more profound changes will be needed (ICCT, 2011:4).

Three broad categories of measures are available: the amount of goods/resources transported

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[64] Or a global average of approximately 1 tonne of CO_2 for every 8 tonne of cargo based on the earlier quoted figures.

[65] These are similar-scale figures to those presented by Dr Pierre Sames, Vice-President Research, Germanischer Lloyd at the SSTT 2012 (see Section 7.1).

can be reduced (ironically the current global downturn is giving greatest effect to this)[66]; regulatory regimes and economic instruments can demand cleaner shipping; and technological advances can be sourced and implemented. Arguably, none of these is overly helpful to seeking Oceanic solutions without (proportionately) large external assistance or subsidisation. Regulatory and economic measures will increase the cost to Oceanic shippers (whose activities produce an insignificantly minute quantity of the problem) without a corresponding increase in revenues; reductions in services will be an increasing penalty to Oceanic communities and economies; and costs for new technology, in the main, make them prohibitive and are generally aimed at new generation plant employed by first world operators on profitable routes.

ICCT (2011:4), along with IMO and ICS, considers technological and operational options aimed at increasing ship efficiency will provide most answers. "Work that has been done on marginal abatement cost curves for efficiency technologies demonstrates the clear potential of these studies to inform policy and industry". But they caution that these are "broad-based estimates, lacking sufficient detail and transparency". And uptake of advances in efficiency needs to be considered in light of the true economic nature of the industry. It is critical to note that large-scale shipping is a speculative business rather than a true service industry. Large profits are made in short periods of optimum profitability during which size and speed are maximised, it is not a case of most profit being made consistently through efficient provision of regular service, the predominate need of island communities.

4.3.3. Alternative Energy Sea-transport Technology: What's on the Radar?

There has been a flurry of activity post-2008 to explore new technologies, primarily targeting large-scale shipping and focussed on improved motors, alternative bio-fuels or gases (for which there are question marks over the overall environmental benefit at the scale required) and innovations in hull design. In relation to the overall scale of the industry these measures are relatively minute and economically driven rather than from a desire to turn the industry green. Investment, whether it is in reducing the sulphur content of fuels or designing new

[66] There are varied reports on the effect on shipping volumes (and process) of current global economics. **A** *Daily Mail* article (Parry, 8th September 2009) shows evidence of fleets of merchant ships "bigger than the U.S. and British navies combined" lying idle off Singapore. Industry sources quoted claim large reductions in chartering costs, 4.7% decreases in volume of container shipping in 2008 and 8% in 2009 while supply of new shipping continued to decrease by as much as 12% in that year.

vessels, is primarily focused at the large ship, international market to the exclusion of domestic options. It is almost exclusively developed-world led, with a marked propensity to consider the needs of the industrial world to the exclusion of the poorer populations and can be described as a classic North-South divide scenario. Those operators that can afford it or can access investment capital to procure new technology will have an operating advantage. Those that can only afford second (third, fourth or fifth) hand ships will have to wait in line and pay ever-increasing costs and penalties.

Both ICCT (2011) and IMO (Buhaug et al, 2009) studies concur on the range of technological and operational strategies available to the industry. These include innovation in: propeller polishing, hull cleaning, speed reduction, autopilot upgrade, air lubrication, main engine retrofits, water flow optimization, hull coating, speed controlled pumps and fans, weather routing, high-efficiency lighting, propeller upgrade, waste heat reduction, alternative fuels, wind power, and solar technology. These analyses also note that, the last three items apart, these are largely already available and most responsible operators are already, at least partially, using. None of these measures individually achieves more than minor savings, nor do they represent any major paradigm shift from existing options.

What options are available from alternative fuels? Although any number of potentials have been mentioned in the literature and websites, including wave energy propulsion, this breaks down primarily to alternative fuels such as bio-fuels or bio-gas, wind and solar[67],[68]. This thesis is focussed on wind potential. In Oceania bio-fuels/gases from local crop production (coconut and cassava both have high potential) or by-product (in particular molasses from the Fiji sugar industry) offer strong possibilities. Ultimately it will come down to the economics of production of such fuels versus the cost of import of fossil fuels as to how fast development and uptake happens. Alternative fuel must not be confused with free fuel.

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[67] The elephant in the room is hydrogen cell technology. Although the theory is relatively simple and has been known for decades, major barriers exist to practical implementation, which, if they can be overcome, would be revolutionary across both global transport and energy production sectors. Many industry websources are claiming that transition to LNG will be an intermediate step to greener fuels.

[68] Work has been ongoing in regard to nuclear propulsion technologies led largely by the US military industrial complex and this still remains the Pentagon's preferred future alternative shipping fuel technology (O'Rourke, 2006). Even if it could be used cost-effectively, the political stance of PICs effectively rules it out of any contention for Oceania.

Solar energy, in the main using PV technology to convert solar energy to storage, is an extremely fast-growing area. Question marks exist over the carbon footprint of manufacture of product, although plant appears long-lived and storage technology, essentially batteries of some type[69], is the principal barrier. While there are a number of cutting edge experiments to date, solar is not yet demonstrating an affordable or effective enough vector in its own right to offer more than auxiliary potential for Oceanic settings. Application potential in this mode though is high and technologically readily available.

It is increasingly difficult to move past the logic that wind offers[70]. It is a simple equation: if no fuel is combusted, there are no fuel and related costs and no emissions. Wind is freely available, proven, and untaxed. There is historical record and proven design. Yet wind power is largely dismissed without adequate analysis. Of the more than 200 reports publicly available via the IMO website examined in 2011, only two mention potential for sail technology, albeit briefly, and both are sceptical of its viability. This position is reflected in climate change information more generally. The third IPCC report has only two pages of content (out of 56) in its Transport Chapter devoted to sea-transport. Sail is only mentioned in regard to the possible potential to retrofit some large ships with auxiliary sails and some interest in 'kite-sails' with associated reports quoting the 2007 SkySails' claim that up to 60% of the world's commercial transport vessels could be retro-fitted with such technology (Ribeiro, 2009).

Wind power options can be divided into use of ship-mounted sails, or kite-sails, or means of converting wind energy to mechanical drive trains. All must be considered as to whether they have application as auxiliary or primary motive propulsion. They must then be considered as either new vessel types or new technology retro-fitted to existing ships. Finally the IRR must be factored. While wind energy is free there can be a high cost to the technology required to transform it to motive power. The leading examples of each are outlined below.

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[69] Super-capacitors offer promise of an alternative to battery storage although this technology is still embryonic.

[70] Assuming, of course, the commonly agreed objective is cleaner and more affordable sea-transport options for consumers. If the objective is the unprincipled maximisation of profit, it's hard to look past the money to be made in burning inefficient and toxic petroleum oil products.

Kite Sails

Two companies, American Kite Sails and German SkySails dominate this field, with test models being used on large ships since 2006. The concept is easily understood by reference to Figure 19, computer-controlled kites attached to the bow of a ship can harness wind power and substitute power for forward propulsion. The system can be retrofitted. Lateral lift from the kite dramatically reduces the heeling effect of hull-stepped rigs. Successful large-scale trials are continuing by SkySails in association with Beluga shipping but uptake appears low. Potential for savings vary widely with manufacturers claiming that up to 60% fuel savings are available, albeit on select routes and usages. Overall savings of only up to 20% are more realistic for general usage. Costs for mid-range carriers are up to US$2.5 million and the cost of maintenance and operation could be as high as 15% p.a. (www.Skysails.com; Faber, 2009).

Figure 19 Kite Sails

Source: www.Skysails.com accessed 2 July 2013.

Wind Engines

Wind engines are available where rotors placed on deck of a ship can generate thrust, taking advantage of the so-called Magnus effect. The Flettner design is the most common.

Figure 20 Flettner Wind Engines

Source: http://en.wikipedia.org/wiki/Rotor_ship accessed 2 July 2013.

Flettner applied for a German patent for the rotor ship in 1922. In 1924 he retrofitted the schooner *Buckau* with two rotors 15m high and 3m diameter driving a 37kW electric system to power her first voyage in 1925 across the North Sea. The rotors did not give any concern in even the stormiest weather, and the rotor ship could sail into the wind at 20-30 degrees, while the original sail rig could not tack closer than 45 degrees. In 1926, renamed *Baden Baden*, she sailed to New York via South America. Despite receiving positive reviews and being an absolute technological success, the idea of "unconventional sailing" was not commercially accepted and the concept was deemed "inefficient compared to conventional fossil-fuel-powered naval vessels" (http://en.wikipedia.org/wiki/Rotor_ship 2 July 2013).

The technology has been revisited recently with Flensburg University developing the *Uni-cat Flensburg*, a rotor-driven catamaran and Greenwave (a UK charity), modelling modern Flettner design rotor use for large shipping (http://www.greenwave.org.uk accessed 2 July 2013).

In 2009 the German wind-turbine manufacturer Enercon launched its new rotor-ship *E-Ship 1* which features an aerodynamic hull, a new and efficient propeller for the conventional diesel-electric propulsion, modern Flettner-rotors with automatic control systems, and an over-sized steering rudder that converts the trajectory of the 'sails' into the desired forward motion. The exhaust fumes of the diesel engines power a steam turbine that generates additional electricity used to spin the four Flettner-Rotors, each 27m high with a 4m diameter. This motor sailor

design reduces the fuel consumption of the 123m ship by 30 to 40% according to Enercon's website. The ship made its first voyage with cargo in 2010, carrying nine wind turbines to Ireland, and today is regularly shipping wind turbines around the world. The build cost is unknown.

Figure 21 Enercon's E-Ship 1

Source: http://www.marinelog.com/DOCS/NEWSMMVII/2008nov00050.html 12 Nov 2012.

Greenwave, a UK research website, estimates that vessels upwards of 10,000dwt of crude oil, chemical, and product tanker, and bulk carrier types could be 'most immediately' applicable for rotor technology and estimates that the costs for manufacturing and installing four wind engines lies in the range of US$0.8-1 million. For a 55,000dwt Supramax bulker equipped with four wind-engines (rotor height 20m and diameter 2.3m) that is 246 days at sea per annum, Greenwave estimates an average fuel consumption saving of 1,023 tonnes per year. Faber (2009:4) derived relative fuel reduction potentials of 8.3% for general tankers under 60,000dwt falling to 3.6% for crude oil tankers over 200,000dwt.

Ship Mounted Sails

The more conventional descendant of sailing ships that dominated world transport historically, these fall into two broad categories: 'soft' and 'fixed wing'. Sail powered ships can be sail-auxiliary where the vessel is primarily a motorboat, hybrids (see B9 and Greenheart below) or pure-sail where motors are used for auxiliary power, port manoeuvring, etc). There were some minimal but critical experiments following the 1970's oil crisis which clearly demonstrated that sail was viable when fuel prices were high with few of the preconceived concerns over safety, stability, leeward and overall speed bearing truth[71].

[71] See in particular *Na Mataisau* and *Shin Aitock Maru,* the first of eight Japanese oil tankers that achieved around 30% fuel savings with fixed wing sails in the 1980's (Section 5.1.1).

Figure 22 B9 3000dwt bulk carrier

Source: http://www.b9energy.com/B9Shipping/tabid/4036/language/en-US/Default.aspx accessed 14 Oct 2012.

There are only a minimal number of designs that are being seriously developed currently. The B9 Ship is a 3000dwt bulk carrier hybrid under development by B9 Energy UK. The result of a design partnership that includes Rolls Royce bio-gas motors (predicted to provide 40% of overall power) and cutting-edge sail and hull designs, B9 was completing tank and wind tunnel testing at time of writing (October, 2012). Prototype construction is projected at £24 million falling to £12 million once production-lined. Attractive though this technology is for Pacific settings, the asset cost amply demonstrates the Oceanic dilemma. It will simply be unaffordable. The personal commitment of the B9 directors (see B9 Shipping website[72]) to ensure this technology can be delivered to SIS once it is proven economically in a European setting is commendable.

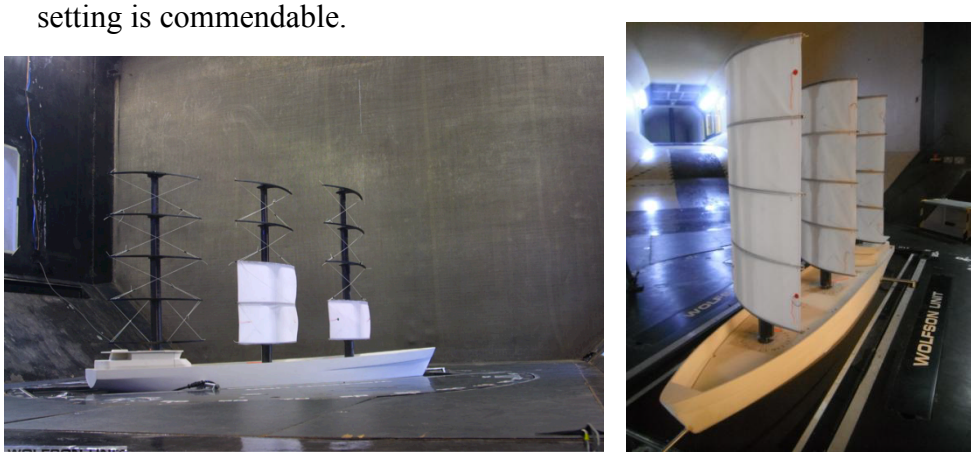

Figure 23 B9 Ship Tank Tests

Source: Di Gilpin, 2012

[72] http://www.b9energy.com/B9Shipping/tabid/4036/language/en-US/Default.aspx accssed 12 October 2012.

The 8,000 dwt container carrier *Ecoliner* is a similar concept to the B9 ship currently on the design board of Dutch naval architects, Dykstra. Technical and cost data was not available at time of writing, although their presentation to the SSTT 2012 asserted the asset cost to be no more than 15% higher than conventional options to achieve upward of 60% fuel savings.

Figure 24 ***Ecoliner***

Source: http://fairtransport.homestead.com/Ships.html accessed 2 July 2013.

The Greenheart Project is currently the only international design concept I have been able to find that is targeting a wind and solar powered vessel specifically for developing world conditions. A Japanese registered NGO, Greenheart have designed a small-scale (75dwt) cargo vessel capable of fulfilling a range of roles, including local transport, disaster response, and research. The Greenheart vessels have been designed by Japanese naval architects under the guidance of an international open-sourced design team especially for developing country needs. The first 220-ton, 32m vessel is to be constructed in Bangladesh in early 2013. Design specifications include a hull speed of 10-11 knots, virtual unlimited range with auxiliary propulsion and onboard power from a 125m^2 photovoltaic array to lead/acid battery capacity giving a 55nm range under power alone from two 200kW DC drive motors. Cradle to cradle design criteria, limiting toxic materials in construction, will be employed and built cost is projected at approximately US$500,000.

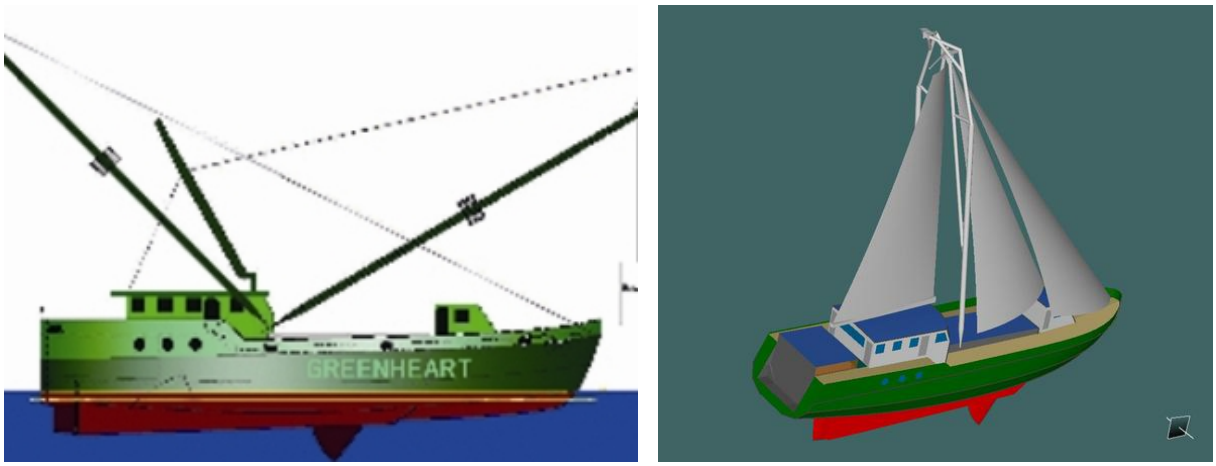

Figure 26 ***SV Greenheart***

Source: http://odf.greenheartproject.org accessed 28 November 2012.

I have been in extended discussions with Greenheart since 2011 and they have offered to bring their prototype to Fiji on its inaugural voyage and along with our partners we are currently exploring various possibilities to use a Greenheart vessel for an extended trial on selected Fiji routes. The Greenheart vessels are configured to internally carry up to three TEU containers which can be independently loaded/unloaded using the vessels' unique mast/derrick configuration without the need for port infrastructure (see Figures 26 and 27)).

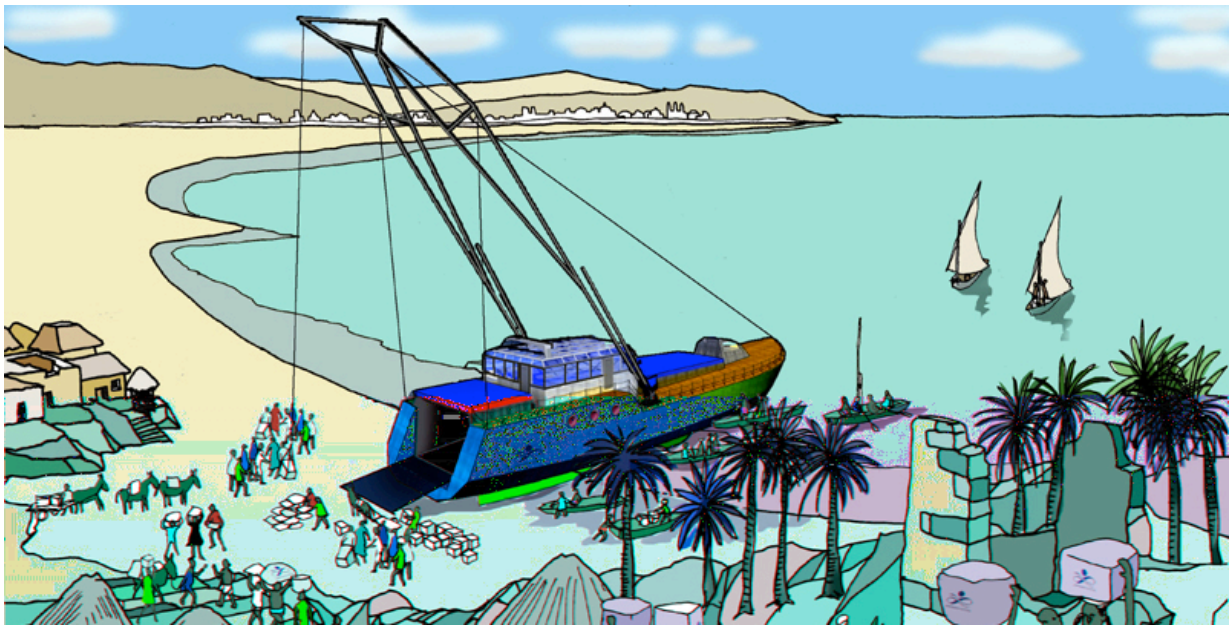

Figure 27 ***SV Greenheart*** **Unloading on Beach**

Source: http://www.greenheartproject.org/en/ accessed 28 November 2012.

There will inevitably be emerging designs and technologies that have not been considered above. Web searches turn up a range of futuristic concept drawings and a number of such sites have monitored during this research. Many sites remain functional for short periods (months to 1-2 years) and then receive no more postings.

Specifically in relation to wind and solar power, it was interesting to note the role of wind power turbine companies (B9 Energy and Enercon) and not-for-profits (Greenwave and Greenheart) in leading design and innovation. None are traditional or commercial shipping companies.

The view at the global level is not that heartening for any Oceanic search for solutions. While international regulation may reduce shipping emissions it is likely to do so at an increased cost to Oceania. Alternative technologies appear to be possible for reducing operational costs but in most examples at an asset cost that will likely make them prohibitive. Biofuels/gases and solar/wind offer immediate solutions but still require being trialled and market proven.

Chapter 5. Case Studies

5.1. Pacific Alternative Energy Sea-transport: Lessons from the Reef of Experience

This section presents a summary of examples of previous attempts to trial or introduce sail propulsion for shipping in the Pacific. They should be considered in conjunction with the emergent international design developments sketched at the conclusion of the preceding chapter. A number of core lessons distilled from these cases are discussed in Section 5.2.

Preceding sections detailed the reliance of the world generally and Oceania in particular on sea-transport, the industry's monopoly dependency on fossil fuel powered propulsion, the lack of efficiency in current vessels and the level of contribution the global industry makes to current and projected GHG emissions. At the start of this research programme it had appeared reasonable to assume that alternative propulsion technology of shipping generally, and that applicable to SIS in particular, had been the subject of continual and increasing innovation in design and operation since at least the oil crisis of the 1970's. It was quickly apparent this was naïve.

Unfortunately, there are only a limited number of experiments using sail (or any other non-fossil fuel powered alternative) available for study and guidance as to future application. Every attempt has been made to assemble as much information as possible on the following case studies. It should be noted that some are based on anecdotal accounts whose accuracy is sometimes difficult to collaborate. There is no claim that the list is exhaustive. The case studies are grouped into two: initiatives emerging from the 1970's oil crisis, and examples of other small-scale shipping initiatives relevant to the Pacific.

5.1.1. Case Studies from the 1980's

"The sudden escalation of oil prices in the early 1970's followed by disruption of supplies through various Middle East conflicts … led to a general policy of energy conservation" (Clayton, 1987:53). However, this trend does not appear to have been extended in the field of sea-transport to any great extent, probably because shipping continued to maintain its monopoly position and the incentive for operators to cut fuel usage rather than simply pass on increased cost to users was missing. The (then) relative low cost of fuel as an overall

component of the industry and the relatively short duration of the event[73] saw some rhetoric but little action on either making sea-transport more efficient or developing alternative technologies.

Five case studies from this period are illustrated here; *Na Mataisau* and *Cagidonu* in Fiji, *Shin Aitoku Maru* and the Japanese experiments with oil tankers, the FAO initiative with artisanal fishing craft in the Pacific; Jim Brown's work with multihulls in Tuvalu; and the EU funded *Tai Kabara*.

Na Mataisau and *Cagidonu*

In an experiment overseen by Southampton University, auxiliary sail rigs were designed and installed by MacAlister, Elliott & Partners on behalf of the ADB for the Fijian Government fleet of inter-island ferries. Two ships were retro-fitted and operated. Each employed a novel standing wishbone construction on the mainsail to give a quadrilateral sail that could be furled on luff spars. The first ship was the 6-year-old *Na Mataisau*, a steel-hull, passenger/cargo vessel, 27m LOA, 274GT with a single diesel engine.

Figure 27 ***Na Mataisau***

Source: Satchwell (1986).

[73] By 1985 oil was at its lowest wholesale price since WWII.

Conversion was carried out at a Fijian shipyard and completed in September 1984, whereupon the ship operated normal schedules with a continuous log kept to record performance data. Good performance was obtained in both sailing and motor-sailing modes with substantial speed enhancement in the latter (Clayton, 1987:58). The project report (Satchwell, 1986) lists an impressive range of savings and benefits, well in excess of those projected at the start of the experiment. Contrary to predictions the vessel preformed exceptionally well, realising none of the initial concerns over ultimate stability and leeward, and resulting in 23% overall fuel savings plus multiple benefits in terms of increased stability (by more than 50% energy used), greater passenger comfort, and greatly reduced engine wear (Satchwell, 1985). Greater fuel savings could have been achieved if a feathering propeller had been fitted. Unfortunately the vessel was lost after dragging its anchors on Moala reef in a developing cyclone in early 1985 but not before she was able to escape under sail alone after the engines failed and save the life of the Fijian Prime Minister, on-board at the time.

The rig of *Na Mataisau* was rescued virtually undamaged and was subsequently installed on a somewhat larger ship, the *Cagidonu.* This ship was completed in December 1985 and showed average fuel savings of 20-25% on its inter-island schedules (Clayton, 1987:59). In his project report assessing the sailing performance Satchwell, (1986:1) recorded savings of 37% with all sails and 21% with mizzen and jib only.

Practical use of the auxiliary rig does not appear to have survived much past the end of the project monitoring. In part this may be attributable to the, by then, relatively low cost of fuel. In part it was due to the fact that the captain and crew received no reward or incentive whether they used the auxiliary rig or not (pers. com. Cpt. Rounds, Suva, 2011). The lesson here is that a comprehensive programme is required. Simply offering up the alternative technology is insufficient.

As part of this experiment, Southampton undertook wind data analysis of all known Fijian wind patterns to produce a comprehensive analysis of future wind-based route planning and predicted fuel saving coefficients for the main inter-island shipping routes in Fiji and Rotuma (Satchwell, 1985, 1986). This data will remain invaluable for any future sail powered shipping. That analysis appears to show that several of the “uneconomic” routes, currently heavily subsidised by the Fiji government under its franchise scheme, are appropriate for sail assisted or driven vessels.

Shin Aitoku Maru

In a similar experiment, Japanese oil tanker owners trialled modern square sails, initially on a 900 tonne vessel, *Shin Aitoku Maru,* using aircraft wing manufacturing technology and computer-controlled rigs.

Figure 28 ***Shin Aitoku Maru***

Source: http://seaspout.wordpress.com/2012/08/03/propulsion-revolution-2/ access 1/7/2013.

These rigs were an evolution of the historic "square-rigger" design. The reported results were impressive with overall fuel savings of more than 30%, increased passage speeds, increased stability and greatly reduced engine wear. Contrary to initial concerns, the sail-fitted vessels were able to safely maintain course in typhoon conditions where sister vessels had to heave to (UNESCAP, 1985). Over three years a fleet of eight such ships ranging from 600 to 31000 tonnes was established. However, plummeting oil prices meant the IRR on the technology was uneconomic, especially given the cost and limits of the computer technology employed, and the experiment was largely discontinued. Some desktop technical studies of the era disputed the performance claims, suggesting overall gains of only 10% were achieved.

UNDP/FAO Artisanal Fishing Craft[74]

UNDP/FAO undertook a number of artisanal boatbuilding projects globally between 1982 and 1989. In the Pacific, building on the work of Save the Children in Tuvalu (see below) FAO produced designs for ten different vessels, from a one-person paddling canoe to an 11m transport trimaran resulting in an experimental fleet of more than 350 artisanal fishing vessels built in eight PICs, many as either pure-sail or sail-assisted designs. The uptake of the sail-

[74] This thesis has concentrated on sea-transport to the exclusion of fishing vessels. There are of course strong correlations between the two sectors.

powered vessels, however, was minimal and did not survive the life of the officially funded project (Gillett, R. pers. com. 2010).

FAO concluded "the only places where a new type of sailing craft has gained acceptance are those where there is a living tradition of the use of sail" (FAO, 1986:71). Other key lessons learnt include the need for any alternative technology to be proven to have direct economic benefit or saving to the user and the need for an entire sailing culture to be re-instilled, including attention to in-country boat building skills and capacities.

The vessel designs were exemplary, have been well recorded, and are still available for future use. The Pacific assessments included a comprehensive analysis of the various options for designs, materials, and construction methods.

Save the Children, Tuvalu, and Jim Brown

Also in this period, acclaimed multi-hull designer Jim Brown worked for Save the Children in Tuvalu. Brown had previously worked on a global study of artisanal local craft that recorded that there were literally millions of small craft operating at village level (Brown, 1982). While, like the FAO work, the focus was initially on fishing craft, the lessons learnt are equally applicable to transport craft. Brown wrote optimistically of the potential for sail-powered technology to be immediately employed.

While Brown found that indigenously built and owned fleets throughout the tropics and sub-tropics are vital at community level for fishing and transportation, there were major issues arising with perpetuating what has historically been sustainable craft. Fuel prices were far from the only problem. "Often local vessel types have evolved through many generations to satisfy local sea-keeping requirements for a specific fishery or a given cargo of a given route. The construction of these craft is usually the supreme example of a local high technology, and that technology is very likely to have depended directly on local, high quality boatbuilding which is no longer in adequate supply" (Brown, 1982:3).

Brown believed that craft must be built locally and preferably in wood. "Alternative boatbuilding materials such as fibreglass, steel, aluminium, and ferro-cement have been introduced into fisheries with mixed results. The cost of importing all materials can result in hull prices infinitely higher to the fisherman who is accustomed to needing zero cash money to acquire a boat … Alien craft and mechanisation can aggravate the problem; especially if

they tend to displace local boat builders and fishermen from traditional employment" (Brown, 1982:4). Brown was the first to identify the negative impact importing designs and materials was having on local economies with locals assuming imports would be superior, leading to loss of locally-evolved adaptation and resilience. As wood is the mainstay of traditional local boatbuilding, he found environmental degradation and deforestation had left many communities with an inferior and diminishing resource in any case.

Brown designed alternative vessels and production methods in Africa, the Philippines, and then Tuvalu, adapting wherever possible local designs and using local materials. In Tuvalu this led to experimentation with first catamarans and then proa designs. There are close parallels with the needs and solutions Brown identified in Tuvalu and Fiji (Brown, 1982:39).

Brown is the first of these case study commentators to highlight that the savings from changing technology are not restricted to the vessels themselves. Multihull vessels are shallow draught and therefore not as reliant on shoreside infrastructure (channels, jetties, docks) needed by a deep draught mono-hull vessel. "These harbour facilities often cost far more than the vessels which patronise them and are subject to storm damage and high maintenance costs … Supernumerary to these investment savings is the matter of the multihulls' miserly running costs" (Brown, 1982:35). As seen in the ADB case example in Section 2.2, much of the current projected transport investment costs needed in Asia-Pacific are associated with such infrastructure. Building new infrastructure and climate-proofing existing assets is the major adaptation. Alternative shipping is not even mentioned.

Again in common with FAO, Brown left a legacy of designs that are valid candidates for further investigation today as they were 30 years ago. Two designs are include here, an 84' fast bluewater passenger catamaran and a 64' tuna long-liner. Both were designed for Tuvalu conditions and projected to save a minimum of 60% of fuel over conventional options.

Brown's description of the issues facing Tuvalu is relevant today and echoes across Oceania. "Tuvalu is located at the end of a long and precarious line of industrial supply. Gasoline costs $4 per gallon; packaged food pulses through the archipelago with jarring irregularity and island communities become further disinvolved [sic] from sources on which they increasingly depend" (Brown, 1982:40). These trends have only increased over time.

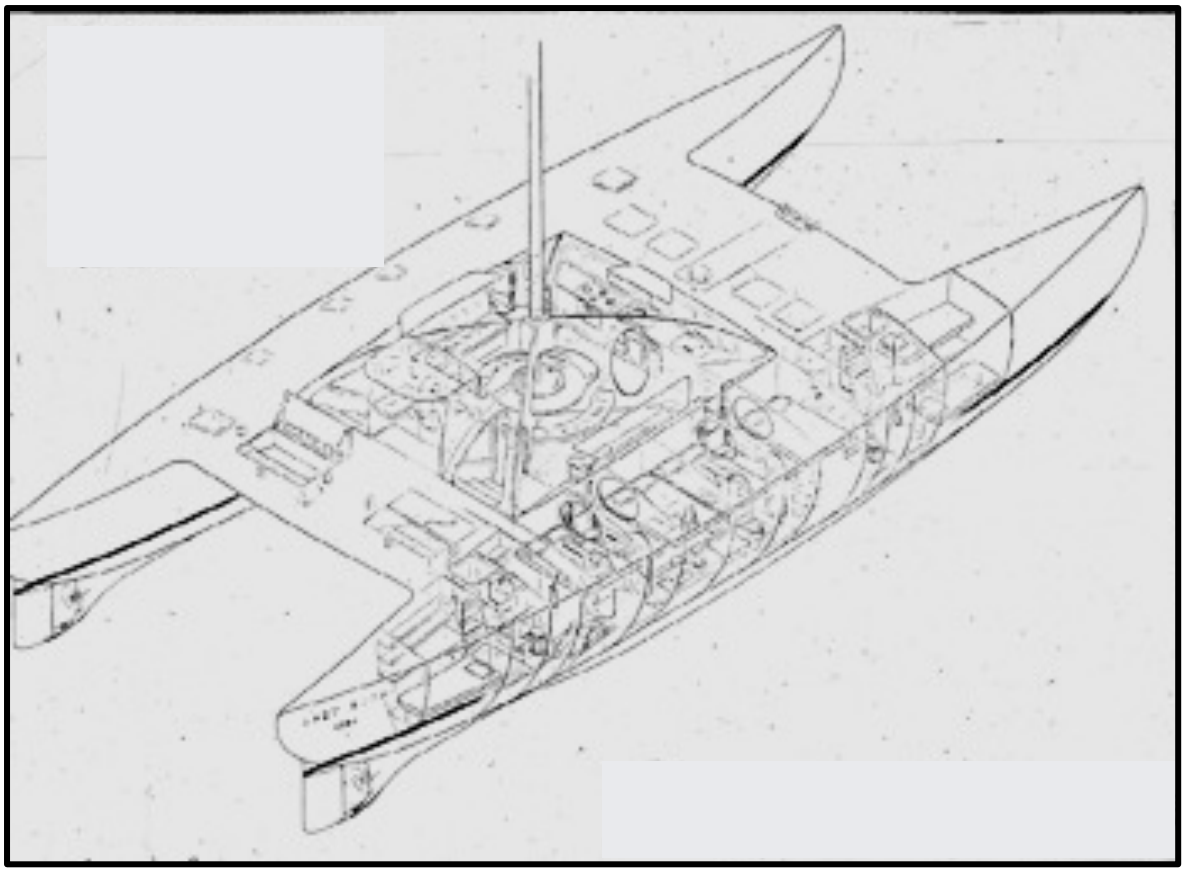

Figure 29 Jim Brown Designed 84' Passenger Catamaran

Source: Brown, 1982:77

Brown identified a prioritised list of applications for alternative vessels for Tuvalu, noting that all but the last represent a return to former capabilities:

1. Subsistence fishing canoes
2. Intra-lagoon taxi service
3. Short-range community fish boats
4. Inter-atoll ferry/transporters
5. Long range commercial fish boats

There is no reason to suppose these priorities will have changed. While Brown's prototypes and analysis have not resulted today in widespread adoption of sail-powered technology in Tuvalu[75], his 1982 insights are even more applicable today.

[75] Variants of Brown's catamarans are still visible in Kiribati today and were being built in a local shipyard up until 2010. Michael Savins' presentations at SSTT 2012 highlighted the ongoing Kiribati ship building experiment that started with Brown and his sons. https://www.usp.ac.fj/index.php?id=12461 accessed 1/7/2013.

Thirty years ago Brown saw that sails offer easy access to renewable energy, with more immediate humanitarian results, than any other method of transition to renewables. His craft were all designed to take advantage of local, traditional wisdom and materials, combining with appropriate modern technology. He sought to involve local people in a closer relationship with the energy source, and to participate in all stages of construction and operation. "Talent and capital must be directed towards less petro-intensive systems. New tools are needed; tools which accomplish more work with less energy and, as such, are a real pleasure to use" (Brown, 1982:77).

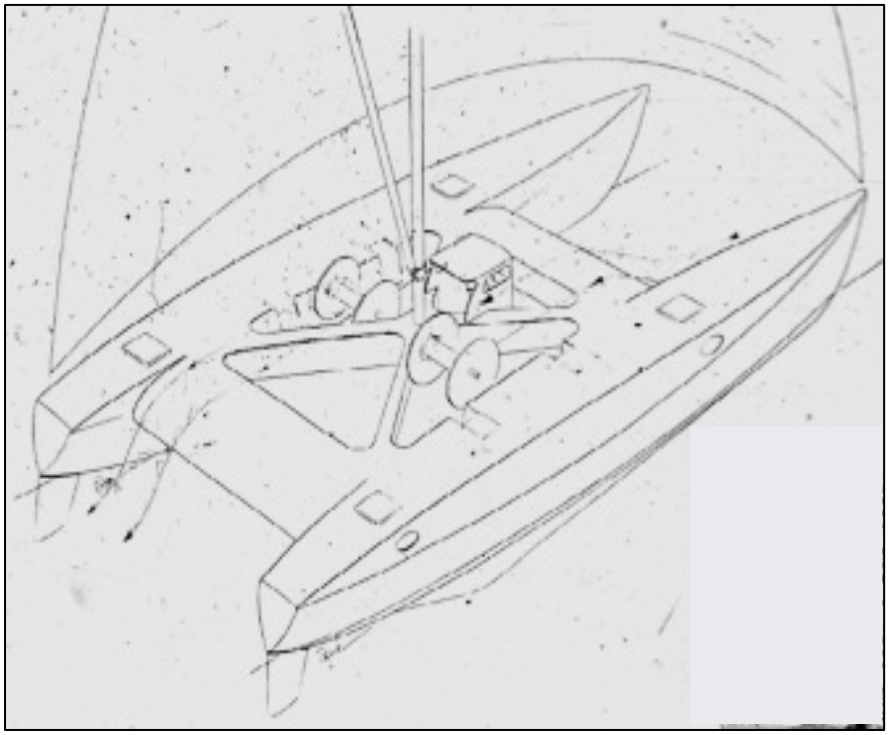

Figure 30 Jim Brown Design 64' Tuna Long-liner

Source Brown, 1982:79

Tai Kabara

I first heard about the *Tai Kabara* when I visited Kabara in the southern Lau in November 2011 to deliver the team researching *drua* culture (see Section 6.4). In informal discussions following the main *talanoa*, the *mataisau* of Kabara were keen for us to hear the story of building the ship on the beach in front of us. This vessel was built at Naikeleyaga village by the *mataisau* between 1984-87. The project was EU-funded as a result of the global oil crisis of the late 1970's. Although only one vessel was constructed, the initial proposal was for an inter-connected fleet of three vessels servicing the Lau and Lomaiviti groups (SPC archives), a similar proposal to that being currently explored under this research programme.

The plans for *Tai Kabara* were drawn up by naval architects at the (then) Fiji Institute of Technology's maritime school where the responsible tutor was from Kabara. She was described to us as a 50 ton, ketch-rigged vessel of classic carvel plank on frame construction with a full keel, secondary bilge keels or runners and cut away forefoot to allow for beach landing. *Dakua* planking, copper fastenings, and cotton caulking were all brought from Suva, the vesi keel, stem, and frames were cut on Kabara, as were the other scantlings from a variety of local timbers. All construction, down to caulking of the hull and construction of the standing rigging occurred on the island, with the *mataisau* showing us the various tools used in construction – in the main rudimentary hand tools.

The *mataisau* told us that the vessel operated successfully as an island-owned and operated trading vessel through the Lau group for the next two decades, surviving two cyclones and several beachings, before being either sunk or scuttled in Suva harbour in 2008 where her hulk can still be seen at low tide.

The memories of the *Tai Kabara* were obviously "bitter-sweet" for our informants. In their recollection, the vessel had worked well while it was in undisputed island ownership but the installation of a Lister diesel auxiliary saw ownership and management shift to the Lau Provincial Council and disputes over the management of the vessel and the use of the profits arising from her operation. The *mataisau* were obviously immensely proud of their ability to build the vessel in the first place and said they would relish the opportunity to build another.

Further data on the *Tai Kabara* project has proved difficult to source. The original plans and project documentation held in Kabara were destroyed in Cyclone Gavin. Staff at the Fiji EU office have since changed several times and no corporate memory of the project exists. There are obviously political sensitivities surrounding the fate of the vessel that restricted asking further direct questions of potential informants. A websearch found one photograph, a six-line newspaper archive (which stated that all the various departments and boards with a role to play following the sinking in 2008 declined to make any comment) and one court decision.

Figure 31 ***Tai Kabara***

Source: https://sites.google.com/site/kpnmarineservices/photos accessed 2/7/2013.

The photo is undated and shows *Tai Kabara* beached on Namuki Island in the Lau.

The judgement was more informative[76]. It was a civil appeal case between Kabara Development Corporation and the Fiji Government over the awarding of shipping subsidies under the Government's franchise scheme. The outcome of the proceedings is not important to this study but the judgement gave important background to the ultimate fate of this project.

The judges first outlined the operating environment of the vessel. "Because of their geographical position, communities in the outer islands of Fiji depend mainly on sea-transport for provision of the ordinary necessities of life. Comparatively few of these islands have airstrips and those which do are available generally for light aircraft of limited carrying capacity. This appeal highlights the problems facing these communities because of their dependence on sea-transport. Because of the small populations any form of sea-transport is not viable commercially without some form of government subsidy".

The judgement discloses that the Lau Provincial Council had sold the *Tai Kabara* to a private company in 1991 for consideration of a FJ$265,000 bank debt. Commercial operations from 1991-1996 ran at a loss at which time the company initially negotiated a 3-year contract under the government franchise subsidy scheme and managed to keep operating this way

[76] Civil Appeal ABU 0017 of 2007 (On Appeal from a Judgment of the High Court, Suva in Civil Action No. 92 of 2004), Judgement of Bynre, J.A. and Goundar, J.A, 16 October, 2009.

until 2004. By this time the vessel could not maintain the government required schedule due to mechanical failures. A compulsory slipping on the eve of one departure in October 2004 found the ship to be in poor condition, with rotten planking, numerous concrete patches, an unrepairable generator, and seepage requiring continual pumping amongst other issues.

The case example is noteworthy from a number of perspectives. The vessel type is not dissimilar to the type of small, locally built ships that dominated island trade from the turn of the century to after WWII. Local participation to the limit of available capacity was employed in designing, sourcing materials and construction, all of which were clearly well within the capabilities of the local community, but long-term control over ownership and management ultimately were not. What began as a donor-funded and island community-based adaptation strategy that appears to have shown strong initial success, was subverted as ownership shifted, first to local government and then to private interests.

At the time of her demise she was obviously in very poor shape, yet for nearly two decades had provided robust service, and was arguably at the end of her asset life. In any event, the original project had not considered sufficiently the on-going needs of maintenance or the limited commercial viability of the harsh operating environment.

5.1.2 Batiki Fishing Boats

While this example does not involve sailing vessels, I have included it here because of the lessons it illustrates. It was a Fiji Fisheries Department project funded and overseen by FDB. A concise summary was provided by Bayliss-Smith et al (1988) drawn from several sources. It is quoted verbatim as there is no doubt about the data and the relevance of the findings.

> "A fishery development programme saw two commercial fishing boats arrive at Batiki, in a bid to expand economic development away from dependence on copra. The boats were seen as a means whereby the islanders could regain control over their links with the outside world and exploit local reefs commercially for fish and trochus shell. The schemes were financed and operated partly by islanders themselves and partly by the Batiki community in Suva. In practice, however, although the fishing boats were useful for passenger trips to Suva and shipping copra, they proved to be a disappointment as sources of income from fish, shellfish, and beche-de-mer.
>
> The larger boat, the *Marama-ni-Wai*, was acquired by Yavu and Manuku villages in

1971 with $15,000 savings and a $11,000 loan from the FDB. Technical and financial expertise was supplied largely from the Batiki expatriate community in Suva but labour was supplied by the villages concerned. By the end of 1976 the scheme was in trouble with loan repayments and it would have become bankrupt but for free maintenance supplied by the Fisheries Division in Suva. In that year *Marama-ni-Wai* made 19 trips from Batiki to Suva carrying copra, which by then had emerged (along with passenger fares) as the principal source of revenue for the scheme. In 1983 the boat was still in existence but it was laid up with engine trouble. On Batiki $1,800 out of the $3,000 needed for repairs had already been collected but commercial fishing was then such a small part of the scheme that assistance from FDB or the Fisheries Division can no longer be relied on.

A second boat, the *Tomitomi I* was purchased in 1972 by the other two Batiki villages but this scheme was never as successful. Persistent engine trouble led to bankruptcy of the scheme in the later 1970's and the sale of the boat to a Chinese trader on the neighbouring island of Gau and in 1982 it visited Batiki on six occasions for copra and freight. In the same year *Marama-ni-Wai* made 17 visits but whereas in the mid-1970's the islanders were able to rely almost entirely on their own two boats (there were 41 copra collecting trips in 1974, 40 in 1976), in 1982 *Marama-ni-Wai* accounted for only half of the 34 copra collecting trips that were made to the island that year.

…On Batiki the very small scale of cash benefits from fish, shellfish, and beche de mer was a disappointment, particularly in 1975 when an alternative to copra was so urgently needed. On the other hand the improved passenger service, cheaper freight rates, employment opportunities for islanders, better social links between the Suva community and the island, and perhaps above all the feeling of community involvement towards achieving some freedom from dependency upon existing trading companies have all been major benefits, albeit intangible ones to some extent. Where social benefits outweigh financial costs in this way, then the methodology of commercial accountancy seems quite inappropriate. In the absence of alternative development options or other pressing needs (e.g. housing); shipping seems a reasonable investment for the savings of people on small islands. It may be cheaper for a government to subsidise these efforts in various ways than to provide itself the frequent shipping services which small islanders desire."

This case study occurred in the early 1970's when fuel was still relatively inexpensive and a low proportion of operating cost, and so it is illustrative of the marginal nature of the industry at local level here in any regard. In this case a well-intentioned aid intervention in the fisheries sector proved effective for community well-being but for providing transport not fishing. The initial object was not to build a fishing industry but to reduce economic reliance on a failing copra industry. The need for cash generation was, in part, to pay for the Batiki transport needs. The donors and the project design were not able to adapt accordingly and the result was a failure for all parties, but particularly the Batiki communities. The example highlights that inventions must be based on actual identified need, not just the problems cursorily and externally identified, and that they must be designed with capacity to adapt and change in the light of observed results.

That the project was well monitored means we have specific data for sea-transport needs of Batiki from the 1970's to compare with a current day model. Batiki lies north-east of Ovalau and the port of Levuka, i.e. a windward or reach route out and a beam reach back to Batiki on prevailing winds. Using the Southampton *Na Mataisau* data this has high wind route advantage for wind-powered transport. From Levuka there is a favourable inside-reef run to Bau landing and a short road route to Suva. If sea-transport is still a major issue for Batiki, as it was shown to be in the 1970's (and I contend it is likely to be an issue of increased magnitude today), then it would appear a prime candidate for a wind powered adaptation.

5.1.3 Small-scale Catamaran Projects

This thesis suggests an industrial form of sail-powered catamaran as a potential vessel for a village-based trading enterprise. As can be seen from the Jim Brown case study above, the concept is neither new nor novel. Catamarans combine speed and shallow draught with low maintenance and operational costs but have the disadvantages of generally poorer windward performance and with lower load-carrying capacity compared to displacement vessels.

James Wharram

The claim on this UK sailor's website is that "in the mid 50's, based on his research into ancient Polynesian boat design, James built the first off-shore catamaran in Britain and sailed it out into the Atlantic" (http://wharram.co./site accessed 13/7/2011). Since then Wharram has generated a range of designs for cruising catamarans, initially for self-build, at the lower end of the price range and more recently including professional franchised build projects.

Wharram has borrowed liberally from Pacific heritage designs. His vessels have proven themselves as reliable, safe, and (relatively) cheap bluewater options, if not competitive in terms of speed, with Wharram's website claiming more than 10,000 designs sold globally. They feature low cost material construction (primarily ply and epoxy over stringer style), sacrificing some displacement and speed for safety and load-carrying capability.

About a decade ago, Wharram and his design partner Hanneke Boone drew the concept plans for his "Vaka Motu" Islander 65 and 55 craft. While these started out, he claims, in response to a request from a Pacific chief for a boat capable of carrying several ton of fish to market, they are now offered as factory-build only models.

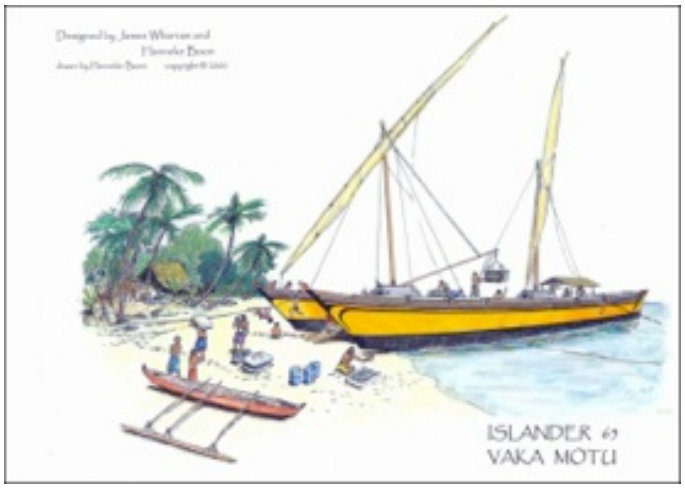

Figure 32 Wharram & Boone Design 65' Vaka Motu

Source: http://wharram.com/site/node/1387 accessed 13/6/2011.

I contacted Wharram in 2007 seeking to obtain a set of plans of the Islander 65 for Solodamu to consider and was informed by his office that this was not possible and Wharram would take legal action if I attempted to build such a vessel outside of this professional factory franchise programme where the price would start at EUR380,000. This would, of course, minimise the local benefit that could be derived from building the vessels in-country. Additionally, it would ignore the lessons learnt from Jim Brown and related experiences that the users of vessels are better able to maintain them if they are integral to the build process.

In a highly publicised event, Wharram and Boone designed a 11.5m catamaran for a project organised by Klaus Hympendah called the 'Lapita Voyage'[77]. Wharram used a Tikopian hull from the Auckland Museum as his template and the vessels were funded by European donors

[77] http://www.lapita-voyage.org/en/index.html accessed 2 July 2013.

who then sailed various legs of the delivery voyage from the Philippines to Tikopia and neighbouring Anuta to donate the vessels to the two islands as local transport in 2009.

Hympendah, who has visited the islands regularly since, reports that the two vaka are still in use “more on the tiny island of Anuta, less on Tikopia … The Anutans sail quite often to Lata, the main town of the Temotu Province placed on the island of Ndeni (main island of the Santa Cruz islands)” (Hympendah, email, 23/7/12). Anecdotal evidence from passing sailors suggested that the Tikopia vessel had been abandoned and was rotting on the beach. This case aptly demonstrates the absolute need for projects of this nature to fully appreciate the local situation and have sufficient time to bed the project into the local political landscape.

Anuta and Tikopia are neighbouring islands settled by Polynesian outlier communities and now politically part of the Solomon Islands, where they are referred to as "the outer islands”. But the political structure of each is distinct. Failure to appreciate this at the outset of the programme saw a successful introduction to Anuta but a different result in Tikopia where, initially at least, the vessel was almost left derelict through failure to identify ownership and management responsibilities that were appropriate to that community and inclusive.

Anuta is smaller than Tikopia with only 14 families (Firth, 1954; Feinberg, 1995). Hympendah recorded 75 outrigger boats on Anuta for 220 people in 2009 and noted that they were highly prized and well maintained family possessions. The donated vessel, *Lapita Anuta,* is owned by the whole community and regularly used “not for fishing but for transport. Sick people were sent to the hospital in Lata [400nm]. Pupils were brought to the secondary school in Lata too. Once on their way back they were hit by storm and ended up in the Torres islands belonging to Vanuatu. They fixed the broken steering paddle and sailed back home” (Hympendah, email, 23/7/12).

Tikopia by comparison has a population of 1,100 on a steep, heavily-wooded island with intensive subsistence agriculture (Mertz et al, 2010). There is traditional rivalry between the two political communities; Faia in the west and Ravenga in the East (Firth, 1936; Kirch, 1982). The *Lapita Tikopia* was put ashore in the area of one chief, which led the rival chiefs to believe it only belonged to one clan. As a politically disputed asset the vessel wasn’t touched for the next two years and began to deteriorate. This was in spite of Hympendah considering he had made his intentions clear that it was to be owned by all on the island collectively and thought he had followed appropriate cultural protocol in introducing the

vessel and his vision for its use. Fortunately, Hympendah has maintained a close relationship with Tikopia and returned in 2011 to seek a remedy. "I asked for a meeting with all four chiefs. I told them to use the boat again, to build a shelter, repair parts of it, and choose men from all four clans as crew. Additionally I suggested they decide who should be the head of the crew and the boat. They chose a teacher, which was wise. According to my latest information *Lapita Tikopia* has been visiting Lata and Waimasi on Vanikolo at the settlement of Tikopia" (Hympendah, email 25/7/12).

Vaka Fanaua

In 2010 the Tongan academic and politician Sitiveni Halapua commenced a project to see a 15m multihull vessel designed and built to service the Niua group of islands, described on the website as "the northern Tongan islands of Niuatoputapu, Niuafo'ou, and Tafahi. These islands, 260nm north of Tongatapu, closer to Samoa than to Nuku'alofa, epitomise the extreme conditions of the South Pacific. They are small, far from their public service provider, isolated, marginalised, and surrounded by deep, exposed waters" [78].

Halapua's project features a trimaran by acclaimed multihull designer Dick Newick with a 2010 projected build cost of NZ$450,000 at a New Zealand shipyard. The website gives the project brief as a "competitive sailing passenger-cargo boat for outer island communities to run and maintain, providing affordable, safe, flexible and regular service", and describes the *Vaka Fanaua* combining "old Pacific island tradition with modern construction to safely and quickly carry almost three tons of people and/or cargo on deep sea voyages".

Figure 33 ***Vaka Fanaua***

Source: http://talanoa.org/TDP_Development_Projects.html

[78] http://talanoa.org/TDP_Development_Projects.html, accessed 16/1/2013

Halapua is now attempting to publicly fundraise for the vessel and as at July 2012 the website showed donations of NZ$92,244 raised. It also states several Tongan's from Niua will be apprentice builders during the construction of the boat so that they can later help to maintain the boat. These islanders will be crew on the boat during its maiden sail to Niua where it will be handed over to a community company to operate and maintain. It is expected that this project will be a model for further development in the Niua group and for other outer-island groups in other Pacific island countries (http://www.nemasail.org/pdf/Fall2011.pdf accessed 12/11/2012).

Okeanos

The Okeanos cargo catamaran initiative, which has also adopted Wharram's name of "Vaka motu"[79], originated from our research in Solodamu and with FIVS. In 2010, when we judged we had sufficient data, planning and local agreement to proceed with a pilot village vessel for Fiji, FIVS approached the German sponsor of the TMoTM voyaging fleet, to ask if they would assist in funding a pilot vessel. The initial reaction was highly favourable and the donor contracted a professional boat-building yard in NZ to design and build a 15m prototype. Various commitments were made to later use a Fiji build base to which moulds were to be supplied at no cost. It sounded too good to be true and it was.

Despite an initial promising start, both FIVS and I were quickly excluded from the design and planning process. When I attempted to visit the boatyard to discuss the planning with the designers, I was informed that the designs were complete and copyrighted and the designers were not to discuss it further with me (pers. com. Nick Peel, Feb, 2011). The project is now being managed from a Hawaiian NGO, Pacific Voyagers Foundation (PVF). When I queried our unexplained exclusion from the project, all reference to FIVS and my involvement and research were removed from both PVF and its 'parent' website, Okeanos Foundation.

Up until the end of 2011 the PVF website was still announcing the vessel was to be brought to three Pacific Island countries, including Fiji, for trials after its launch. This example highlights some the issues associated with philanthropy-driven programmes. It is easy for the cheque-writer to assume this role equates with decision-maker. There is lack of transparency and accountability. Because a 'gift' is being made, the 'giftees', who are automatically in a

[79] It is no known what permission, if any, was sought for the use of this name by either designer, both of whom have copyright. There are obvious intellectual property right /traditional knowledge issues.

subservient position, especially if they are of Oceanic cultural descent, are extremely hesitant to criticise, object or raise concerns.

It is still not clear what rationale was used to exclude Fiji and Solodamu from the experiment. We had offered a collaborative approach; open access to our own research and findings; we had already spent two years preparing the village of Solodamu to be part of such a trial. Selected village youth had made life-changing commitments to begin training as ships engineers and seafarers. USP had offered to provide independent assessment of the trials and a research programme had been prepared for the same. We had commenced discussions with all the relevant agencies (Maritime Safety Authority, Ministry of Transport, Fiji Customs, etc) that had been favourably received.

The resultant vessel, *Okeanos*, was launched in November 2011 and taken to Vanuatu. When I contacted PVF to clarify why the vessel was not coming to Fiji I was informed that Fiji was no longer a target because it was "too developed" and our project was "too far down the track" (Simon, K. email, 17/2/12). No explanation was given as to what we should now tell the expectant villagers in Kadavu or our other collaborators in Fiji with whom we had run workshops in expectation of the pilot vessel's arrival. PVF openly admitted that they had undertaken no research or preparation in Vanuatu, had no research or business plan, had not decided which communities of Vanuatu they were going to work with, what stakeholder groups needed to be involved and had not considered any of the commercial or regulatory aspects involved. Nor had they decided how any trial was to be monitored or reported (Simon, K. email, 17/2/12).

Anecdotal reports from ni-Vanuatu sources are that US and Tahitian researchers have now been flown in to do this research. One of the Vanuatu communities being targeted was assisted in 2006 by a New Zealand lawyer and sailor to build a 9m Wharram catamaran. That project failed and the boat was abandoned due to "inferior plywood resulting in rotting decks and emerging village politics and jealousies over ownership and management that weren't sufficiently thought through at the beginning of the project" (pers. com. Allen, R. 2011).

Despite numerous overtures, PVF has thus far refused to share any information on the vessels, their costings, operation, etc. A spokesman for the project was interviewed on Radio New Zealand in 2010 where he stated that the initiatives will not be working with Pacific governments or official agencies so it not known how they plan to cooperate with authorities.

A commitment was made by this charity to make publicly available the findings of their *Okeanos* experiment at the Festival of Pacific Arts in the Solomons in 2012 (Simon, K. email, 17/2/12) but that did not occur. PVF was invited to the SSTT 2012 to which they sent representatives who made a presentation but failed to provide detail of the vessels, project planning, or research.

This unfortunate chain of events has impacted on the research programme of this thesis, in addition to the loss of a practical research model. Expectation, once built, is hard to rebuild and we have been in the difficult position of having to explain to Solodamu and the wider collaborative network that the trial vessel is not coming to Fiji. This has caused embarrassment for the village, which, in true Fijian fashion, feels it is their fault. It also highlights the problems with a framework for stakeholders, which is discussed in Chapter 7.2

SV Kwai[80]

Kwai is a 36m, 179GT, converted Norwegian fishing vessel. Shown here with a partial rig, she has been fitted with a full mainmast and bowsprit and a mizzen is planned. Since 2008 she has operated as a tramp ship between Rarotonga and Hawaii servicing the Line Islands en route, which offers excellent year round sailing across the trade winds in both directions.

Figure 34 ***SV Kwai***

Source: https://sites.google.com/site/sailcargo/ accessed 30/8/2012.

The website, which gives extensive coverage of each trip and the vessel herself, proudly proclaims that "sails are our only subsidy, and the fuel in our tanks often goes ashore to run island generators". Anything and everything is carried from store goods to vehicles. Copra

[80] https://sites.google.com/site/sailcargo/ , accessed 30/8/2012. All information on this case example has been sourced from this site.

and seaweed make regular consignments. Many of the small islands en route are still not supplied on a regular basis and *Kwai*, despite her age has proved herself the most reliable carrier available. Data is not available to compare it directly, but if the 60% fuel savings claimed are correct, she is obviously the lowest overhead vessel to operate. She makes sufficient profit to pay her way and progressively refit the vessel, decreasing her overheads as she does so and her more efficient sail rig further reduces her fossil-fuel dependency. The website information suggests her asset cost to date is less than US$700,000.

Applying the Lessons Learnt

The case studies provide a rich feeding ground to trawl for lessons to inform future initiatives, the focus of Section 5.2. In Section 5.3, two case studies are considered that are representative of extreme shipping scenarios in Oceania: Rotuma and Tokelau. For both, the nature of current options is neither sustainable nor positive but constitutes a major burden and expense with all predictions being this will continue to increase into the future. It is argued that there is sufficient justification for at least considering sail as an alternative technology for use on both routes. While such alternative technology cannot provide an immediate replacement for all shipping services on these routes, it could provide a significant supplement in the immediate future. If sail technology has application for the extremes of Rotuma and Tokelau, it must follow that it has application for most Oceanic routes where it is desired to reduce fuel dependency, empower resilience, and increase options.

Whether introducing such sustainable alternatives is justified from a fuel dependency, local environment or climate change basis, and given the emergent nature of the alternative-energy shipping industry, it is critical there is cognisance of these lessons now and, I argue, close collaboration across initiatives, research, and policy to plan to address them. Section 5.4 sets out the reasoning for suggesting that this type of technology should be introduced to Oceania via promoting Fiji as the hub of such a technological revolution. In doing there is heavily reliance on the lessons learnt from the above examples.

5.2. Lessons Learnt

The previous section presented a summary of a range of past and current case examples, all except one involving sail technology. A number of leading examples of the development of new sail-based technology emerging globally were outlined in Section 4.3. The lessons for Fiji and Oceania from these cases are discussed below.

Section 4.1 argued that alternative small-scale shipping, especially when it is not reliant on expensive transport nodes and related shore-side infrastructure, offers to increase a range of well-being potentials for Solodamu and Kadavu communities and this argument is repeated in the next section in regard to Rotuma. If it is accepted that such situations are representative to some degree, then it is further argued that utilisation of alternative shipping technology can also assist access to such benefits across a range of local community settings throughout coastal and island Oceania.

For such benefit potential to be maximised, and for it have any significant effect on either country or regional fuel dependency and budgets, the introduction of the technology will need to be at some scale, both in terms of number of applications but also in type. The case examples considered above range in size from 7000dwt container/bulk carriers (Ecoliner) to single-person dugout fishing boats (UNDP/FAO) and cover applications from fishing to passengers, tramp, dry-bulk, oil and container carriers. Similar cases could be easily made for other applications, such as bluewater barging where modern day variants of the scows of yesteryear have potential application today.

Although sufficient economic analysis has not been undertaken here to prove the above contentions conclusively, and this would require real-world testing in any regard, my analysis currently is that the investment in such research and development would be minimal in comparison to the benefits potentially accruable. A coordinated and well monitored programme is obviously required if such potential is to be unlocked successfully and it is argued in Section 5.4.2 that Fiji is the logical starting place for Oceania and should seek to become a regional technology hub in this regard. For any of this to become in any way a reality it is essential the lessons from past experience are first distilled and heeded.

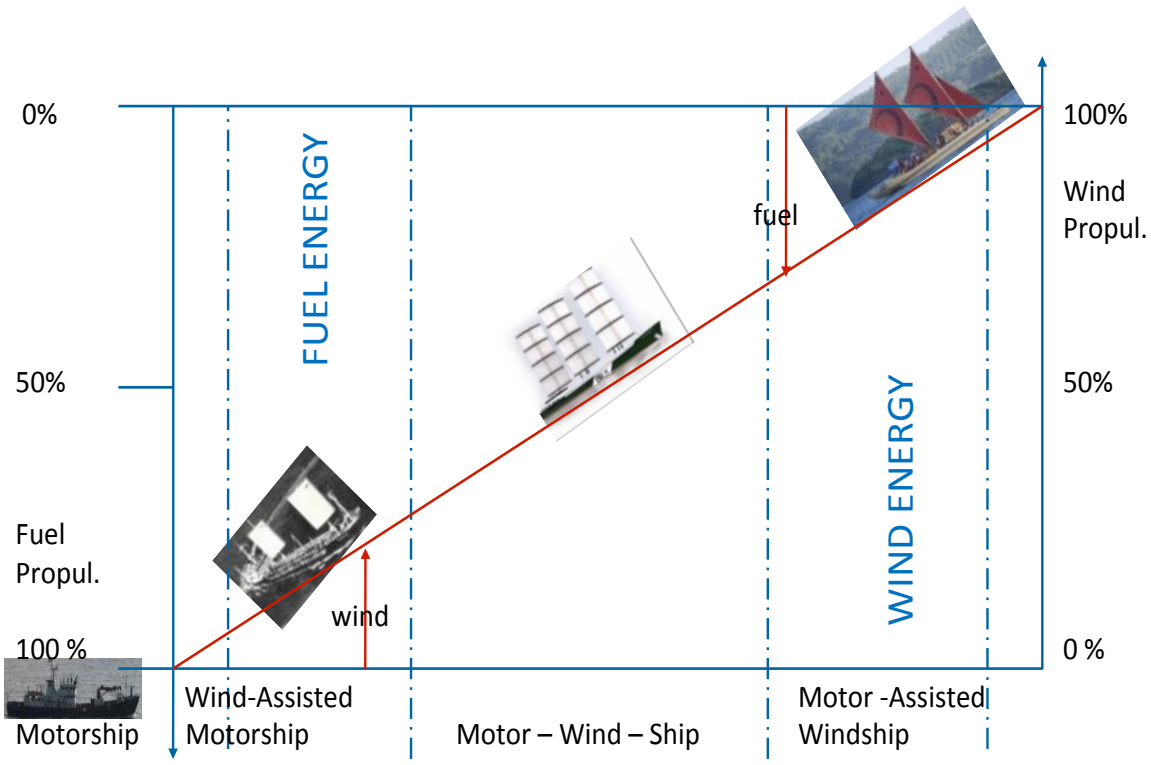

Figure 35 Propulsion Options for Sea-transport Vessels

Source: Adapted from UNESCO (1986)

The examples represent a broad range of vessel types and applications. The simplified sketch in Figure 35 divides shipping into four categories: pure-motor vessels; motor-powered with sail-auxiliary; hybrid vessels, where the motors might be fossil-fuel or alternative-energy fuel; and pure-sail vessels where the auxiliary motor, if fitted, is only used sparingly, for reef passages, manoeuvring, anchoring, etc.

Within the first category, savings in fuel usage and GHG emissions are not available from alternative energies. The only ways to save fuel are to reduce steaming speed, improve hull or motor efficiency, or increase vessel size to achieve fuel savings through economies of scale. Slow-steaming only saves fuel if there is no premium placed on speed of service. If you go half as fast you can only deliver half as much in the same timeframe.

The second category, employing auxiliary-sail power, offers savings of up to the 20-30% range (achievable using available data from *Na Mataisau*, *Shin Aitoku Maru*, and SkySails). Vessels in this category generally comprise retrofitted adaptions to existing asset. Proportionally lower savings are available for proportionally lower investment compared with procurement costs of dedicated new asset. *Na Mataisau* and *Shin Aitoku Maru* demonstrated

additional (and considerable) benefits over and above fuel savings. It is assumed kite-sails would produce similar secondary advantages.

Hybrid-vessels seek to combine the benefits of combining more than one type of primary propulsion system, accepting a lower degree of overall savings when compared to pure-sail vessels but retaining similar (or enhanced) performance capability to totally fossil-fuel driven shipping. It is a 'best of both worlds' or 'better than either world' approach. Fuel use, whether fossil or other, is minimised or eliminated when sailing conditions are optimum yet the vessel can steam or motor-sail when weather conditions are not complimentary. Additional benefits (increase in overall passage speeds, reduced engine wear, increased inherent stability, passenger/crew comfort, etc) as evidenced for sail-auxiliary systems will also apply to hybrid configurations.

Current market leaders of hybrid designs, e.g. *Greenheart*, *B9*, *E-Ship 1,* are predicting fuel savings of up to 60%. This is also similar to the savings Jim Brown calculated for his fast 25m passenger catamarans and 20m tuna long-liner and in the range being reported currently by the *Kwai.* Where the auxiliaries are alternative-fuel powered, biogas for *B9* and PV-powered electric motors for *Greenheart*, this should result in close to zero-emissions. The true cost of these technologies requires greater economic analysis than provided. It was previously cautioned that biogas may arguably be cleaner but is not necessarily cheaper. However, rapid recent advances in technology, especially PV and electric motors, indicate they will become increasingly cost efficient, therefore more accessible and so more readily acceptable and serviceable. Such technology is currently not well embedded here, especially in remote locations, and there is a case for arguing that given the fuel use will be minimal it may be more appropriate, if less purist, in the immediate future to use existing and locally understood and serviceable fossil-fuel motors.

Finally, pure-sail options, at the far extreme of the scale, can offer up to 100% reductions, although there are increasing penalties in terms of scheduling and routing, which need to be considered. Needing only small or no power plants, asset cost and downstream operating and servicing costs are accordingly reduced.

All the propulsion types considered (including pure-motor vessel operators seeking to maximise efficiencies) require greater cognisance and allowance for wind route planning. On some days the assistance available from wind power will be greater than others and wind

direction will affect overall passage scheduling and course if maximum potential is to be realised. Such cognisance is necessary for both operators and service users.

But it need not be such a barrier as may be perceived. Conventional routes are regularly affected and changed in relation to weather conditions. While a conventional mechanical drive, powered by whatever fuel, allows a vessel to travel directly to windward (the reason after all that first steam and then fossil-fuel driven vessels came to dominate in the first place) it does not necessarily follow they can do so comfortably, efficiently or safely. They can certainly not do so cheaply. Current timetabling throughout the world has already been affected since 2008 by the introduction of slow-steaming regimes. The anecdotal evidence in Fiji currently is that most ferry operators have dramatically reduced steaming speeds on several routes to off-set fuel costs. In the Tokelau example (Section 5.3) the recently supplied short-term lease vessel, although capable of much higher speeds, will not be exceeding 11 knots because of this factor[81]. In any regard, the type and condition of many local domestic vessels regularly means sailings are postponed or curtailed because of weather conditions.

While irregular variations to routes and timetables to allow for wind route planning to be effective may be a result of introducing new technology, any negatives of this need to be balanced against the potential benefits. In the *Kwai* example it has not apparently affected demand for their service. In the case of the villages envisaged as the beneficiaries of the catamaran options being explored for Solodamu, if the service timetable varies from week to week and passage to passage but the net result is a regular service at reduced costs with asset ownership and management being locally controlled, it is likely the negatives would be seen to be significantly outweighed. Route planning then needs to considered and factored, but does not appear necessarily a major or unassailable impediment.

And it is not an 'either/or' situation. In many cases, alternative-energy vessels offer a supplement rather than a competitor to existing services and this is especially true for currently uneconomic routes. Alternative technologies should increase the range of service options available. In the Rotuman and Tokelau examples, a coordinated fleet of smaller, alternative-powered vessels could be used to provide an increased frequency of smaller loads while bulk items (heavy machinery, etc) can be transported on less frequent, conventional

[81] http://beehive.govt.nz/release/new-ferry-lifeline-remote-tokelau, accessed 16/7/2012

load-carrying barges or ships (though the ability to fit these with kite-sails or other auxiliaries is also a technologically available option).

5.2.1. Is there a Technological Barrier and is it the Primary Barrier?

There does not appear a barrier in terms of technological design or knowledge and this is especially true for domestic shipping options. The experiments from the last oil crisis indicate that technological solutions are available, or at very least readily conceivable and attainable, and capable of achieving savings across a range of applications. Despite the view expressed by MFAT, (see Mayhew, 2011b and related emails in Section 5.3.3), the concerns that alternative energy powered shipping is a new, unknown, or untested option are not consistent with this research. Some of the current advances may be new, e.g. kite-sails, but in the main it is mature technology. Sails themselves are as old as transport itself and PV, electric drives, small-scale catamarans; wind-powered barging and auxiliary-sail rigs have been available and proven for a long time. The technology used in the Flettner drive (see Section 4.3.3) was comprehensively proven in the 1920's but has not been exploited since until very recently by Enercon.

Small-scale shipping, particularly appropriate for community to inter-island domestic use, looks especially well-suited to adaptation either by retro-fitting existing vessels in various ways or replacement with dedicated alternatives which would provide greater rates of efficiency. The solutions being considered or implemented internationally for medium-scale shipping (e.g. *B9, Ecoliner, Enercon*) are attractive technologically but at a procurement cost an order of magnitude above the capacity of existing PIC budgets. But here it is access to affordable technology, not the technology itself, which is the barrier. While Third-World orientated solutions are not currently being explored at any scale, with the exception of the Greenheart project, there are a number of options available. At the micro-scale, the small multihull vessels, such as have been considered here for the Solodamu case example, it is obvious that technology is not the barrier. A range of proven designs are available and have been for some decades. Jim Brown's designs appear eminently sensible and have done so for at least three decades as do Wharram and Newick versions. Brown's vision was not limited just to transport but also to bluewater fishing vessels. The ability to turn these designs into usable and viable assets using straightforward construction processes and relatively cheap materials is also well known as was proven in the FAO case and as is currently the case with KiriKraft in Kiribati.

Possibly the greatest barrier the technology poses is the perception that alternative shipping is essentially a 'technological' issue. This blurring has always been the case. "Seafaring is about more than technology and seafaring skills. Activities at sea need to be viewed in their wider social context. Voyaging is a social process that also involves onshore infrastructure to provide logistical and organisational needs as well as training and motivational influences," wrote D'Arcy (2006:177) about Pacific sailors in times past and it is as relevant today.

D'Arcy's point is underscored throughout recent history. If Couper (1973) is correct, Pacific Islanders' attempts to establish locally-owned and operated sea-transport ventures in the past has not generally failed because of an inability to adopt and adapt new technology but from more intricate reasons, which include the need for commercial application to include, acknowledge, and allow for cultural imperatives within the commercial operating modus. Even when shown to be viable, substantive challenges will exist to re-association of Pacific Island communities with sail technology, many of which are perceptual, social, and cultural as well as physical or economic. This appears as true today in Solodamu as it was for the historic period Couper was considering. Only through serious analysis of all factors can we evaluate whether the effort of accommodating all needs warrants achieving the benefits the technology might accrue. An understanding and accommodation of the wider social and cultural context within which such technology is to be deployed must be achieved.

Na Mataisau, *Shin Aitoku Maru* and *Kwai* would seem to demonstrate that a range of existing vessel classes can be retrofitted and achieve considerable and varied savings, in the case of *Na Mataisau* and *Kwai* at moderate cost. The high asset cost of the Japanese oil tankers reflects the 'high technology' approach employed, sophisticated and expensive sail technology coupled with the then high cost of the computer technology in 1984 to operate. The Japanese developers were also concerned with ensuring crew costs were minimised and believed computer-controlled electronics could significantly reduce crewing levels. However, the fuel and related savings achieved by the Japanese could also be sought using 'low technology' adaptations of the concept. In Section 5.4 the use of such rigs is suggested for bluewater barge traffic in Fiji.

Na Mataisau involved retrofitting an existing ship and one originally designed to be primarily motor driven. The hull configuration is quite different to a purpose design sail-driven hull and the researchers were initially and wrongly sceptical of the performance under an auxiliary sail rig. The *Kwai* is the second example in the second-hand category; all the others, bar

SkySails which is discussed separately, have focussed on a new asset approach. The *Kwai* example appears to successfully demonstrate the economic viability of taking an old, second-hand vessel and progressively modifying to alternative-energy as profits accumulated from fuel savings allow. She is arguably the most cost-effective and reliable vessel on the current Cook Islands run and there are irregular media reports of her filling in on routes where other ships are unavailable due to either high cost or breakdown.

The obvious alternative to the *Kwai* example is a *Greenheart* type approach, employing a new purpose-built asset with a similar load capacity but superior performance being predicted for a comparable overall asset cost. *Greenheart* has the added advantages of being entirely fossil-fuel free, therefore lowering operating margins even further, and being designed to operate without the need for shore-side infrastructure. As new asset, her maintenance costs should theoretically be substantively lower, at least initially.

Kite-sails offer potential at national and regional level and for both transport and fishing. The retrofitting capability is alluring. As was pointed out in Section 4.3.3, a careful assessment of the economics of the IRR on the asset, operation and maintenance will be needed (as it will for any emergent technology). Specialist operation skills and training will also be required. This in itself should not be seen as a major barrier and is true for many emergent technologies across all development fields, not specifically shipping or transport.

At the large scale and international levels, there is more of a basis for arguing a technological barrier, and even here current designs appear well poised. As discussed elsewhere, it is access to the technology because of economic barriers that is likely to be the major inhibitor, not the technology itself.

5.2.2. Reporting

There has been poor documentation of case examples in many instances. *Na Mataisau* arguably offers the most reliable and objective data. The *Shin Aitoku Maru* project was dogged with counterclaims over the reliability of the information provided (Clayton, 1987). With other international examples, such as Enercon and SkySails, I have not been able to source credible independent reviews of performance and cost/benefit analysis. There are obvious commercial sensitivities around such information. *Okeanos* is a clear example of one intervention that makes substantive claims but fails to deliver any supporting evidence. Initiatives' such as *Kwai, a* purely commercial venture, have not been so shy in providing

open data on their operations and costings. I also heard anecdotal reports of several past attempts to develop alternative small-scale shipping in different parts of Pacific that have never been formally reported, some where projects never got past conception and others where they failed for a variety of reasons (under-financing, poor construction, and lack of understanding of local environments - economic, political, and social). It is also obvious that there have been limited attempts to collaborate between projects. There are hopeful signs of a wind-shift with the active involvement of a wide range of stakeholders and participants at the SSTT 2012.

5.2.3. Projects and the Project Cycle

A number of the case studies have been 'project' based – e.g. *Mataisau*, *Lapita Tikopia/Lapita Anuta*, FAO, *Okeanos*, Batiki. We are dealing with a concept which is fundamentally an industrial application of technology where a R&D 'hump' has to be passed to prove the economic worth before there is likely to be any scale of commercial uptake. It is likely that the path forward will involve further projects. There are inherent dangers with these, common to many aid or development initiatives, illustrated in the case examples.

In broad terms there are three key lessons. The focus on the technology is at the expense of the wider operating environment and related issues. *Okeanos* is a case in point, where a top New Zealand designer and yard has produced a high-tech solution and it has then been taken out looking for a use without preliminary work being done in the target catchment. Whether the vessel type and construction is best suited for its end use is unknown. Building the vessel in a first-world setting without the full participation of the end users is only addressing part of the problem and potentially creating greater difficulties further down the project cycle or, worse, after it has ended and external support withdrawn.

The focus on the technology trap was also evident in Anuta and Tikopia, where a proven vessel was left to rot because of a lack of understanding of local politics and culture and an assumption these would be similar on neighbouring islands. It would appear that most projects in this field have focussed their energy on the technology with insufficient attention to the critical social, political, and economic operating catchment. Investment in technological application has not been matched with investment and planning in the human capital that will own, operate, and manage those assets and sufficient thought has not been given to the unique human operating environments they would serve.

Secondly, the project lifecycles are generally short, at best a few years. In the *Na Mataisau/Cagidonu* and FAO cases it appears that savings were not maintained after the project, despite the technology being proven, because there was no ongoing monitoring programme and no incentive for the crew to achieve savings. In the FAO case, a large number of vessel types and numbers were provided, the design and execution of the projects appears exemplary, but as soon as the project cycle ended, use of technology dropped. Once the project cycle is complete, there is seldom any follow-on or follow-up, and the intervention becomes isolated and disconnected.

Thirdly, projects tend to lack flexibility, be externally driven, and require positive results to be judged successful. In the Batiki case the right solution was arrived at but for the wrong problem. When it became apparent it was a transport issue not a fishing issue, the project managers/donors were not able to be flexible in their design and delivery. I have alluded previously to the project danger that if successful outcomes are not delivered within the project framework or timeframe, the project is generally considered a failure and not an opportunity to learn from experience and accumulate data for subsequent attempts. As such an 'unsuccessful' project can poison the well for other initiatives.

In light of this assessment, the need is argued here for a long-term coordinated and cross-discipline programme of research and investigation as opposed to individual and disconnected short-term pilot projects. There are too many interconnections and similarities across Oceania for any project to happen in isolation. In this regard our ocean is simply too small. This is of course no new revelation. Couper (1973) noted that the efforts of Batiki villagers to gain control over transport links between their island and mainland were regularly repeated in similar examples across Fiji and Oceania. Bayliss-Smith (1988:181) recorded that "in relation to commercial shipping criteria, these village-based schemes are usually judged to be hopeless failures, since they seldom persist beyond the lifetime of a one particular boat which itself may be terminated prematurely by shipwreck or bankruptcy. Commercial expansion in order to mount a sustained challenge to existing shipping interests is generally not envisaged by the organisers, but anyway it does not happen. Yet judged from the perspective of villagers the profit and loss account seems much more evenly balanced". If the ultimate goal is to increase community resilience, then such projects must be orientated and driven at this level, fully supported externally and their effectiveness critically monitored.

There is an extremely important lesson embedded in the FAO work where it was found that

those Oceania cultures that have managed to maintain "a living tradition of the use of sail" (FAO, 1986:71) have a distinct advantage over other communities in successfully adopting sail-based adaptations. This is especially true in an Oceania setting where leverage for transition is sought from the region's sailing heritage. Most Fiji island/coastal communities are now at least two or three generations removed from such tradition and it is unknown to what degree this has dislocated cultural capacities. It was certainly 'lost' knowledge in Solodamu and many other Fijian communities I have had experience with, except in the Lau. A transition from fossil-fuel to sail-based sea-transport, whether at an individual fisher or inter-state cargo level, requires more than changing the means of propulsion. A true sailing culture must be re-instilled in both transport operators and end-users, effecting a change from 'mariners' to 'sailors'. As FAO recorded, these skills and mentality are already instilled in cultures for whom sailing is as normal as swimming in their primary cultural environment. Such communities are now as rare as historically they were prevalent.

The FAO example also provides the valuable learning that, ultimately, the technology must be proved of direct economic benefit for there to be any long-term uptake, regardless of what other benefits are on offer. If such benefit is not obvious to the end user, uptake will always be an upwind exercise. This underscores the breadth of the challenge. Both *mana* and money need to be fully considered and incorporated if a change is sought to be effected at the level of paradigm.

Many of these lessons were reinforced by the presentations prepared by Mike Savins for the SSTT 2012 that summarised 20 years of practical experience of building small-scale alternative vessels for village and island use in Tuvalu, Kiribati, and the Solomons. His other key points included being cognisant of the large variation in vessel design requirements in the Pacific, that costs of vessels must be a key criteria when talking sustainability and he stressed that new technology must be both affordable and serviceable. These experiences underscore the critical need for long-term commitments to demonstration of concept and investment in training and capacity building of end users.

5.3. A Tale of Two Sea-Transport Scenarios: Rotuma and Tokelau

This section considers two case examples of current Oceanic remote island shipping scenarios. The sea-transport issues and recent history for each case are summarised and the two compared in light of the knowledge acquired from the preceding sections. The role that

alternative shipping options might play in these two examples is then discussed. Finally there is a discussion of Tokelau's renewable electricity generation programme compared against the implications of recent policy decisions that suggest Tokelau's sea-transport future, by far the largest portion of the country's energy footprint, is to be fossil-fuel bound for the foreseeable future. It is concluded there is no logical or rational reason, apart from the inherent invisibility of the option, why alternative-energy alternatives aren't being considered for sea-transport in either scenario given the potential benefits and savings.

5.3.1. Overview

There are a number of similarities between the Rotuma and Tokelau scenarios. Both have long seafaring heritages. Both represent extreme examples of the Pacific sea-transport dilemma; small populations on geographically remote, small islands, with highly limited economic income generation capacity. Sea-transport always has been, is increasingly today, and will remain for the foreseeable future, the lifeline of each, and a high priority for resident communities. Neither has a protected harbour meaning a vessel of any scale cannot be locally-based and a return trip to an external homeport is always required.

Their sea-transport history in the past century has seen an increasingly desperate situation develop, littered with literal and economic shipwrecks. All options in at least the past 50 years have been fossil-fuel propelled and have required ever-increasing government subsidisation. Sea-transport is regularly the largest line item in government budgets in Tokelau records (Tokelau Government Website[82]) and while this has not been confirmed for Rotuma it can be assumed to be of a similar scale. This situation has been exacerbated by the ever-increasing international cost of MDO, a trend which is predicted to continue. The client communities of both islands have increasing transport demands and expect increasing levels of service, safety, and comfort. Both are currently subjects of their respective government processes to develop long-term sea-transport solutions.

There are three major differences. Rotuma has the advantage of also having air access. Rotuma is a high volcanic island whereas Tokelau comprises three atolls separated by bluewater passages with a high point of some 3-5m above high tide and therefore vulnerable to being totally destroyed by sea-level rise and other global warming related changes or

[82] http://www.tokelau.org.nz/Tokelau+Government/Government+Departments/Department+of+Transport++Support+Services.html, accessed 12 July 2012.

severe weather events in the short to medium term. Finally Rotuma is politically integral with Fiji, itself a SIS, while Tokelau is a voluntary dependency of New Zealand, an acknowledged member of the 'developed' world. Tokelau's quasi-independence means that it reports annually on its political status to the UN General Assembly, where its reports regularly prioritise shipping and climate change over all other issues[83].

Both case studies presented themselves serendipitously. The difficulties and costs of providing sea-transport to Rotuma are well-known to the Fiji government. As documented in Section 4.2, the government has historically been reluctant to provide such services directly, preferring to use the franchise scheme to subside commercial operators. Even with a high subsidy rate it has proven increasingly difficult to find operators prepared to take on the route and the government fleet does not have capacity to always provide adequate cover when commercial operators fall short. In 2012, following a successful FIVS-run workshop of Fijian stakeholders to introduce the concept of alternative sea-transport options, FIVS received an invitation to present to the government-appointed Rotuma Think Tank on potential options.

I agreed to assist FIVS in researching this as it fitted with my research focus for two principal reasons. Firstly, Rotuma represents the most extreme shipping route within the Fiji group, a bluewater return run of more than 300nm each way from any other port in Fiji. It is therefore assumed that this represents the most extreme shipping dilemma in terms of cost and difficulty and that if an alternative-energy solution could be used cost effectively for Rotuma then it could do so for any Fijian route.

Secondly, *Na Mataisau* (see Section 5.1) had been trialled on the Rotuma route in 1984 under auxiliary sail rig and demonstrated strong efficiencies. Discussions with Greenheart (see Section 4.3.3) suggested their proposed alternative-energy vessel design could be suitable for servicing the route. Although her proposed configuration does not currently provide the passenger accommodation that would be needed to support the indicated demand, her displacement, and overall loading specifications are not that dissimilar to the *Na Mataisau*. Given *SV Greenheart* is a purpose-designed sailing vessel, unlike *Na Mataisau*, it can be assumed that the efficiencies and therefore savings of *Na Mataisau* would be a safe

[83] UN General Assembly, Special Committee on Decolonization, 10th Meeting (AM) 25 June 2010. http://www.un.org/News/Press/docs/2010/gacol3213.doc.htm

conservative estimate to use to calculate the minimum savings of the *Greenheart*. Southampton University had calculated 'Reduced Fuel Factors' for Viti Levu-Rotuma in 1985/85 as 1.55 and 1.03 for the outward and homeward legs respectively or a more than 50% outward saving and a small over-all homeward one (Satchwell, 1986). Given that a custom design would have greater windward capacity than the retrofitted auxiliary rig of *Na Mataisau*; this indicates a highly conservative minimum fuel saving of more than 25% on current usage by comparable craft and more than 50% a more likely conservative estimate[84].

The presentation to the Rotuma Think Tank has been delayed at the time of writing (October 2012[85]). I was, however, in the process of researching the Rotuma scenario when the New Zealand Minister of Foreign Affairs made an announcement of a NZ$17 million solution for Tokelau's shipping problems (12 June 2012). The subsequent media reports immediately caught my attention as Tokelau had been at the periphery of other aspects of the inquiry; particularly in relation to *drua* culture where Tokelau is possibly the north-eastern extreme of the *drua*-design catchment (see Chapter 6). Tokelau is similar in both population and distance from safe anchorage to Rotuma. Comparison of Rotuma and Tokelau gave the opportunity to compare a Fijian scenario with another Pacific case. Also Tokelau's intention of being the first country in the world to achieve 100% renewable energy use by 2012 has been well reported in the media over the last three years and I wanted to confirm how sea-transport was included in this claim. I have never visited Tokelau, although I had once passed between its atolls in command of a small sailing ship in heavy weather whilst on passage to Samoa and am fully cognisant of how difficult the operating environment can be.

I wanted to know if the Tokelau 'solution' announced by the Minister provided lessons that might be of assistance in the Rotuma example. I also wanted to know if the 'solution' had

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[84] It is difficult to give truly accurate estimates of savings without cleaner data than available currently. However, if a highly conservative estimate of 500t MDO p.a. is used for sea-transport to Rotuma currently and if all options were available using hybrid technology this could equate to at least FJ$0.5 million savings, comparable to the current annual subsidy for the route. These calculations and the others in this section require more careful and expert scrutiny. However it is contended they provide sufficient evidence to warrant such investigation.

[85] FIVS and Greenheart presented in December 2012.

ever included consideration of alternative energy options[86] and what the effect of including such options would be on the predicted costs and services. If no such consideration had been factored into the proposal then what, if any, contribution could this research programme and that of my collaborators such as Greenheart offer? Also, Tokelau, a fully government-operated service, might allow better access to data on costings and expenditure, an area I have found difficult to access in terms of Fiji's highly competitive, private commercial operating environment. Consequently, I attempted to enter into a dialogue with MFAT.

I and another colleague had separately made repeated approaches to discuss concepts of sustainable shipping generally with NZAid/MFAT since 2009, resulting in meetings in the High Commission in Suva in 2009 and MFAT's offices in Wellington in 2010. The initial response to approaches in 2012 repeated the pattern of the earlier attempts. We were politely received, our initial information offerings were described as exciting and positive and when it became apparent that we weren't offering a commercial and immediately available solution, but rather initial research findings and options for a paradigm shift to the approach MFAT was currently embarked on, it was quickly suggested that we could possibly come back again the next year when MFAT wasn't so preoccupied. We were also told clearly that the issues of sustainable sea-transport for PICs simply weren't a focus for MFAT at this time.

My initial requests for background information from MFAT on the Tokelau shipping issues and the Ministerial announcement were rejected as being commercially and/or politically sensitive and I was forced to repeat such requests under the Official Information Act. After several weeks this resulted in the release of edited copies of Ministerial briefing papers on Tokelau shipping issues from 2006 to 2008[87]. While these contain some useful data, it has been necessary to assemble the summary on Tokelau by extrapolation of the data released with other information sourced from various websites.

As shown below, the issue of providing a long-term Tokelau shipping service has become increasingly expensive and protracted with no long-term solution now likely before at least

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[86] It apparently has not, although MFAT's refusal to disclose records makes it impossible to conclusively confirm this.

[87] This was only a fraction of what I had requested and I have since applied to the Ombudsman to have the entirety of the information I sought released. Unfortunately this has not resulted in provision of more recent briefing papers and other reports held by MFAT at the time of writing.

2014. Despite investment of millions of dollars each year for at least a decade, Tokelau has been left with an inadequate service that is arguably marginal at best in terms of safety and capacity. The NZ government was scheduled to go to international tender for design and construction of a new Tokelau ship in August/September 2012. It does not appear that there is any incentive or requirement for this to consider renewable energy options.

5.3.2. Rotuma Sea-transport Scenario

The islands of Rotuma are located north of Fiji (348 nm Ahua to Suva; 320 nm to Lautoka; 360 nm to Savusavu). Rotuma Island itself is 13 kilometres long and 4 kilometres wide and home to about 2000 Rotumans. About 10,000 Rotumans now reside on Viti Levu (Howard and Rensel, 2004).

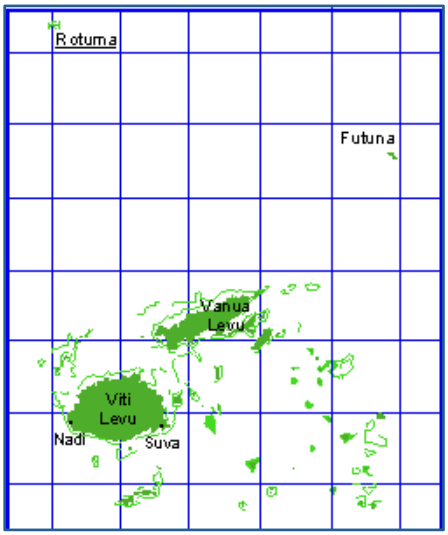

Figure 36 Location Map of Rotuma

Although annexed under the ambit of the larger Fijian colony in 1881, Rotuma presents its own distinct historical, cultural, and geographical circumstances (Nicole, 2006:22). As with other Oceanic cultures, it has a long seafaring heritage (e.g. Hornell, 1975); although Howard (in Feinburg, 1995:114[88]) suggests not as significant as many other Polynesian societies. This legacy has not been assessed in this thesis with the same rigour as applied to *drua* culture in the rest of Fiji[89]. The use of indigenous bluewater sailing vessels appears to have ceased within a few decades of the arrival of regular whaling and trading ships. D'Arcy (2006:95-96) quotes the visiting yachtsman Wood in the early 1870's whose report suggests

[88] Dr Howard also includes extensive notes on Rotuman vessels and voyaging at www.rotuma.net.

[89] Although I hope to return to this subject in the future. There is an intriguing possibility that Rotuma may have played a catalytic role in the transfer of the oceanic lateen rig between Micronesia and central Oceania.

Rotumans historically had significant bluewater capacity: "one sees several large double canoes, similar to those of Fiji and Tonga, lying in their sheds on the beach. The people assure me that no one now alive, or their fathers before them, have ever seen these canoes in the water. Were they to launch them, they would not know how to manage them, nor could they make the mat sails suitable to them, so completely have they lost all their former knowledge of navigation".

Local food production formed the basis for commerce with European ships in the 19th century, when the island was a favourite stopping place for whalers to re-provision. Rotuma also began a brisk trade in coconut oil, which gave way to copra in the 1870's. In addition to trading with passing ships, Rotuman men eagerly seized opportunities to sign on as crew, or to work in the pearl fisheries in the Torres Straits, diving and managing boats. They earned both good wages and a reputation for competence and reliability (Howard, 1995, also http://www.rotuma.net/os/Economy.html).

After cession to the British Crown in 1881, Rotuma was incorporated into the Colony of Fiji, and was closed as a port of entry[90]. Rotumans continued to seek opportunities for earning and adventure on ships, though they had to go to Fiji to do so. Copra, became the island's primary cash crop, and had to be shipped through Fiji. Political affiliation with Fiji has been central in facilitating Rotuma's economic well-being, not only in providing government jobs on the island, but by allowing Rotuman migrants in-country access to opportunities for education and employment, and ease of interaction with those on the island (http://www.rotuma.net/os/Economy.html).

Transport Infrastructure

The island is serviced by a small airstrip. There is no secure harbour and a jetty has been constructed accessing an open leeward roadstead. The government allocated FJ$400,000 in its 2011 Budget to complete the extension of the Rotuma jetty by about 7m (*Fiji Times*, 27/1/2011). In adverse conditions or in the presence of persistent ground swell, cargo and passengers must be lightered to beaches with local boats.

Air Services

[90] It was re-opened as an entry port in 2010 in an attempt to stimulate Rotuman trade.

The frequency and costs of air services has fluctuated in recent years. In 2007 Air Fiji flew from Suva to Rotuma on Wednesdays and Fridays, a two hour one-way trip costing FJ$430 per seat. In February 2011 fares with Pacific Sun had risen to FJ$610.80 one-way, rising by March 2012 to FJ$631 (*Fiji Times,* 28/2/2011). Airlines are dependent on fuel supplies shipped in by sea for the return flight, causing obvious issues. For example in January 2011, Pacific Sun temporarily suspended its Rotuma service for several weeks due to a lack of on-island aviation fuel (*Fiji Sun,* 25/1/2011).

Energy Demand

In 2007 Rotuma consumed a total of 300,000 litres of liquid fuels per annum[91]. Diesel accounted for 185,000 litres, followed by 45,600 litres of Multi-Purpose Kerosene and 36,000 litres of premix. All fuel is imported by sea in 200 litre drums. Demand is expected to increase moderately over the next 10 years[92]. Current studies into use of coconut-based fuels suggest there is potential for Rotuma to meet its local demand with the appropriate technology and planning, and further potential for export, albeit that such technology is still in an embryonic state[93].

Shipping History

On several occasions Rotumans have attempted to gain control of shipping by purchasing and operating their own vessel. As early as 1901 they had a schooner built to ship copra and passengers between Rotuma and Sydney via Suva. The 50 tonne vessel cost over £2,000 and operated for eighteen months before sinking on a reef (Eason, 1951:89-90). More recently, in 1992, a Rotuman group purchased an inter-island vessel, the second-hand *MV Wairua*, at a cost of FJ$250,000. For every basket of copra cut on Rotuma, 25 cents was levied. It went aground on a reef off Kadavu in 1993 and was judged unsalvageable. Insurers denied liability (Howard, 1995).

Numerous vessels have been used to service Rotuma including Fiji government vessels,

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[91] Given that Rotuman bound vessels do not bunker there this figure does not included the fuel used by shipping. A ballpark estimate including the shipping fuel would likely more than double this figure.

[92] http://www.rotuma.net/os/Publications/Biofuel_Rotuma.pdf accessed 26/8/2012.

[93] http://www.rotuma.net/os/Publications/Biofuel_Rotuma.pdf accessed 26/8/2012.

Rotuman-owned vessels, and Fijian-owned commercial vessels. In recent years all have been either old and unreliable ships, or tourist-orientated vessels pressed into service for lack of alternatives. Given the nature of the route, it attracts government subsidies under the Shipping Franchise Scheme, currently aimed at subsidising a monthly service. In 2005 FJ$2.2 million was budgeted by the government for the scheme to improve services to Kadavu, Rotuma, Lomaiviti, and the Lau group. Western Shipping Services, which was then servicing the Rotuma route, received about FJ$14,000 per trip[94] (*Fiji Times*, 20/11/2005). No arrangement has yet proved totally satisfactory and a number of vessels have been lost, in part at least due to the age and condition of the vessels.

Kadavu Shipping & Holdings, a subsidiary of the Kadavu Provincial Council, lost the *Bulou-ni-Ceva* in 2006, seen here sitting on the reef at Lopta, Rotuma (Figure). Locals reported that the boat came to Rotuma with only one engine working. The insurer denied liability (*Fiji Times* 13/11/2006; 30/12/2006).

Figure 37 ***MV Bulou-ni-Ceva***

Source: http://www.rotuma.net/os/NewsArchive/Archive2006/archive0607.htm

Western Shipping operated the *Bawaqa* and *Cagi Mai Ba* from Suva to Rotuma and 2007 prices were quoted as deck/cabin FJ$130/150 (http://www.lonelyplanet.com/fiji/rotuma/transport/getting-there-away).

[94] Other companies receiving subsides under the scheme at this time were Seaview Shipping Services (Lomaiviti, Kadavu, and southern Lau routes), Sali Basaga Shipping, Khan's Shipping, Lalavata Shipping, and Kapaiwai Shipping.

The *Fiji Times* (23/52008) reported that "thousands living on outer islands face the possibility of isolation as a shipping company revises its schedules to cope with increasing fuel prices. People living in the Lau and Yasawa groups along with those on Rotuma may have their transport link severely disrupted as Western Shipping Company Limited plans to cut back on trips to the areas". The company claimed fuel price rises meant the routes were now uneconomic even with subsidies. "Our fuel bill for running a trip to Rotuma alone stands at more than $23,000 and this will rise further, the fuel bill for a trip that left for Lau today (yesterday) stands at $22,700 while a regular trip to Yasawa is about $3000" (*Fiji Times*, 23/5/2008).

In December 2007 Blue Lagoon Cruises management reported they were in the process of retrieving their vessel, the 39m *MV Lycianda*, which ran aground on Oinafa Reef in Rotuma due to strong winds caused by Hurricane Daman. The boat was able to detach itself from the reef (*Fiji Times*, 9/12/2007).

Blue Lagoon Cruises resumed services to Rotuma in February and March 2011 after *MV Nanuya Princess's* maiden and subsequent voyages in November 2010 and January 2011.

Figure 38 ***MV Lycianda***

Source: http://www.tropicalfiji.com/Resorts/blue_lagoon_cruises/lycianda.asp accessed 2/7/13

They were asked by Fiji Shipping Limited to service the Fiji-Rotuma route after a temporary suspension of inter-island services placed on Bligh Water Shipping's *MV Westerland* in October the previous year by the Minister of Transport because of the poor condition of that vessel (*Fiji Times,* 25/1/2011).

The *Fiji Times* (11 April 2011) reported that the government would continue to subsidise one boat trip per month under the franchise scheme and that additional unsubsidised trips could be made by private shipping operators if they choose. They obviously chose not to as the next year the *Fiji Sun* (10 May 2012) reported that a government vessel was expected to service Rotuma on an additional quarterly basis after transportation problems to the island were raised with the government. By then Rotuma was being serviced monthly by the *MV Lady Sandy* under the Government franchise scheme at a fare of FJ$185 per head one-way. The high cost to passengers was the reason given by the government for providing the additional services.

5.3.3. Tokelau Sea-transport Scenario

Tokelau is a non-self-governing territory of New Zealand consisting of three coral atolls in the South Pacific: Atafu, Nukunonu, and Fakaofo. These atolls lie approximately mid-way between Hawaii and New Zealand and about 300nm north of Samoa. It has a maximum altitude of 3-5m above sea level and a total land area of 10.8 sq km (www.tokelau.com). The population of Tokelau in 2011 was 1,411(NZ Department of Statistics website[95]).

Figure 39 Location of Tokelau

In 1925, the atolls came under New Zealand administration and a territory in 1948. Today, more Tokelauans live outside Tokelau than on the islands, with approximately 6,800 living in New Zealand. Tokelau has an Administrator appointed by the New Zealand Minister for Foreign Affairs; however, in 2004 the Administrator delegated his powers to the three Village

[95] http://stats.govt.nz/browse_for_stats/people_and_communities/pacific_peoples/2011-tokelau-census-landing-page/final-count-2011-tokelau-census.aspx, retrieved 22 Aug 2012

Councils (www.tokelau.com[96]).

Access to Tokelau is only available by sea, there is no anchorage and no lagoon access for vessels any larger than outboard-motor propelled fibres. New Zealand assistance provides the vast majority of Tokelau's recurrent budget as well as funds for major projects such as infrastructure and shipping (http://www.mfat.govt.nz)[97].

The NZ government considers that "over the past three decades Tokelau has moved progressively towards its current advanced level of political self-reliance … It has its own shipping and telecommunications systems. It has full control over its budget" (MFAT website). However, the decision-making that has occurred since at least 1991 in relation to providing sea-transport to Tokelau would tend to confirm that all decisions, including budgets, on this matter are decided in Wellington.

Tokelau Shipping Background

Prior to European contact Tokelauans travelled by canoe to and from quite distant neighbouring islands. Canoe travel other than for fishing purposes is no longer practiced due to the convenience of modern shipping services (SPREP, 2002). As discussed in Chapter 6, Tokelau is likely to have been within the historic catchment of drua. Almost the entire male population was lost in 1863 to Peruvian slavers and a dysentery epidemic from Samoa the same year reduced the remaining population to only 200 (Hooper and Huntsman, 1991:83). This is likely to have had a highly detrimental, possibly terminal, effect on indigenous knowledge of seafaring and vessels.

In more recent times, transport has proved increasingly problematic. An air link was briefly established with seaplanes to Samoa in the 1980's[98] but generally it has been reliant on erratic shipping of varying capacity, reliability, and frequency. The *MV Wairua*, chartered from Suva in the 1980's, provided the most reliable service for a time. The NZ government procured a dedicated vessel for the Tokelau government, *MV Tutulo*, in 1992 (McLean and 'Aubert, 1993).

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[96] http://www.tokelau.com/, accessed 22 August 2012

[97] http://www.mfat.govt.nz/Countries/Pacific/Tokelau.php, accessed 23 July 2012.

[98] Private helicopters can be chartered from Samoa at high cost. The current MFAT 'solution' includes fresh investigations into building a runway or using floatplanes.

Tokelau Transport is responsible for the provision of Tokelau's Shipping Service, the means by which the government implements its shipping service policies. The key objective for the government-owned Tokelau Shipping Service is to provide Tokelau with a regular, reliable, and safe service covering the carriage and transfer of passengers and freight between Apia and Tokelau including also transfers from ship to shore when in Tokelau (Tokelau Government Website[99]).

MV Tutulo was a custom-built, new-design, power catamaran whose main function was to transport passengers and cargo between the three atolls, serve in any emergency evacuation to Apia, and transport needed supplies from Apia. It was, however, not allowed to take passengers internationally and was to be supplemented by the *MV Forum Tokelau,* a 5,136-ton ship that carried 60 deck passengers and eight cabin passengers between Apia and Tokelau (SPREP, 2002). That ship was procured in 1997 with funding from NZODA and was being managed by the Pacific Forum Line under an agreement with PFL, NZODA, and the government of Tokelau. The *Forum Tokelau* proved too expensive to maintain, accruing a repair bill in 1998 of NZ$0.5 million. With its disposal, the *Tutulo* was converted, at further cost, in 2000 to a mono-hull, renamed *MV Tokelau*, lengthened and heavily modified to allow it to carry passengers internationally (MFAT Ministerial Briefing Paper, 2008).

Figure 40 ***MV Tokelau***
Source: http://tabisite.com/phos/190tk/ate.shtml

It doesn't appear to have been a successful solution. These changes weakened the structure of the vessel and maintenance and repairs costs have proved expensive, with regular slippage and refit bills (MFAT Ministerial Briefing Paper, 2008). For example, the 2011 Tokelau budget includes a line of NZ$688,000 for *Tokelau* slippage. Such "maintenance and repairs costs are expensive but are necessary to keep the ship seaworthy as it is the only means by

[99] http://www.tokelau.org.nz/Tokelau+Government/Government+Departments/Department+of+Transport++Support+Services.html, accessed 12 July 2012.

which Tokelau remains connected to the outside world" (Tokelau Government website[100]). The *Tokelau* was expected to travel to Tokelau on a fortnightly basis. The duration of the round journey varied between 6 to 11 days depending on inter-atoll and national activities or training and consultation requirements (Tokelau Government Website). At 3.24 tonnes of MDO per day to operate, this approximates to 20-35 tonnes per trip or an annual bunker of 520-910 tonnes per annum[101].

By 2005 MFAT reports to the Minister were stating that the *Tokelau* was at the end of its service life and even extending this by two years would come at considerable cost (MFAT Ministerial Briefing Paper, 2006)[102]. In 2009 Prime Minister John Keys was quoted as stating the *Tokelau* was costing more than an average of NZ$2 million p.a. to service (Radio Australia, 2009[103]). The 2009 Tongan ferry disaster, the loss of *MV Princess Ashika*, brought the Tokelauan situation into fresh relief. Further expensive repairs to *Tokelau* followed and charter ships (which also required MFAT-funded modification) from Samoa Shipping Line (SSL) have been regularly used to cover service deficiencies over the past decade. *Tokelau* was retired from service formally in 2012.

The costs involved are considerable in terms of the expenditure to maintain the service, the projected replacement cost, and the NZ government's processes of deciding what services to provide. MFAT has yet to disclose the original asset cost of the *MV Tutulo* or the cost of its conversion in 2000 to the *MV Tokelau*. However it is likely these were only a small proportion of the operational costs through her lifetime. Ministerial briefing papers quote the 2005 sea-transport cost for Tokelau as $2.1 million, of which $0.7 million was the cost of additional charters from SSL[104]. This is only the cost of the subsidy. In 2007 the cost of a

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[100] http://www.tokelau.org.nz/Tokelau+Government/Government+Departments/Department+of+Transport++Support+Services.html. accessed 12 July 2012.

[101] This does not include the fuel bills for emergency evacuation trips or that used by the additional charter vessels from SSL. These would inflate the figures by as much as 50%.

[102] MFAT repeated this advice three years later in 2008 (MFAT Ministerial briefing paper, 2008).

[103] Tue, 15 Sep 2009, http://www.abc.net.au/news/2009-07-15/tough-voyage-for-tokelau-to-get-new-boat/1354128 accessed 2 July 2013.

[104] New Zealand's ODA assistance to Tokelau in 2009 was NZ$19 million (http://www.mfat.govt.nz/Countries/Pacific/Tokelau.php accessed 12 July 2012).

one-way fare from Tokelau to Samoa was NZ$286 and private freight was also charged[105].

NZ government processes for determining a long-term solution, ongoing since at least 2005, had cost more than NZ$0.5 million in project management consultants by 2008, additional to the costs of at least six NZ government departments, the commissioning of numerous "intensive" independent and inter-departmental assessments, reviews and audits and at least two previous complicated international tender processes and additional 'interim' charter ship leases. In 2009 and 2011 Tokelau Fono representatives were brought to Wellington for briefings at which both sides stated sea-transport was the highest priority subject.

The June 2012 announcement of a NZ$17 million long-term 'solution' includes a two-year lease of PB Sea-Tow's 45m *MV Matua* at NZ$12 million, design and commissioning of a purpose-built vessel, and investigations into shore infrastructure improvements and aircraft runway potential (http://beehive.govt.nz/release/new-ferry-lifeline-remote-tokelau). Previous Ministerial advice has been that a new design/commissioning process will take a minimum of four years (MFAT Ministerial Briefing Paper, 2008) in which case the 'interim' charter costs can be assumed to need doubling. The projected conservative asset cost of a new-build in 2008 was NZ$8–10 million (MFAT Ministerial Briefing Paper, 2008). In 2009, Prime Minister Keys was quoted as stating the option of a 25-year leased vessel would cost NZ$140 million (Radio Australia, 2009)[106].

5.3.4. Comparison of the Scenarios and the Potential for Alternative Technologies

To compare the Tokelau/New Zealand figures with Rotuma/Fiji, none of the vessels referred to servicing Rotuma would have a replacement value of more than FJ$2 million. Lack of investment capital, low IRR, low income generation potential, and the high physical risks are all causative of the Rotuman 'old ships replaced by old ships' cycle. This cycle is unlikely to be broken in the future without external intervention. There is always the possibility that a donor may supply a new(ish) vessel but this generally will only be a short-term solution and does not address the recurring and ever-increasing high operating costs. In a BAU scenario, options for a solution to the Rotuman situation narrows to increased charges, ever-increasing government subsidies, or reduced services. The only options for reducing bunker cost is to

[105] http://www.tokelau.org.nz/site/tokelau/files/TeVakaiI.pdf accessed 16 August 2012.

[106] NZ$140 million ÷ 25yr = NZ$5.6 million p.a. Minister McCully's June 2012 announcement stated NZ$12 million was allocated for a two-year charter arrangement.

reduce steaming speed (already being used), increase vessel load capacity by using larger ships (which will require greatly increased expenditure on shore infrastructure) or introducing alternative, non-fossil-fuel technologies.

Ironically, global measures to increase maritime safety and regulation as well as the MARPOL regulation changes to SO_X emissions from MDO as a climate change mitigation process will increase the costs of operating fossil-fuel powered options for both Rotuma and Tokelau by as much as 60% over current costs in the near term (see Section 4.3).

In the case of Tokelau where the relationship with a wealthy patron allowed the option of new ship design, poor design and purchase decisions were made in Wellington around 1990 and the past two decades have highlighted the long-term consequences. It also underscores that the initial asset cost is only a fraction of the lifetime cost of operation, especially when the initial procurement decision has been flawed.

This has a critical lesson for the decision-making currently being undertaken by NZ government processes for the future of Tokelau. The decision to go with the *Tutulo*/*Tokelau Forum* option in 1991 and the subsequent decision to convert the *Tutulo* to the *Tokelau* in 2000 effectively sentenced Tokelau to an inadequate, unsatisfactory, and increasingly expensive option for half a generation. It is my opinion that the current decision-making process now underway in Wellington could (and is likely to) similarly commit the next generation to an equally unaffordable and unsustainable solution, without adequate consideration of other options and in particular alternative-energy powered vessels. Such options may provide not only more sustainable shipping services but also greater Tokelauan autonomy. Such measures would require shifts in paradigm, policy, and approach but would appear, on the limited evidence available, to be more in keeping with the political wishes of the Tokelauans themselves.

Both communities now expect regular services (fortnightly for Tokelau, monthly for Rotuma) and increasing standards of comfort and amenities. A number of causative factors have steadily increased the sea-transport demand in both communities and, I contend, led to a continuing decrease in their ability to maintain self-sufficiency. There is the degree of the diaspora of both cultures and the desire to maintain physical contact with kin and ancestral roots, combined with an ever-increasing exposure to globalisation through increased communications and information technology; leading to exposure, reliance and finally

addiction to consumer goods, especially processed foods. There is also the increased demand for access to essential external services (health, education, etc.), and access to greater cash through remittances to order and purchase an increasing range and quantity of goods.

Sea-transport is the lifeline of both communities, as it always has been. It is likely to retain this status for the foreseeable future. It is an absolute need and priority. The level of such is possibly not fully understood outside of an Oceanic epistemology. This may go some way to explaining why the Rotuman concern is understood by the Fiji government, who lack the resources to respond appropriately, and not similarly understood or honoured by Wellington politicians in regards to Tokelau, who can commit the funding, albeit to-date begrudgingly and inappropriately. At a global scale, sea-transport for Rotuma and Tokelau is a higher priority, an absolute basic need, than for most other communities, especially those in the major continental powers, where sea-transport is also an absolute economic necessity, but at the level of nation state and not community.

History demonstrates the difficulty associated with meeting this need. As a commercial investment, sea-transport is clearly high risk, of minimal profit at best and most likely a negative economic return. This is reflected in the reluctance of any party in the Rotuma example to invest in high cost assets; the IRR simply cannot justify it. This means the options are always restricted to the continual cycle of old and often-inappropriate vessels being replaced with like and is consistent with the regional pattern discussed in Section 4.2.

The *Fiji Times* (11 April 2011) reported the government's preference for Rotuma to have a Ro-Ro ferry to transport vehicles and equipment. Such an option could include the recently available Goundhar Transport's 100m *MV Lomaiviti Princess*. She has a gross tonnage of 5864 tons with a summer dwt of 529 tonnes, built in 1972[107], and is significantly larger than current vessels on the Rotuma run. It was reported in local media as costing FJ$2 million to purchase in 2010 (*Fiji Sun,* 2/1/2010). Vessels of this scale are unlikely to be able to service Rotuma without expensive and technologically difficult upgrades to shore infrastructure. Although she is large and luxuriously-appointed by local standards, in a global context she must be considered close to, if not past, her due-by-date.

Alternative-energy propelled vessels potentially offer the opposite. Not restricted by fuel

[107] http://www.shipspotting.com/gallery/photo.php?lid=1360312, accessed 6 September, 2012.

bills that require larger vessels to achieve economies of scale, non fossil-fuel ships can be smaller. This allows for fleets of smaller vessels rather than large single-vessel operations, which opens up a number of possibilities with local benefit. It greatly increases operator flexibility. In periods of increased demand, additional ships can be deployed. Such vessels have lower overall procurement costs and no fuel operational costs. Designs such as *Greenheart* mean they can operate independently of shore infrastructure. Crewing levels for multiple vessels may be higher, but in countries of high unemployment and with a lack of vocational options to retain local skilled workforces, this is arguably a positive not a negative feature. In fact, it would go some way to meeting the political objectives of the Tokelau Fono who have lobbied NZ to provide capacity-building and training to ensure greater local participation and control of their shipping services. Smaller vessels, with lower procurement and operational costs, offer a scenario where they would be affordable to ownership at village or family scale, inviting the potential for a collective ownership and central management model of business, possibly with a micro-finance component to facilitate establishment. Whether such visions are realities would take greater analysis than provided here. The point though is, they are not even options to be considered in the 'larger conventional vessel, economies of scale' model.

Such flexibility would have other advantages. The Tokelauan vessels are currently required to perform medical evacuation (Rotuma has the option of aircraft) and maritime surveillance. This means a large vessel has to be deployed for medical evacuation, usually a single passenger, at the same operational cost of a loaded vessel[108]. Smaller alternative-energy vessels would significantly reduce this cost. Smaller vessels means smaller loads, but more regular passages can be made, increasing the number of vessels in the vicinity, which would increase surveillance and coverage for maritime emergencies.

Passenger discomfit is also cited as a major issue for both routes. This is due to the use of inappropriate vessels in both cases, for example the chartered *MV Lady Naomi*, a modified coastal passenger vessel that rolls heavily in open sea conditions on the Tokelau run.

[108] MFAT projects this to be in the order of NZ$250,000 for an average 3 trips p.a.. Tokelau Fono representatives reported in 2009 that the number of such trips is regularly under-reported.

Figure 41 ***MV Lady Naomi***

Source: http://www.tokelau.org.nz/site/tokelau/files/TeVakaiI.pdf accessed 27 August 2012.

The evidence from the *Na Mataisau* and Japanese oil tanker experiments in the 1980's (see Section 5.2) is that passenger discomfort can be significantly reduced by the use of sail-powered vessels, both pure-sail and auxiliary rigs. The effect of deploying sails in both those experiments clearly showed that vessel stability was enhanced, the degree of roll significantly reduced and, in the Japanese experiment, crew downtime significantly reduced due to increased comfort. These advantages are additional to the savings in fuel consumption (for both motive and stabiliser power), faster overall passage times and reduced mechanical wear (Satchwell, 1985, 1986; UNESCO, 1986).

Alternative vessels, again using the *Greenheart* design as an example, have potential for facilitating new or increased options for inter-country trading. Fiji re-opened Rotuma as an international port of entry in 2010 with a view to commencing trade with Tuvalu and other neighbouring countries. The initial target has been root crops and fruits and the quantities involved are relatively small, shipments of a few tonne at a time. Providing the shipping has proved problematic. *Fiji Times* (26 January 2011) reported: "It is likely that a Government vessel will now facilitate the trade between Rotuma and Tuvalu. Trade between the two islands was put on hold from last year due to the unavailability of a vessel which was supposed to have been provided by the Tuvalu Government".

On 7 September 2011 (*Fiji Sun*), the Fiji Ministry of Information reported "Rotuma earned $28,000 from two container loads of dalo exported to Tuvalu. The 50m Tuvaluan vessel *Manu Folau* donated by Japan has been instrumental in freighting the cargo to Tuvalu". This is a large craft to dedicate to moving a small load. A *Greenheart*-type ship would have significantly increased the profit margins of such an exercise. Anecdotal evidence from

Rotuman informants suggest that local growers have become frustrated as crops planted to supply the new markets have spoiled due to the lack of adequate and regular shipping and such plantings have now been reduced or stopped. Meanwhile the Fiji government has invested more than FJ$1 million in state-of-the-art biosecurity controls and treatment to assist such trade (*Fiji Times*, 29 May 2012).

5.3.5. 100% Renewable Energy for Tokelau: World-first or NZ Mutton dressed as Lamb?

The section examines the current Tokelau renewable-energy programme in the context of the shipping issues, and questions whether it has any legitimacy as either mitigation or adaptation to climate change. The example illustrates graphically a range of issues within current debates over alternative energies and externally-led interventions to promote these. While I am fully supportive of Tokelau's decision to seek a 100% renewables target, the claims being made as to the effectiveness of the project need to be examined.

Firstly, it is obviously not 100% of energy, but only electricity generation that is being referred to. The following is typical of the blurring. "The tiny Pacific nation of Tokelau has told a UN conference it plans to use only renewable energy within a year. It would be the first country in the world to do so. The head of the Tokelau Government, Foua Toloa, told *Pacific Beat* that although his country is small, it has a powerful message. "By September, 2012 Tokelau will be the first nation 100% renewable energy efficient, fulfilling our global obligation" he said" (*Radio Australia*, 2012). Similar claims appeared on other websites (including UNDP, NZAid, Tokelau Government, Radio New Zealand, as well as industry and world media).

If only it were true. Unfortunately, even if 100% electricity generation was renewable, the greater majority of Tokelau's energy budget is expended on sea-transport. This underscores the invisibility of sea-transport on the global and development agendas in their current discourses on renewable energy. It's not that it isn't recognised. Two MFAT presentations to the Awatea Conference May 2011 and IRENA in October 2011, showed transport to be the single largest energy use in the Pacific at 48% averaged across the region with electricity generation averaging 37% (see Figure). MFAT acknowledged that transport makes up 75% of petroleum use in some PICs (Mayhew, 2011a, 2011b), and presumably Tokelau is in this category. Ultimately MFAT concluded that there are "fewer options to reduce petroleum use

for transport" and that "the electricity sector provides easier opportunities to use renewable energy and reduce diesel dependency, but at a risk of playing around the edges" (Mayhew, 2011b).

I'm not singling out my own country for criticism. At least MFAT acknowledge the issue, even if they are not currently prepared to more than superficially examine it. As discussed in Section 2.2, major regional players, e.g. UNDP, USAID, simply don't mention sea-transport in their publicly distributed information and master plans on renewable energy issues for the Pacific, unless it is to bemoan the high cost of sea-transport in delivering other sector programmes.

New Zealand's Foreign Minister McCully has put an emphasis on renewable energy in the Pacific under the current NZAid Programme, one of six priority areas for the Ministry. "We have a fully committed development programme with Tokelau. Notwithstanding that, we have advanced funds to Tokelau to achieve their renewable energy goals due to the high priority we and Tokelau place on making this happen," (NZAid Website[109]). New Zealand's focus on renewable energy as part of sustainable economic development in the Pacific region was highlighted at the 2011 Pacific Forum in Auckland.

"This [the Tokelau PV] project is unique and has the potential to demonstrate what can be achieved through the perseverance and hard work by the Government of Tokelau …. Photovoltaics are a mature, reliable, off-the-shelf technology that has been proven for years. Given the high cost of diesel, renewable energy should not be seen as an 'alternative' source of energy, but rather an essential key to unlocking the Pacific's potential" (NZAid Website[110]). So why can't this logic be applied to sea-transport?

MFAT have suggested that the reasons for their hesitation include that the introduction of 'new' technology such as being suggested for shipping was unproven with a long lead-in time and that MFAT is risk averse (Cameron, email, 29/6/2012). But several alternative shipping proposals are proposing 'mature' PV technology combined with conventional boatbuilding/design processes, proven sail technology and electric motors. None of this is

[109] http://www.aid.govt.nz/media-and-publications/development-stories/march-2012/tokelau-leading-light-renewable-energy, accessed 20 June 2012

[110] http://www.aid.govt.nz/media-and-publications/development-stories/march-2012/tokelau-leading-light-renewable-energy, accessed 20 June 2012

'new' technology.

How much fuel is being displaced by the Tokelau PV project and how does this compare with shipping? It depends on whose figures are used. New Zealand PV contractors have installed 4,032 solar panels (one megawatt of solar) and associated storage battery banks across the three atolls aimed at providing 90% of all electricity needs (Powersmart website). UNDP state that the Tokelau Government succeeded in leveraging approximately NZ$8.5 million in grants and soft loans from New Zealand for the project (UNDP website) although MFAT refer to NZ$7 million, "as an advance on Tokelau's budget support" (Mayhew 2011b). The contractor's website claims this will replace the 200 litres/day currently burnt to provide electricity for 15-18 hours/day[111]. I calculate this to equate to 73,000 litres or approximately 60 tonnes p.a[112], emitting 159 tonnes of carbon.

However, the NZAid website claims "almost 2,000 barrels of diesel a year will no longer be required to generate electricity" (http://www.aid.govt.nz, accessed 17/10/12). A barrel is a vague measure, is not normally used to measure distillate fuels such as diesel, and is undefined by NZAid. Assuming a barrel is referring to a 200-litre drum in which fuel is delivered to the islands, this equals 400,000 litres p.a. or 332 tonnes. If an oil barrel is being referred to (commonly equal to 159 litres) then this is approximately 318,000 litres or 264 tonnes p.a. Either way, NZAid appears to be claiming fuel savings approximately 4-5.5 times that of the contractor. The MFAT website claims savings of both 200 litres/day and 2000 barrels a year[113]. There is no obvious correlation between the figures.

UNDP record that Tokelau spends "approximately NZ$1m annually on imported fossil-fuels" (UNDP website). UNDP doesn't clarify but assumedly this refers to internal electricity generation on the atolls. It is also unhelpful as the cost of fuel per litre is not given. If the contractor's figures of 200 litres diesel per day being displaced is correct then this equals $13.70 per litre. If current international MDO spot prices per tonne are used, (July 2012 costs were US$980 per tonne) this equals 1,020 tonnes per year of fuel. Prices have fluctuated widely over the past 12 months and the current figure is at the high end.

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[111] http://www.powersmartsolar.co.nz/commercial accessed 20 June 2012.

[112] Using a coefficient of 1 litre of diesel weighing 0.83 kg.

[113] http://www.mfat.govt.nz/Countries/Pacific/Tokelau.php accessed 17/10/12.

Other blog sites have now combined and extrapolated from these statistics e.g. "currently, the island state is reliant on the diesel shipped in from New Zealand[114]. As a result, the country's diesel generators burn around 200 litres of fuel daily, which amounts to 2000 barrels each year at an annual cost of NZ$1 million—and yields a considerable environmental impact … the solar power system will enable Tokelau to save over 12,000 tonnes of CO_2 during its operation" (Inhabitat website[115]). How this latter figure is derived is unclear. If we assume that the generators currently being used are new and efficient diesel units then a factor of 2.65 can be applied[116]. If 73,000 litres of fuel is currently being used a year, then this will produce ~193 tonnes of carbon a year or ~62 years to produce the "12,000 tonnes CO_2 savings". This also assumes a nil carbon footprint for production and operation of the PV panels and battery banks.

With shipping data to hand it is not possible to be as precise in estimating the current fuel usage. *Tokelau* burnt 3.24 tonnes per day. If this is combined with MFAT's consideration that a full charter option would necessitate 150 days vessel hire per year, a very conservative estimate of ~500 tonnes p.a. can be safely used, a total comparable to the electricity generation figures using MFAT data and at least eight times greater than the PV contractor's estimates[117].

As discussed in Section 2.2, saving the GHG emissions from either electricity generation or sea-transport for Tokelau (or elsewhere in the Pacific) is not an effective mitigation measure for climate change. The figures are just too minute to have any effect on global trends and at best would have symbolic value. A single midsized container ship will burn more fuel and emit more GHG in less than a week than all annual fuel use for Tokelau. Can Tokelau's PV programme be considered a valid adaptation measure? As discussed above, whether the UNDP figure of NZ$8.5 million or MFAT's NZ$7 million is preferred, neither are referring

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[114] It is shipped from Samoa not NZ.

[115] http://inhabitat.com/south-pacific-island-of-tokelau-is-to-become-the-worlds-first-solar-powered-nation/tokalu-island/#ixzz22kuGn0Pa accessed 2 August 2012.

[116] 1 litre of diesel typically weighs 0.83 kg. ~87% of this is carbon, so one litre of diesel contains 0.722 kg of carbon, each atom of carbon weighs 12 atomic units. Combined with two atoms of oxygen it becomes CO_2, weighing 44 atomic units. The 0.722 kg of carbon in the original fuel then becomes ~2.65 kg of CO_2.

[117] This is a highly conservative estimate. The current charter vessel is twice the size of *Tokelau*. Earlier, using MFAT data I calculated annual fuel use for just one of the vessels employed on this route at 520-910 t p.a.

to additional aid. New Zealand is simply 'loaning' Tokelau the money against the projected savings in fuel purchases from its future annual budgets. Barnett and Campbell (2011) argue strongly that under international treaties adaptation funding needs to be a contribution from developed countries over and above their normal aid allocations and cautions strongly against attempts to disguise climate change expenditure from other normal commitments.

In this case New Zealand appears to have exchanged future payments of NZ$7 million for diesel to external sources for payment of a similar figure paid to New Zealand renewable energy companies. The savings or financial benefits to Tokelau are difficult to see. It will remain to be seen if the overall cost savings including full life cycle maintenance of the PV/battery system are lower than BAU costs using fossil-fuels but it should not be assumed that renewable energy electricity generation equates to free electricity supply over time.

Current New Zealand government projections of NZ$8 – 10 million[118] to build a new Tokelau ship indicate that such a vessel would be a high-value item, roughly half the cost of the entire annual Tokelau budget and more than the reported cost of the PV programme. The 2008 projected operating costs of the new vessel were estimated at NZ$3 million p.a. (accompanied by the prediction that these can be expected to rise with increasing global oil costs) and it is this that presents the greatest shackles to the Tokelauan communities of the future. This is a substantial increase of 70% on the NZ$2.1 million cost of operations in 2005. The new asset will have a projected life of ~20-25 years, equating to ~NZ$60-75 million of operational cost for this lifeline in today's currency. But if only a minimum of 30% of the operating costs are fuel (and this is a highly conservative estimate[119]), then an equivalently priced alternative-energy technology vessel would save at least NZ$18-22.5 million over the life of the asset (or more than double the MFAT projected asset cost) and that is not allowing for any increase in fuel costs. As discussed earlier the cost of global mitigation of shipping emissions will likely have a further knock-on effect in higher prices for cleaner fuel, in today's prices of as much as 60% or ~NZ$10.8-13.4 million over the lifetime

[118] 2008 estimates from Ministerial Briefing Papers released under the Official Information Act. Even at this early stage, the officials were warning there is a high risk of these estimates being significantly overrun in the build process.

[119] Fuel costs comprising ~40-60% is the best estimate for Fijian domestic shipping figure available and this is likely conservative (Capt. Rounds, pers. com., 2012).

of the ship[120]. Of course if the new Tokelau vessel did not use fuel, then this would translate to additional savings, including additional income if carbon trading was available. This is without considering any of the other potential additional benefits discussed above.

It is not being claimed here that an alternative-energy vessel is suitable for Tokelau conditions. But it is being recommended that it should be seriously assessed as a potential option before a decision is made to commit Tokelau to a largely fossil-fuel dependent future, in direct contradiction of the claims being currently made that it will be the first fossil-free energy country in the world.

Finally, to return to the MFAT website claim that Tokelau is in control of its own decision-making and budgets. This is not borne out by any examination of the Ministerial Briefing Papers and related information. There are references to Tokelau being extensively 'consulted' by the various teams of consultants, experts and NZ officials that have travelled extensively to Tokelau over nearly a decade to investigate and plan a long-term shipping solution. There is reference on both NZ and Tokelau government websites to Tokelauan politicians repeatedly meeting NZ counterparts in Tokelau or travelling to Wellington or reporting to the UN General Assembly on the priority for them of shipping, their frustration with current arrangements and proposed solutions offered them by New Zealand. I cannot confirm but strongly suspect that no alternative-energy shipping options have been suggested to Tokelauan 'decision-makers' by their New Zealand 'advisors'. It is also clear from the information currently to hand that decisions over budget allocations and preferred options in any case are made at the New Zealand Cabinet table and not the Tokelau Fono.

Minister McCully's announcement was made on 12 June 2012. On 27 June the following announcement appeared in some Pacific Island media websites: "A minister in Tokelau has been stood down from his portfolios after problems between him and the New Zealand government. Foua Toloa had held the finance and transport portfolios, which have been transferred to the current leader, or Ulu of Tokelau, Kelisiano Kalolo. Due to the relationship

[120] In the negotiation over a global agreement on bunker fuel SOx reductions IMO had suggested a compensation package to safeguard against this type of penalty for developing countries. Whether this is successfully negotiated remains to be seen, as does clarification of Tokelau's status as a SIDS or a part of NZ's developed nation within such a framework. The IMO members or experts that presented to the SSTT 2012 confirmed in response to my questions that they held no hope such a measure would actually emerge (D P S , D Tristan Smith).

between Tokelau and New Zealand, there were some issues between the Minister of Foreign Affairs and also Ulu O Tokelau, it was best that the Faipule of Fakaofo would stand down in the meantime. It has got to do with shipping decisions" (Island Business[121]). Foua Toloa was the Ulu when the Tokelau delegation came to Wellington in 2008. I suggest that NZ government decisions made in contradiction to Tokelauan decision-makers priorities have had a negative and disruptive effect on internal Tokelauan political relationships.

5.4. Windward Towards the Future: the Case for Sail as a Regional Sustainable Adaptation Technology and the Rationale for Fiji as Hub

> *An island community that controls and owns its own sea-transport is a community that has control of its own decision-making and destiny. An island community reliant on external and irregular sea-transport services is a vassal state reliant on the decision-making of others.* (Nuttall, 2012)

This thesis has considered shipping and potential alternative options from a range of perspectives (micro, meso, macro, and historical) and situated them within a Fiji and Oceania context. Section 5.2 summarised the lessons from a number of case studies. Section 5.3 scrutinised and compared two extreme sea-transport scenarios in Pacific settings.

This section returns to focus on Fiji. It proposes that a coordinated programme to fully investigate and trial a range of sail-powered sea-transport options for Fiji and Oceania would entail a relatively small investment and the result could be a revolutionary approach to a central issue for all modern Oceanic communities that provides truly sustainable solutions from a local base built on a remarkable regional heritage. If this is correct and desired, the corollary question is where should such a revolution be centred. The reasoning for promoting Fiji as the hub is set out in Section 5.4.2, but before setting out this case further we return to the Fiji story where it left off in Section 4.1.

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[121] *Island Business* "Tokelau minister stood down over shipping issues with NZ" 27/6/2012 http://www.islandsbusiness.com/news/index_dynamic/containerNameToReplace=MiddleMiddle/focusModuleID=130/focusContentID=29089/tableName=mediaRelease/overideSkinName=newsArticle-full.tpl, accessed 27 June 2012

5.4.1. Single Vessel/Single Village to Managed Fleet to Integrated Network

The Solodamu inquiry is summarised in the following stylised diagrams[122]:

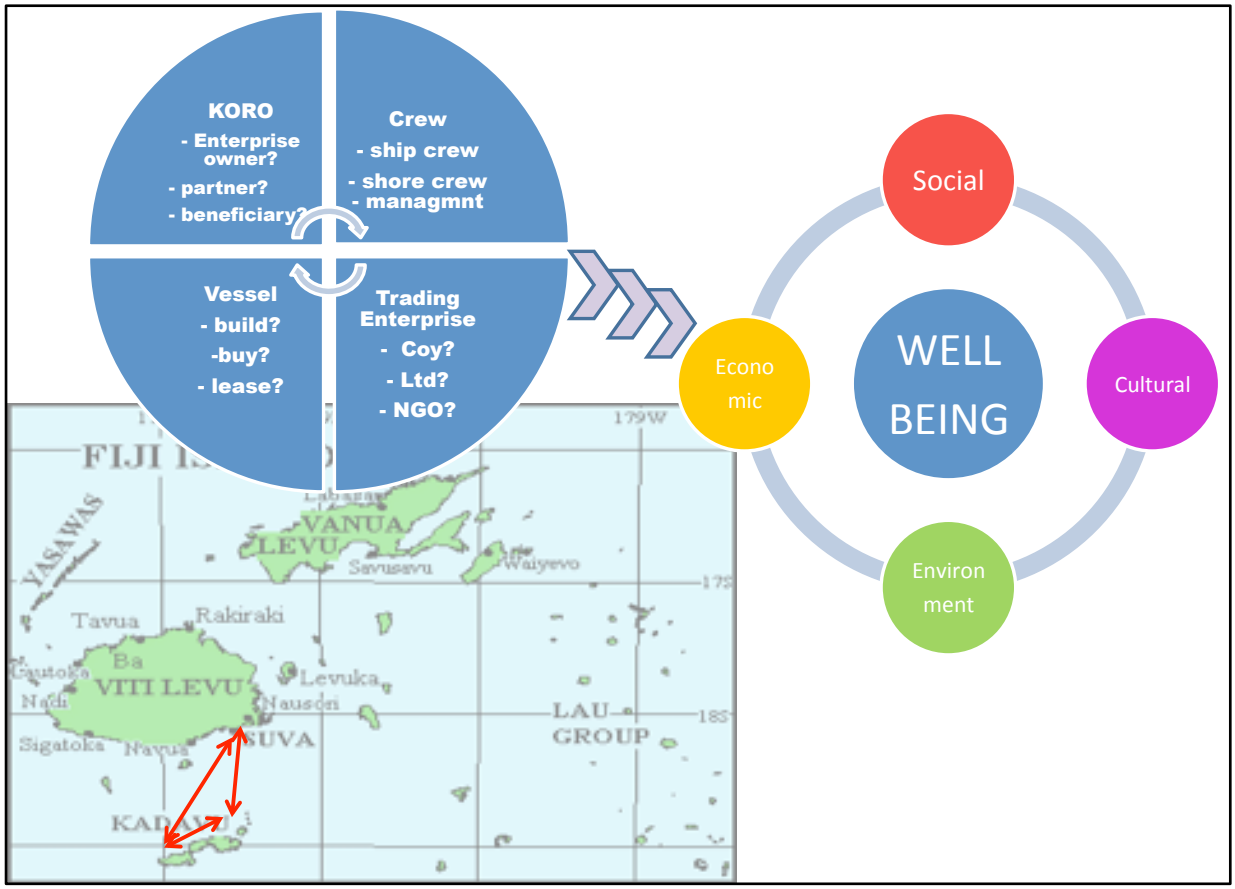

Figure 42 Solodamu Inquiry: Challenges and Opportunities

The business proposal was for a sustainable village vessel to commercially operate between Kadavu and Suva. The blue left hand circle signifies the four core areas identified as needing to be addressed in order for a successful enterprise to contribute to the well-beings shown on the right and expanded below (Figure 43). The benefits of a successfully executed operation would provide more than just economic return. When considered across quadruple well-beings, a number of primary and tertiary benefits are possible, all of which can be claimed to add to the resilience of local communalities.

[122] These diagrams are adapted from the PLA *talanoa* held in Solodamu in 2008/2009 and subsequent business plan discussed in Section 4.1.

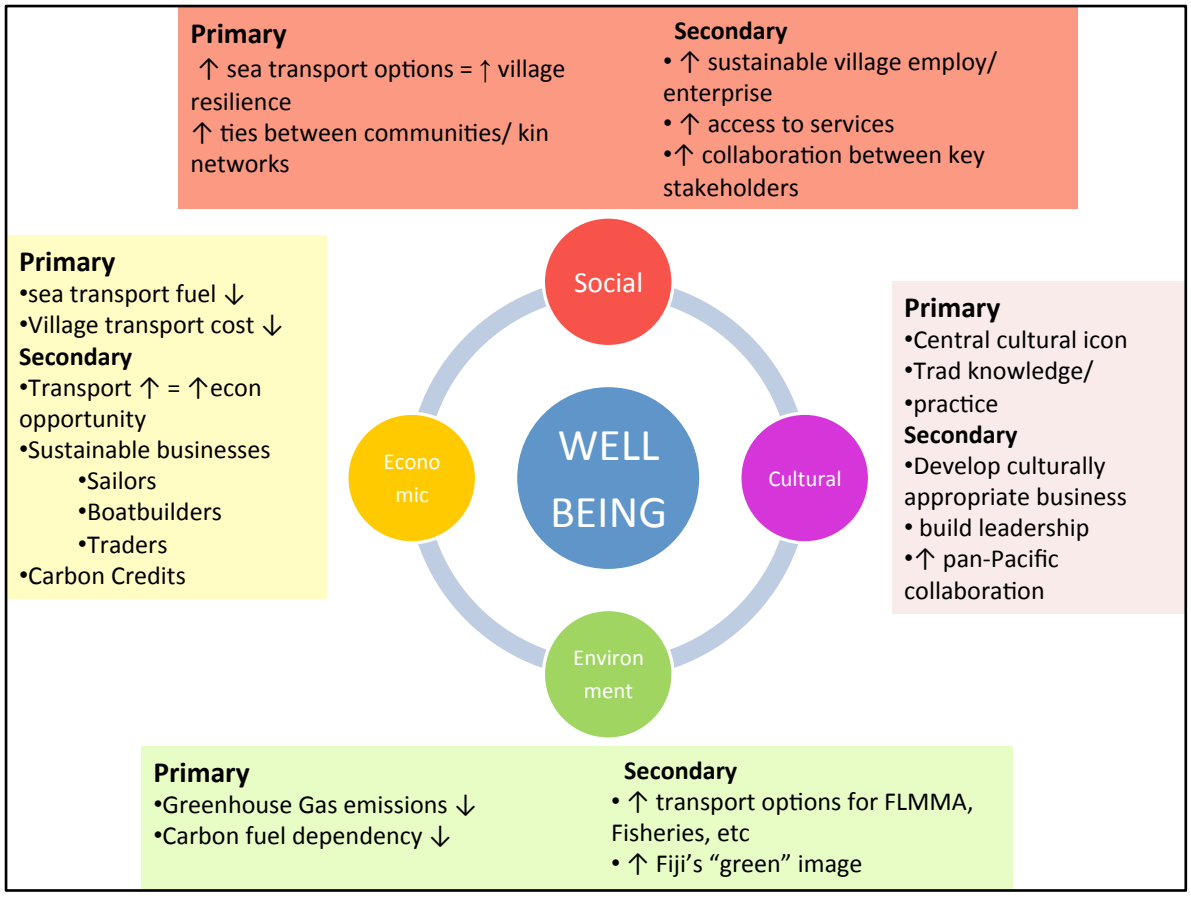

Figure 43 Solodamu Inquiry: Well-beings

At the end of Section 4.1 I arrived at the tentative conclusion that a single vessel/single village approach was too difficult due to a number of 'game-breakers'. Working with FIVS and an increasing network (in particular IUCN, WWF-SPP and USP) we began to explore the issues from other perspectives seeking a model that could provide service and benefit at a local level but overcome the issues uncovered.

This led to consideration of a managed fleet of small vessels operating a number of routes where communities (or members of communities) such as Solodamu could participate under some form of lease-to-buy or franchise scheme and their entry mentored from within an established collective. The managed fleet concept has a number of advantages. Vessel construction could be production-lined and achieve efficiencies through economies of scale and a higher build standard. This in turn allows consideration of establishing a boat building programme, rather than a single build project, with numerous potential downstream benefits. The logic also applies to aspects such as crew training and operational management. Vessel maintenance could be coordinated and a managed fleet would allow flexibility of service as well as cover for peak demand, breakdowns, accidents, routine maintenance, etc. If this were

achieved then insurance and financing would become more accessible.

Despite these advantages, all the issues that were apparent at village level require resolution. There is still an R&D hump both in terms of the technology (vessel design, sea-trialling, etc) and, more importantly, ownership and management frameworks. Following further *talanoa* in 2011 we were able to summarise this in the next series of figures.

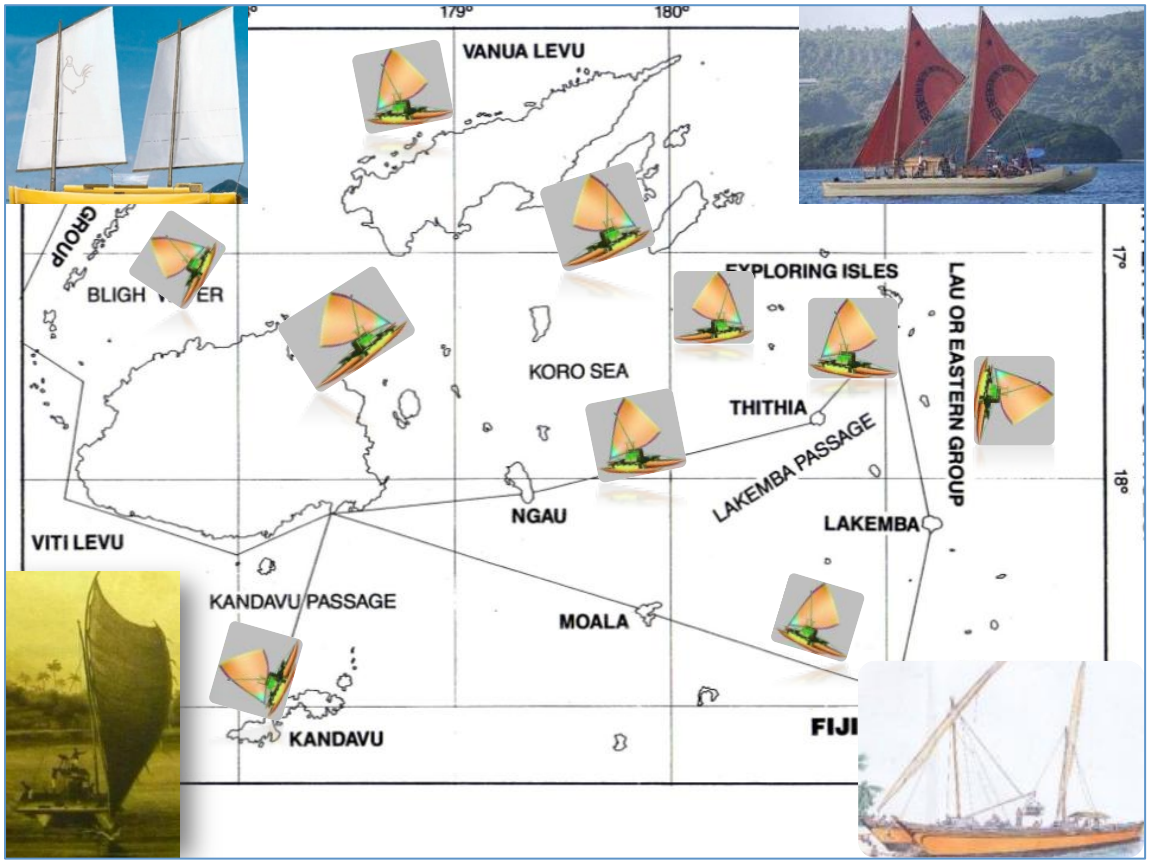

Figure 44 Primary Routes Considered for Small-scale Catamarans

Using the Southampton wind route data and extensive local knowledge we identified a number of primary routes for which small scale trading catamarans (4-10 dwt)[123] would be best suited including Kadavu, northern, central and southern Lau, Lomaiviti, Rotuma, Yasawa, Taveuni and the north coast of Vanua Levu. We overlaid this on the 'Solodamu' template, expanding the blue circle to detail the range of critical questions to be addressed.

[123] Depicted in Figure 44 as stylized drua. A number of options of design of this type of vessel are available as discussed in Section 5.1.

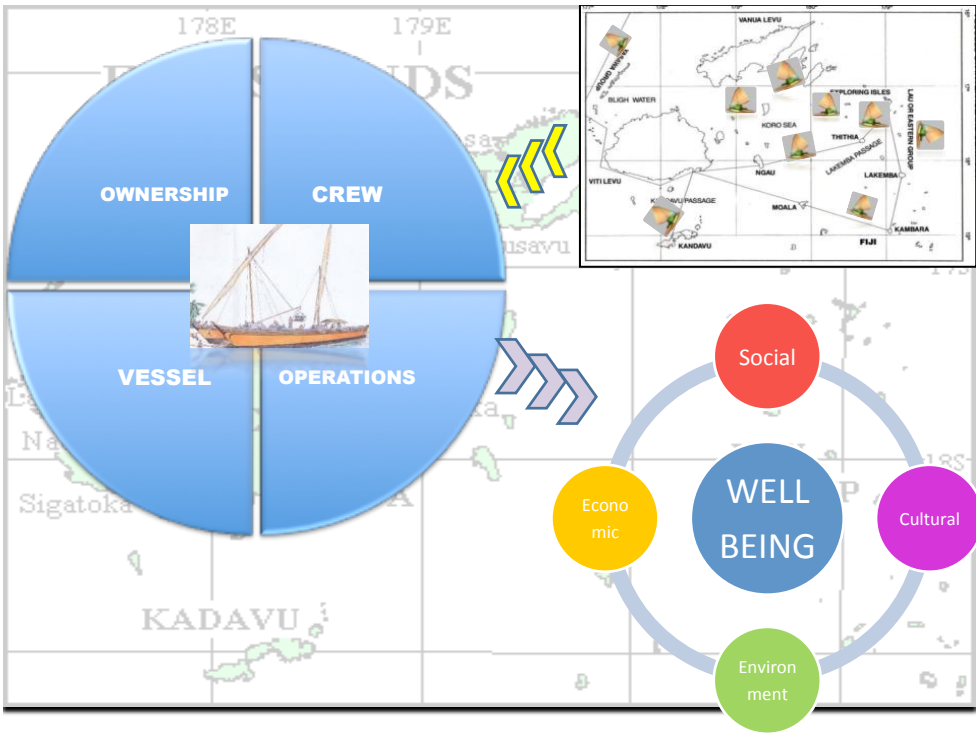

Figure 45 Sustainable Sea-transport Network Overview

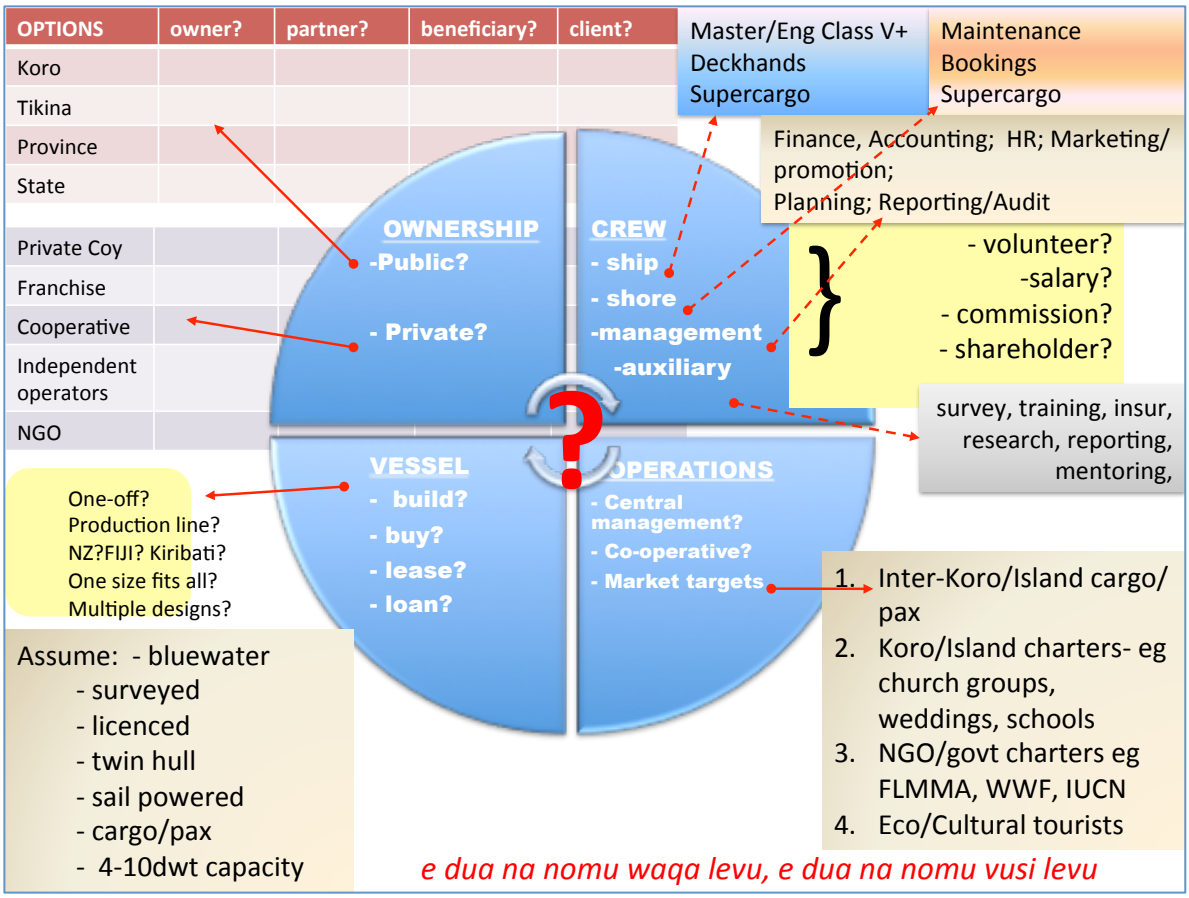

Figure 46 Sustainable Sea-transport Network Primary Issues

Although the diagrams are simplistic, all the issues identified are complex. For example, current vessel survey requirements revolve entirely around conventional motorised craft. Even though vessels that use sail, solar and electric drives are being considered, under the current regulatory framework a diesel engineer would have to undertake the survey. Qualifications and training similarly are aimed at mariners not sailors. But the real issues lie in the quadrants labelled 'Ownership' and 'Operations'. Who and how will such commercial operations be owned, financed and managed. Here again, a programme of coordinated research and modelling followed by field-testing backed up by monitoring, mentoring, and reporting is needed if other than a haphazard approach is sought. Our network is currently considering a number of potential frameworks for operational structures.

This was the point reached by the end of the 2011 research season. At this stage we were still under the impression a trial vessel was being built for our use by Okeanos and would allow real world testing of some of these scenarios. Unfortunately the pilot vessel failed to arrive and our programme has been delayed in this regard.

The serendipitous arrival of new research partners such as Greenheart and B9 Shipping at the end of 2011 allowed us to increase the scope of technology and research options being considered. In collaboration with FIVS, USP, WWF, and IUCN, we have now begun looking at the potential of integrated fleets of vessels, beginning with expanding the Kadavu example into a model for the southern and central Lau. The bluewater passages from Suva to nodes in the Lau Group are relatively long, up to 180nm, and once in the Lau there are only a limited number of islands a large vessel can access safely. Island communities outside these nodes are minute and there is little profit to be made and much fuel to be burnt in using such vessels to stop at individual islands to collect a handful of passengers or small cargoes. But combining outer-island based catamarans with a Greenheart design as a "mother ship' between Suva and the main nodes seems eminently sensible (Figure 47).

If this can be achieved it would be arguably the first alternative-energy powered integrated sea-transport network in the world. And if proven viable then options such as presented in Figure 48 begin to emerge, with B9-type technology being used on the international routes, Greenheart-type vessels working between main island groups and inter-state to neighbouring PICs, while smaller cargo/pax vessels such as the catamarans previously discussed service individual islands and communities.

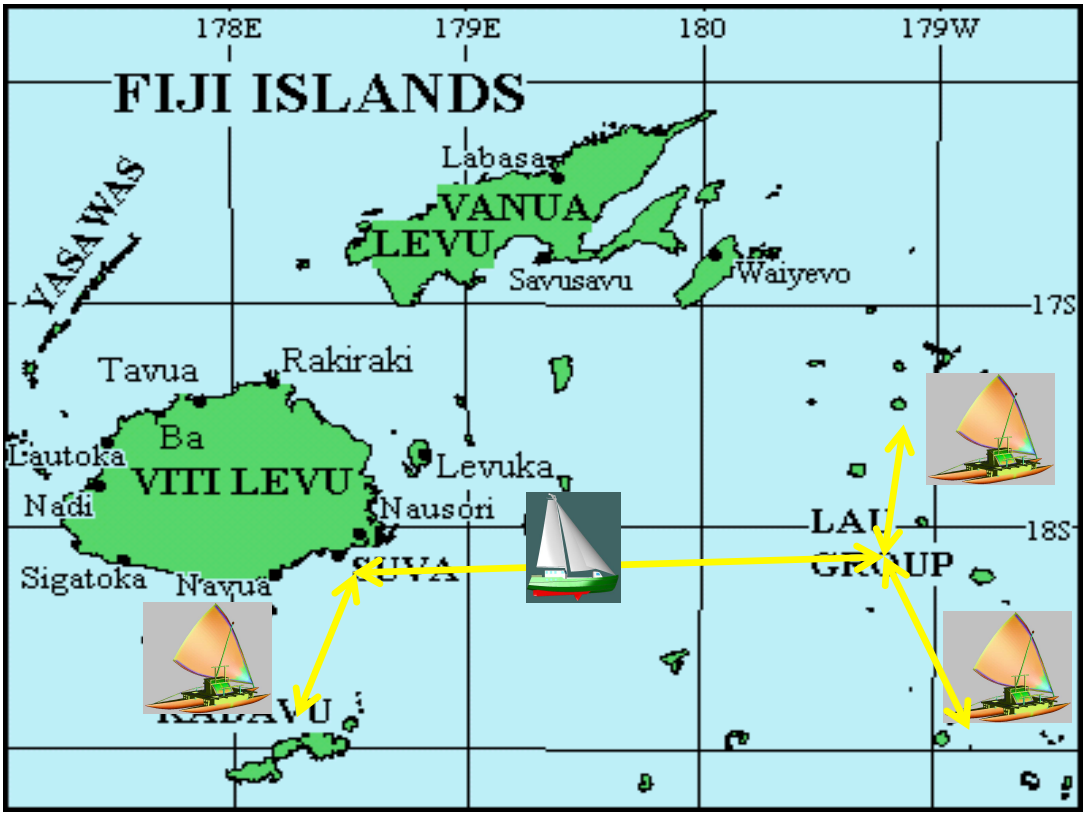

Figure 47 Schematic of Pilot Vessel Routes

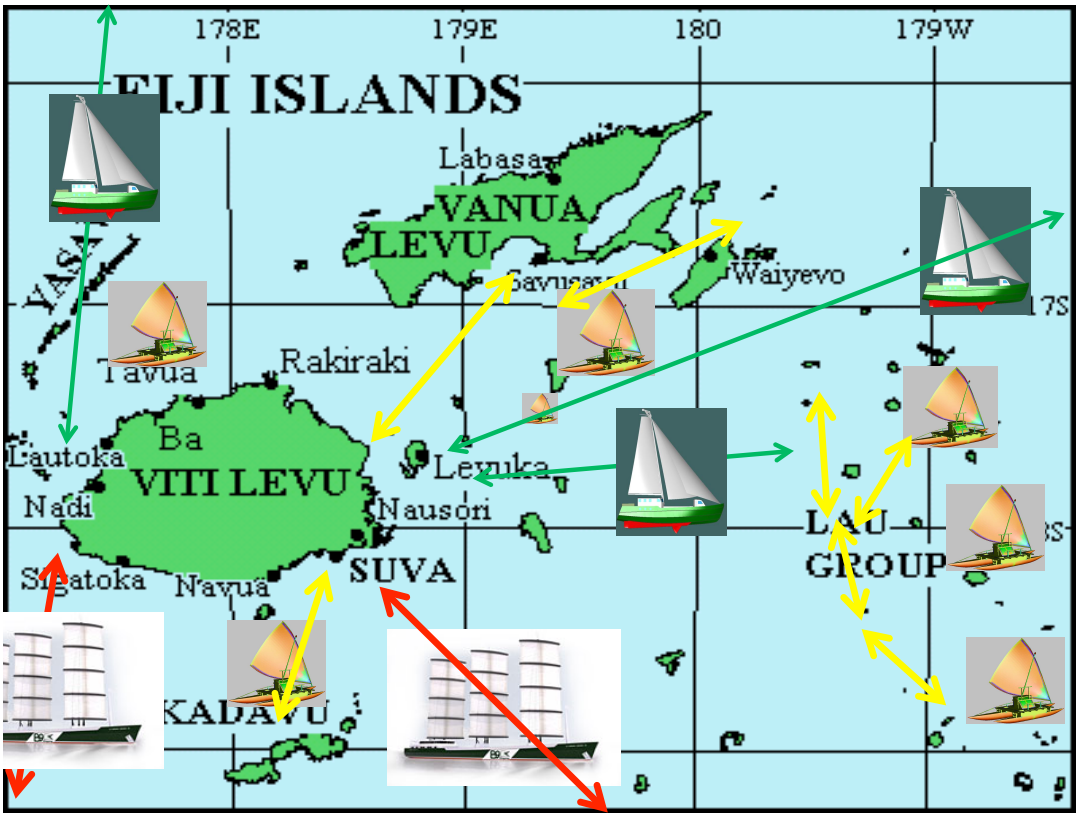

Figure 48 Schematic of Expanded Sustainable Sea-transport Network

Collaboration and research has now reached a stage where external funding is required to progress in order to prove the business case and we have begun submitting applications to a variety of potential sources.

In 2012, as the evidential base increased and our network expanded internationally, we continued to raise the profile of the *talanoa*. A number of platforms have been used. The success and media attraction of *Uto Ni Yalo* and its now seasoned crew gave us access to a series of newspaper articles, mainly in Fiji but also internationally including the New York Times and Australian alternative energy websites. I have presented on this research at regional conferences convened by both FNU and USP. Collectively regular briefings have been made to the Fijian government, including Departments of Transport and Energy, MSAF, Navy, GSS, and the Cabinet, to regional agencies SPC and SPREP as well as development agencies such as ADB, AusAID, USAID, UNDP, etc.

Prior to beginning this research, the concept of alternative-energy for sustainable shipping had no visible profile at any level or with any agency. In July 2012, following *Uto Ni Yalo* and the TMoTM fleet's triumphant entry into Fiji on their way to the Solomon's SPAF and the subsequent five-day 'Drua Pageant', USP offered to host a three-day *talanoa* on sustainable sea-transport for Oceania in November 2012 as a precursor to a major symposium in 2013. The responses to the invitation were positive and the resultant SSTT 2012 is summarised in Section 7.1.

5.4.2. Why Fiji Should Lead?

If an agenda such as that set out in the first half of this section is now to be pursued and an impact of any longevity and scale desired the community with greatest likelihood of success, if willing, should be backed with the aim that a successful intervention can then be catalytic in the region. This thesis preferences Fiji as the logical hub.

If proven in a Fijian centre, then export of the paradigm and the technology outwards across Oceania would become plausible. In a 'best case' scenario, such a progression would be self-perpetuating, culminating in the re-establishment of an industrial sustainable sea-transport base in Fiji commensurate with the role Fiji played in this industry a little over a century past (see Chapter 6). The practical obstacles to such an agenda should not be downplayed. The challenge is substantial and would require a major initial investment, in priority, planning, capacity building and training as well as financial.

Against this though, is the knowledge that the potential indicated in this research to date is but a subset. This thesis has focussed on sea-transport for local demand, but similar potential exists across numerous applications. Fishing is an industry of considerable importance and priority to Oceania, again at all levels from village to region. Although considered only peripherally in this research, it can be assumed that there are numerous parallels. It is an industry currently totally reliant on imported fossil fuel despite Brown and others offering sound technological options 30 years ago.

And the list goes on. USP has identified the cost of transport as a major inhibitor to its capacity to deliver research and teaching throughout its catchment. Kiribati has recently announced the world's largest marine reserve but lacks sufficient budget or asset to effectively patrol or monitor it. Various conservation organisations (e.g. WWF, IUCN, Birdlife International) have reported in our reiterative *talanoa* that sea-transport costs can account for in excess of half of operational budgets for island-based projects.

Nor are the options suggested here within the commercial sea-transport scenario a comprehensive list. By way of example, sea-barging is a common means of moving large loads and is an obvious target. Sail powered scows successfully fulfilled this role for many years. In the 2010 drought, the Fiji government was reported (*Fiji Times* 3/9/2010) as spending $1.4 million on providing emergency barging of water to Yasawa and northern communities. The laden route is directly downwind. If a low-technology version of the *Shin Aitoku Maru* rig were retro-fitted to existing barges, significant fuel savings would have been possible. The square-sail rig used there was not discontinued because it failed to achieve significant fuel savings but because the IRR on the high technology aspects of the design (e.g. aircraft wing technology, computerised control) did not prove economic in periods of low fuel costs and high staff costs. But in the Yasawa example, a low-tech rig built around industrial bearings and basic winches, welded pipe and laced tarpaulins could be employed. If this works, then the same logic can be applied to the transport of pine and other timber resources, copra, etc from Kadavu and the Lau, all of which are downwind runs for the laden leg and currently marginal economically due in large part to high transport costs.

What is absolutely certain is the demand of sea-transport is unlikely to diminish and, without alternatives, will be an ever increasing burden on Pacific governments and communities.

The reasoning for a Fijian hub is based on purely technical grounds; its size, capacity, level of

infrastructure, location, history, and nodal positionality (physically and economically). The choice has not been considered from a political standpoint; whether such a development should favour one country over another because of associations, profile, donor acceptability, etc. However it were to be, then Fiji's current membership of the non-aligned movement and therefore potential for South-South alliances would be an additional factor in its favour as would its leadership role in the growing Melanesian Spearhead alliance.

An alternative approach would be to centre the focal point in a country or community of 'greatest need'. Arguably, if this were the determinant, then it would fall to a country like Kiribati or Tuvalu, where pioneers such as Jim Brown and Mike Savins have laboured so long and hard. Again, it need not be viewed as an 'either/or' choice and regional collaboration should be encouraged.

This research programme has been primarily focussed on domestic sea-transport issues; inter-community and inter-island. However the potential with *Greenheart*-type shipping technology, with its unlimited range, is that direct small-scale containerized trade between island nations becomes a real possibility. SPC is currently spearheading consideration of increasing inter-state transhipments within Oceania. While this is highly dependent on development of more appropriate mechanisms for regional trade, including complex political issues of tariffs, etc., the practical logistics of such trade is also an essential determinant. SPC (2009) compared costs for shipments from Fiji to other SIS finding that the current arrangements which require transhipping through Australia add an increased cost to consumers of US$50 per ton than if it had been shipped direct. That analysis compared conventional shipping with conventional shipping and it can be assumed that fuel-free shipping would increase the differential further in favour of island-to-island delivery. As with this thesis, SPC found that Fiji makes the logical hub, in part because of its geographical position, partly because of its existing shipping infrastructure and services and partly because of the increasing range of product Fiji now supplies to its neighbours (SPC, 2009:11-12). As discussed in Section 4.2, regional trade is currently heavily imbalanced in favour of Australia and New Zealand. While international trade amongst PICs is growing, especially within the Melanesian Spearhead countries, current transport options are a major inhibitor of this trend.

Until the privatisation of the Government Shipyard following the coups of the 1980's, Fiji had a well-established and recognised industrial ship building operation and maintenance capacity. While much of this has been leached to the Pacific Rim in recent years, Fiji still has

a well-developed industrial engineering base and several high-quality yards producing vessels for the small-scale end of the market, particularly for tourism and recreation. Fiji's Minister of Transport recently announced its intention to revitalise the government shipyard (*Fiji Times,* 10/2/2010)

Fiji's regulatory structure is also well-developed. Fiji is currently developing national policy on carbon trading with potential for carbon credits to subsidise or offset sail trading costs.

Historically Fiji was a vital link in a highly sophisticated sail-trading network that connected island/village communities from Samoa, Tonga, Rotuma, Niue, and beyond using fleets of large, sophisticated vessels. This is the focus of Chapter 6, which concludes that future sustainable solutions for Fijian sea-transport are likely to be best addressed if viewed in the context of networks of related islands and archipelagos, such as dominated in central Oceania for millennia. Before changing course for the past however, the core lessons from the research are summarised below.

5.4.3. Critical Learnings

From the case set out thus far several predominate themes appear. Firstly, sea-transport is a primary concern to coastal/island Fijian communities and still connects most Fijian communities, a pattern replicated throughout much of Oceania. The region has developed a capacity (over millennia) to adapt to sea-transport challenges through a lateral ability to evolve design and application of technology, seamanship, and organisation from a minimalist resource base. It is not known to what extent this adaptive capacity is diminished today, with more than a century of increasingly limited practical usage, but the literature quoted in Section 2.2 suggests cultural resilience is still a substantive Oceanic trait. If this is cogent there appears no reason why it should not allow Oceania to lead the world in a renewed approach to sustainable sea-transport for the future. As cautioned earlier, this will need to be in the context of fully-informed knowledge/understanding of the constraints of modern sea-transport options and not just on faith in past ability.

Historically it would appear that it was the challenges of balancing socio-cultural needs of sea-transport with economic business imperatives and changing scales of vessel ownership that restricted successful management of commercial sea-transport by Oceanians, not a failure in seamanship, vessel management, or an inability to understand Western commercial imperatives. It was not just a case of 'outsider' or colonial powers dominating over

indigenous trading networks; the very economic and cultural basis of trade and transport was fundamentally different. While the scope and scale of such interrelationships may have changed during the colonisation and post-colonisation eras, the issue is still pertinent and achieving a future balance is as essential.

Current shipping policy is stuck in an inappropriate paradigm (replacing old ships with old, increasingly expensive, entirely dependent on imported fuel, etc) and this carries through into the way shipping is perceived and framed politically and economically. No alternative paradigm, until now, has being seriously countenanced. Without a paradigm shift, these issues appear doomed to increase exponentially.

An alternative, in particular sail-based shipping technology, offers strong potential that could conceivably address many of the problems that exist but is shut out of the policy space. This exclusion is currently partial at the global level and total at an Oceanic one. The primary barrier to proper evaluation of this alternative, and then its employment, is perceptual. No alternative is seen because none is expected or being looked for. It doesn't appear on any of the charts for the area and no radar is tuned to its frequency. Given the obvious need and priority of shipping to Oceanic this is irrational, especially if considered in light of current widespread and progressive policies and initiatives for renewable electricity generation and the focus on climate change adaptation.

Part of this perceptual barrier is the belief that because shipping options have largely been imported from outside the region in recent history, then future options will/must follow a similar course and Oceania therefore needs to wait for alternative solutions to be developed elsewhere in the hope they are replicable and can provide some future application here. This may be the correct and most pragmatic course, currently we have no basis or data on which to assess this either way, but to date a potential for seeking Oceania-orientated solutions now from within Oceania has yet to emerge. Sea-transport innovation and design is no longer perceived as an Oceanian preserve, an area of expertise in which it led the world, but an area where Oceania can only follow others or view from afar. Inherent in this is the same 'small is vulnerable is dependent' pathos that was the central core of Hau'ofa's seminal 1993 paper.

The research to date strongly indicates that there is low potential for globally led programmes to produce appropriate sustainable marine technology tailored toward the unique nature of Oceania. Models most appropriate to allow PICs to develop a local solution will need to

come from within Oceania, albeit with appropriate external support and collaboration.

This research indicates that a practical transition to sail (or other low-carbon options) is potentially feasible and beneficial to village/island Fiji as measured across multiple well-beings. The complexity of such a transition will require both a collaborative multi-stakeholder/interest approach and one that is Fiji/Oceania tailored and led, including governments, regional bodies, NGOs, industry/business interests, researchers, and donors. Collaboration with other SIS is desirable. In this instance, the "FLMMA" model offers salient lessons and a proven model as explored further in Section 7.2.

Finally, history offers direction and knowledge. "The people of the sea travelled and traded beyond their immediate landscapes and seascapes for a variety of reasons" (D'Arcy, 2006:52). "It was evident in early contact times that every community in the Pacific Islands was engaged in some form of trade" (Couper, 2009:49). As seen in Chapter 6, the drua of central Oceania, as with all the great vessels of this ocean, were valuable, high cost and highly-prized assets and major investments. "Great care was taken of them ... the construction and maintenance of canoes was a community effort. Only chiefs could muster the manpower (sic) and resources needed to construct large voyaging canoes" (D'Arcy, 2006:92). Such vessels were not just physical assets; they were also symbols of chiefly and community *mana*. The completion of a large canoe was a source of great pride. "When Tui Nayau sailed his new *Drua*, *Rusa i Vanua,* from Vulaga to Lakeba in Nov 1842, his followers were thrilled to note that the hulls were longer than those of *Ra Marama,* the canoe being built at Somosomo for their rival Bau" (Derrick 1957: 81).

Chapter 6. Looking Backwards to the Future (or It's Forward Thinking to go Backward)

> *These fragments I have shored against my ruins*. (T.S. Eliot)
>
> *There are aspects of our culture we must make sure are not lost altogether. But how do we go about this? ... The adaptation [into an uncertain future] I am thinking of is a more conscious act done in full awareness of what is required. And what is required is survival - not of the fittest but of the best.* (F. Helu, 1999:13)

This section explores the extent of known knowledge on Fiji's sailing heritage. The reiterative analysis of the 'thick descriptive' accumulated by 2011 reinforced that this was the next priority focal point at that stage and the rationale for what became an extensive course deviation was set out in Chapter 1. This thesis argues that the barriers to a successful introduction of new technology are more than economic but include deep-seated issues of culture/connection that may require an entire heritage base of sailing to be re-invigorated, including "valourisation" of past. Section 2.1 referenced Clark, Overton, Helu, Hau'ofa, Thaman and others to support an approach where the past is examined to provide lessons and signposts for the future. In essence this chapter addresses this question: can digging up the past provide a mountain from which to see over the horizon?

Given the primary nature of this inquiry, an industrial study into potential future technological application, the reasoning for this course deviation from forward-reaching and exploratory to heritage-based analysis needs to be explicit and is four-fold.

Firstly, as early as 1982 the multihull designer Brown was signalling "canoe people are prime candidates for the imperative transition away from a petro-dominated economy" (Brown, 1982:5). This must be considered against the clearly stated learnings from the UNDP/FAO case study (see Section 5.1.1). "The only places where a new type of sailing craft have gained acceptance are those where there is a living tradition of the use of sail ... Many other fishermen rarely use sail, finding the fuel savings hardly worth the skill and labour required to handle them. The most favourable conditions for developing the use of sail for primary or secondary propulsion are where fishermen still use sail, fuel supplies are erratic, fuel costs are high and the price of fish is comparatively low" (FAO, 1987:71). If this holds for fishing craft it is likely equally applicable to sea-transport at local levels.

This lesson implies two things: that sail-based culture is learned and that coming from a sailing heritage, even the finest sailing heritage, is insufficient where living memory is extinct. FAO did not suggest what level of input would be necessary to effectively raise Lazarus. In Solodamu, this suggests that there is limited chance of long-term success without significant investment. Only one *qase* in the *koro* could recall seeing, let alone sailing, any traditional craft. Small but declining pockets of active sailors are known to be still building and sailing *camakau* in the Southern Lau (Gillett, 1993; personal observation) and amongst the Banaban community of Rabi, but these aside, my initial assumption was that community-based sailing experience and possibly knowledge was largely extinct in the wider Fiji I had visited. If this was correct then it follows a successful reintroduction or reinvigoration agenda will need first to establish the extent of knowledge retained.

Secondly, examination of all data collated in the research so far pointed to successful uptake of sail being linked to a general appreciation of, and sympathy with, a sail-orientated service delivery, not just by the sailors and transport service providers. That is, the whole catchment community of a sail-based operation will need to understand the basis of a sailing culture. Transport users will need to understand and be sympathetic to routes and timetables being orientated to and varied by wind and route planning considerations. Policy and regulatory agencies will need to be cognisant of its nuances. The alternative form of energy source being used for primary propulsion is such that an alternative transport 'product' is being offered, not simply an alternative vessel. There is an element of Fijian and all sailing heritage that today sees sail as associated with a remote and discarded, possibly glamorous but outmoded past. Returning to Solodamu; larger, newer, more powerful motors are signifiers of positive or progressive development. The use of sail is considered a step backwards, away from 'progress' and this means that a sailing culture would need to be rebuilt/learned across the Kadavu community if local sail trading is to be fully supported.

One practical way of counteracting a negative perception of sail is obviously to associate future use of sails with the positive and iconic attributes of Fijian (and wider Oceanic) heritage. The question at this point was whether this is best achieved at a micro, meso or macro level. Using the relationship built between 2010-2012 with FIVS and its widespread support base, in particular from OCACPS, Fiji Arts Council and *iTaukei* Affairs, we opted to

focus revival at a national level[124]. *Drua* culture, even if it is little practised on the water today, is still one of the most central and instantly recognisable motifs in Fiji today. *Domodomo* adorn every *Telecom Fiji* phone box. *Drua* and related images are found on stamps, coins, badges, coats of arms, government forms, t-shirts, buildings, churches, police stations, park benches, and business logos. I have never yet talked about *drua* with any *iTaukei* and not had a faraway look appear in their eyes.

Thirdly, recent and related events conspired to commence a nucleus of *drua* cultural reinvigoration, though it too early to say whether any or all have sufficient momentum to ensure a sustained revival of Fijian sailing heritage by Fijians. The spin-off of the growing renaissance in sailing culture evidenced in other parts of Oceania, sparked in Hawaii by the Polynesian Voyaging Society and its linkages to Micronesian heritage through the late Mau Piailug, which has built steadily and consistently since the 1970's and is keenly followed by academics, students and researchers in Pacific Studies, History, Anthropology etc. A four-lecture series that traverses the voyaging and colonising of Oceania is a recent requirement of all undergraduate studies at USP[125]. As a direct derivative of the renaissance, Fiji was offered, *Uto Ni Yalo*, as described in Section 1.3.3. While not a vessel of traditional Fijian design, the adventure has captured the imagination of many Fijians and elevated the status of these Fijian sailors to a level similar to national sporting heroes.

Coincidentally, a US-based NGO, Pacific Blue, had begun a small project to reintroduce *camakau* in Yanuca and host an annual *camakau* race in Suva Harbour (see Figure). This attracted five entrants in 2010 and eight in 2011 with widespread media coverage and high public support. Prior to this the Fiji Arts Council had funded the building of four new *camakau* for the Melanesian Cultural Festival in Suva 2006. In 2010 *Fiji TV* aired a documentary on *drua.* Even if there are no known operational *drua* in Fiji waters today, the culture is still evident and should be described as being in a state of emergent resurgence[126].

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[124] In mid-2012 this culminated in a week long "*Drua Festival*" of performance art, exhibitions, practical sailing demonstrations, and public lectures coinciding with the arrival of the TMoTM fleet in Suva.

[125] For the past two years I have co-ordinated this lecture series with FIVS volunteers.

[126] "A direct result of [this thesis] has been providing a catalyst for the OCACPS creative programme since mid 2011 including the two full-length performances; 'Vaka: the Birth of a Seer' and 'Drua, The Wave of Fire', as centrepieces for the 2012 Solomon Islands Festival of Pacific Arts" (Vilsoni Hereniko, speaking at the world premier of 'Drua, The Wave of Fire', 15 June 2012).

Figure 49 Camakau sailing on Suva Harbour, 2011

The fourth reason for examining the heritage record is that, regardless of the current state of Fijian sail culture, in its past Fiji had a strong sail-powered sea-going tradition. Unless the ancestors came out of the *vanua* or were transported by supernatural means (accounts of both are held within Fijian cultural record) large parts of ocean had to be traversed to arrive in the archipelago initially and then subsequently move around it. Locally-derived effective sea-transport had been successfully developed in these waters previously and that needed to be examined and understood for any useful lessons before any attempt to introduce a new one.

The stimulus to now investigate the potential use of sail is prompted by changes in energy and resource availability and environmental change. However, responding to the challenge by embracing change is nothing new in this ocean. "There is extensive evidence that Pacific societies have frequently adapted to a multitude of environmental and social events in the past. It is this historical evidence for continuity, resilience and resourcefulness that is evident today in many Pacific communities where engagement with cultural heritage is increasingly seen as a means of strengthening and retaining group identity and preserving the local environment while allowing many Pacific Islanders to participate effectively in an increasingly globalised economy and society" (Liston et al, 2011:2).

The focus for this section is then set. Excellence in sea-transport technology and operation is arguably the greatest technological legacy of central Oceania: what is that heritage in a Fijian context; what lessons does this heritage offer for future application; and what elements of that heritage are still available and applicable for use in a modern and future setting?

The research started with a standard literature search from which was compiled a compendium of acknowledged written sources. This was then distilled for areas of agreement and divergence, for lessons learnt applicable to the inquiry, and for gaps in the canvas. With this analysis to hand, attention turned from the written to ask the status of unwritten knowledge still held culturally or 'in-house' within Fiji and to negotiate a process for ensuring this was recorded. Each stage is discussed below.

6.1. Literature Review and Compendium

The compendium was compiled to assemble a summary of known literature references to *drua* and related Fijian sailing culture and history[127]. There is no single comprehensive literature source or reference to *drua* and the wider subject of Fijian sailing culture is dispersed across a variety of sources. Important detail is contested by various commentators. The literature on Fijian sailing culture is sparse and scattered relative to other 'canoe'[128] cultures of Oceania. Neither Fiji's *drua* culture nor the related culture in central Oceania has been the subject of the intensive research of Eastern Polynesia with its focus on long distance migration and debate over drift versus planned migration and return voyaging capacity.

There is disagreement between authors as to the historical and pre-historical extent, ability, and source of Fijian sailing culture. As the *drua* is agreed by all commentators to be virtually identical in design and handling to the Tongan *kalia* and Samoan *`alia* references pertaining to *kalia* and *`alia* were also included were references to Tongan, Samoan, and Fijian relationships in the critical mid 1700 – 1900 period.

Goetzfridt's 1992 review of references to Pacific navigation and voyaging was used as the

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[127] The phrase 'drua culture' is used throughout as shorthand for this and includes vessels, sailing, navigation, and all related aspects of culture. Morphologically there is little design difference between the later vessels of Fijian, Tongan, and Samoan ownership. This is not to say there are no differences in the operational or socio-cultural attributes of *drua* between the cultures. Where there is no necessity to distinguish between the country (or culture) of ownership, the class of *drua/kalia/`alia* collectively is referred to as *drua*. *Ndrua* and *drua* are interchangeable spellings as are *thamakau* and *camakau* in the archival material.

[128] Hornell notes the inadequacy of the term 'canoe' to describe what were often massive, bluewater, long-range, planked-hull sailing vessels but concludes the term is so ingrained in the literature and generally accepted as to defy re-branding. The term 'vessel' is used here rather than 'canoe' where possible. As discussed in Section 2.1, Jackkie Leota-Ete reminds us even this term is value laden.

starting point for the literature search. As sources were identified in Goetzfridt's review a summary of any relevant content was made. There are only two Fiji-specific sources out of more than 650 articles reviewed though several sources included reference to Fijian-related matters. By comparison Goetzfridt lists 114 sources for the General Pacific, 363 for Polynesia, 160 for Micronesia and 20 for Melanesia[129]. To these were added additional written sources, some pre-1992 but not included in Goetzfridt's review and others that have been published since. At the time of writing more than 80 separate sources, primary, secondary, and tertiary have been examined with direct *drua* relevance[130]. There is an extensive, well-reviewed but again scattered pictorial record.

Having assembled the written material I then sought to digest and distil. Nicole (2006) cautions the need to recognise the relationship between archive and power, and references the Haitian historian Trouillot. "Rather than read the archive as a neutral institution, Trouillot has described it as a politically active repository of historical experiences and facts which are not created equal. In Fiji, as elsewhere, what is deemed important in history is a function of who decides what is worth recording and remembering. It is a function of power" (Nicole, 2006:3). It is critical to note with the exception of a tiny minority of sources, all comment on *drua* culture has been recorded through a Western lens. Even the indigenous records in the autobiography of Bulu (1876) and the 1915 paper by Toganivalu are translations, the first by Fison and the later by Beauclerc.

There are a limited number of primary sources but remarkable consistency amongst these as to vessel form, construction, and functionality – what Tippet describes as morphological study (Tippet, 1968:81). Such commentaries are largely records of professional seamen (e.g. Anderson, Cook, Erskine, Jackson[131], Mariner, Samwell, Wilkes) or missionaries (e.g. Bulu, Lawry, Thomas, Williams,). Then there is a body of work post the era of the 'great' *drua* (*waqa tabu, musu waqa, tabetebete*) but within the period when *drua* culture was still being practiced (e.g., Haddon and Hornell, Kramer, Thompson, Tippet ,Toganivalu). These must be considered a mixture of primary and secondary sources and the commentators primarily

[129] The artificial and externally imposed demarcation of Oceania into these categories is particularly distracting when examining Fijian records.

[130] The compendium, which I consider a living document, now comprises more than 38,000 words, is too large for inclusion in this thesis, and can be web-sourced from www.sailingforsustainability.org.

[131] John Jackson is most probably a pseudonym for William Diaper 1820-1891 (Legge, 1966).

professional academics. Finally there is the body of work from the past four decades, coinciding with the current 'renaissance' in Oceanic sailing/voyaging since Lewis and the early work of Finney (e.g. Banack and Cox, Clunie, Couper, D'Arcy, Finney, Hage and Harary, Howe, Irwin, Kane, Lewis, Neich, Neyret, Sahlins).

The *drua* of central Oceania were the greatest of the Pacific double-hulled vessels and arguably the finest bluewater sailing ships of their age. While there is widespread agreement among commentators on many issues pertaining to *drua*, there is also marked divergence on critical points. Two main schools of thought exist. The first proposes evolution of a Fijian or Melanesian technology and design origin route after exposure to Micronesian rigs and hull configurations. The hypothesis is that the resultant vessel class was subsequently adopted and finished by Tongan and Samoan craftsmen after it had travelled east to the Lau Group, who in turn came to dominate the resultant *drua* building industry, particularly in the Lau.

The alternate view is that the evolutionary design breakthrough was performed by Samoan craftsmen under Tongan instruction blending Micronesian rigs with adapted Tongan hulls, with the introduction of iron as a possible catalytic factor. In the latter theory, Fijian sailing and ship design/construction capacity is held to be minimal until the recent period of Tongan influence. Fiji gains the *drua* by default as a result of a geographical accident. The primary resource extraction site for construction of this new technology was the southern Lau due to the limestone derived *vesi loa* from which these craft were built. While neither theory can be conclusively proved on available evidence, this review finds that there is reason to doubt some of the reasoning offered for the latter theory.

Figure 50 Model Drua

Source: http://collections.tepapa.govt.nz/Theme.aspx?irn=2356 accessed 12 November 2012.

6.2. Consensus Within the Literature

The following areas of consensus can be adduced, either because there is total or near total agreement amongst the various commentators or because there is no comment or contradiction offered by other commentators.

***Drua, Kalia, 'Alia* were, in respect of design and handling, largely identical.** The vessel class is characterised by a Micronesian-designed[132] Oceanic lateen sail and rig unused elsewhere in Polynesia on two true hulls of unequal length sailed by 'shunting' end-for-end as opposed to 'tacking through the wind' with the smaller hull always to windward. Detail of design and construction is reasonably well characterised (Hornell, 1975; Thompson, 1940; Toganivalu, 1915; Williams, 1870) and the existence of preserved examples of *drua* and numerous museum models and artefacts leaves little doubt as to the reliability of this information. There are a number of first-hand reports of the methods of sailing and general operation and a strong pictorial record. There is near total, but not unanimous, consensus that the Tongan shipwright achieved a superior finish of vessels to the Fijian. Cook (1777) noted "nothing can be a more demonstrative evidence of their [Tongan] ingenuity than the construction and make of their canoes, which in point of neatness and workmanship, exceed everything of this kind we saw in this sea". Hornell (1975) details the Samoan hull construction method which is considered more complex than the methods employed in Fiji and quotes descriptions and figures by Kramer (1902-3) and Buck (1930).

Two separate classes of *drua* are documented, although this classification is not realised by all recorders. Small *drua* were constructed *saucoko* style; a single hollowed log forms the base of each hull with a single lashed strake used to raise the height of the hull. This is the construction style of the *Ratu Finau*, the 1913 13m example preserved in the Fiji Museum, and is probably close to the limit of size capable for this form of *drua*. Much larger vessels, also known as *Waqa Tabu* and *Musu Waqa,* were built using the *tabetebete* design where the *takele* (keel) is formed from two or even three scarfed planks and then the hulls built up using several planks per side. It is commonly reported (e.g. Thompson, 1940) that no *tabetebete drua* has been built since the end of the 19th century. There have been a number of *saucoko drua* built over the past century, although none are believed to be operational today.

[132] But see also further discussion.

The *drua* class were the finest and technologically most advanced double-hulled canoes of Oceania. In addition to the glowing praise of Cook and his colleagues for Tongan *kalia* and *tongiaki*, Alden (1870) describes *drua* as "a product of barbarian genius", the "fastest sailing boat in existence" and "capable of sailing nearer the wind than any European vessel". Clunie (1987) offers that "[t]he massive *drua* or *kalia* made last century in Fiji is justly celebrated as the most remarkable voyaging canoe ever to ply the Pacific". Hornell (1975) describes the drua as "the largest and finest sea-going vessel ever designed and built by the natives of Oceania before contact with Europeans". Lewis (1980) described both *drua* and *camakau* vessels as "the pinnacle of Oceanic canoe technology". Finney (2006) states that "the *kalia* has been lavishly praised as a stunningly fast shunting hybrid made by joining the double ended hull form and pivoting Oceanic lateen sail rig of Micronesian flying proas to a pair of hulls".

Drua achieved great size, were fast, could perform to windward, had great load carrying ability, and were built in large numbers. Their hulls were fashioned from a timber described as the "titanium" of Pacific boat building timbers (Banack and Cox, 1987:161) *vesi loa*, a toredo worm resistant greenheart, which comes only from the limestone belt of islands in the southern Lau group, and is still considered superior to all other timbers. The vessels' home range included at least Fiji, Tonga, Samoa, Uvea, and Futuna. They easily outperformed the equivalent European ships they met and there is evidence that they were the preferred vessels by Fijians, even into the start of the 20th century (Thompson, 1940; Toganivalu, 1915; Tippet, 1968). They displayed greater windward ability than any other double-hull Oceanic design, in particular the *tongiaki* they quickly displaced in Tonga. They were highly prized, arguably the highest prized asset. The skill displayed in design, construction and operation awed the European recorders, some of them skilled naval architects. The following extracts confirm these assertions and are only a sample of the available evidence found in the compendium.

> "The next day we proceeded towards our destination, calling at the island of Ovalau … even Tongan and Wallis's Island canoes had come from Lakeba and other places to the long anticipated banquet at Bau, on the occasion of the arrival of this new canoe which had been building seven years, and was at least one hundred feet long, and sufficiently large to carry three hundred men" (Jackson in Erskine, 1858:453).

> "The following are the dimensions of the largest canoe I know … Extreme length, 118 feet; length of deck, 50 feet; width of deck, 24 feet; length of mast, 68 feet; length of

yards, 90 feet" (Williams, 1870:63).

"These [49] canoes [seen in Tongatapu] are from one hundred to one hundred and forty feet long, and carry two hundred to four hundred people each; they are double, with a deck and house or houses, and with one enormous sail, scud along at twenty miles an hour. These canoes are wonderful pieces of naval architecture; they are made of different pieces and jointed together in a most curious fashion, with so close a joint as to be hardly perceptible, and not a nail being used in any part; they are sewn with signot, made from the cocoanut, on the inside, the outside presenting a smooth and polished surface" (15 March, 1864, *Otago Daily Times*, Issue 699:6.).

"In one of the lofty canoe-sheds on the beach [at Lifuka] we inspected the king's great double canoe, as those of the largest class are called by the Europeans … The canoe in question was upwards of a hundred feet in length, and like all of those dimensions, had been built in the Feejees, these islands affording no timber fit for the purpose. It is a proof of no little courage and dexterity that these apparently fragile and unwieldy vessels must be navigated in the face of the usual trade-wind between two and three hundred miles" (Erskine, 1858:132).

Drua were fast. Thomson (1908:292) gives the speed of the *drua* as "from 10 to 15 knots with the wind on the quarter" and Hornell (1975:327) notes that "*drua* with a wind on the quarter could attain under favourable conditions a speed of about 12 miles an hour" and quotes West (1865) who describes undertaking a 38nm trip on a *drua* in three hours and also noted that "they are highly adapted for sailing close upon a wind ... within even three points of the wind".

Others contend that while capable of achieving such windward performance they didn't in practice. "Although it could lie remarkably close to the wind – within about three points of the wind as opposed to about six points for the English square-rigger of the day – the *kalia* through its shallow draft was driven down wind and could not head into heavy sea, which forced the hulls asunder. An expert crew could beat home to Tonga under even quite fresh conditions, but some idea of the difficulty can be gained from the 77 tacks Tu`ihalafatai is recorded as making on his last voyage from Fiji in the teeth of the Southeast Trades" (Clunie, 1987:15).

The missionary Williams (1870:76) who travelled extensively by *drua* found that a "canoe in

good condition makes very little water, and such as have just been described would safely convey 100 persons and several tons of goods over 1,000 miles of ocean". Lawry (1850: 144) on October 10, 1847 witnessed "the fleet of Thakombau sailed out this morning with not less than 200 warriors on board each canoe". Coppinger (1883:163) describes a *drua* he saw in Bau in 1880, as "72 feet long, with a depth of hold about 5 feet; it was intended to carry 250 men" and "he entertained no doubt about the correctness of this number".

In a double canoe about 100 feet long "the beam would be 6 to 8 feet" and "... a man could easily walk in the hold without touching the deck. A pig could be roasted whole in the open cooking place and the food and water were easily stowed away for long voyages. On one occasion a canoe carried 12 head of cattle in her holds from Natewa Bay in Vanua Levu to Levuka, a trip of 120 miles, and another carried on deck from Tailevu to Suva a cargo of bagged maize sufficient to load the *Alarm* ketch of 30 tons and the *Xerifa* of 20 tons burden" (Wall, 1916, quoted in Haddon, 1975:326).

Fleet sizes could be large. A fleet of canoes and the warriors transported by it were known as *bola*, the Fijian term for a hundred canoes (Clunie, 1997: 34). "Fijian canoe fleets numbering scores and often a hundred or more vessels. An allied fleet which ran down William Lockerby in Wailea Bay in 1808 was composed of some 150 canoes" (Imthurn and Wharton, 1925:39). A Bauan fleet in the Bau-Rewa wars of the mid century consisted of about 200, "counting together the double canoes, those with outriggers and sailing canoes ... when they sailed away, Laucala Bay was absolutely crowded with canoes" (Toganivalu, 1912).

"Another Bauan canoe fleet which took Charlie Savage, Paddy Connell and other beachcombers on a raid in 1809 (Turpin's Narratives:94) was hardly less impressive, comprising 64 *drua* or double canoes, 36 large *camakau* outrigger sailing canoes, 26 *tabilai* fighting canoes; and 10 small *takia* sailing canoes; in all 136 canoes transporting some 2,700 men" Clunie (2003: 35). And from a report made in 1847: "The spot over which we are now sailing (en route from Ngainge (sic) past the island of Malagai (sic) to Bua) is one which Varani will not soon forget. He was here, a short time since, in his terrible character of warrior and cannibal: and in one canoe he met and encountered a fleet of sixty canoes, one of which had a small cannon on board" (Lawry, 1850:80).

Upward of 50 sail, coming from as far away as Tonga and Uvea were counted in Bau waters for the commissioning of the *Ra Marama* in 1849 by Jackson who had earlier sailed in a

similar sized fleet. "In a few days we accordingly started, a great fleet of canoes consisting of about forty, and the number of natives about two thousand … and then we were mostly obliged to sleep in the canoes, jammed up in such a manner to be actually lying in two and three layers on top of each other" (Erskine, 1858:423).

Similar sized fleets of *kalia* were recorded in Tonga. Wall, (1909) recounts an 1855 fleet of 30 canoes from Tonga that sailed to attack parts of Fiji and returned safely (quoted in Goefridzt, 1992:51). An unnamed correspondent recorded: "a small speck in the horizon indicated a canoe, and soon another, and another followed … These 49 canoes came bounding along with their living freight like racehorses" (*Otago Daily Times*, 15 March, 1864).

Mariner was a castaway in Tonga from 1806 to 1810 and repeatedly recorded large numbers of vessels from this period. "The large canoes of Lefooga, about fourteen in number, were then launched, which with Toobo Nuha's fleet from Vavaoo, made together about fifty sail" (Mariner, 1827:91). "All things being in readiness, the following morning the king embarked with the whole of his forces, about 5000 men, besides 1000 women, in fifty large canoes, containing also the four carronades, ammunition, and every thing necessary for a vigorous attack upon the strong fortress of Vavaoo" (Mariner, 1827:159).

Tippet (1968:83) describes the autobiographies of early Fijian missionaries Jemesa Havea and Joeli Bulu as being, to a large extent, nautical narratives. Bulu (1871) graphically describes sailing from Tonga to Moce in two days, sailing *drua* from Viti Levu to Kadavu in atrocious conditions and even surviving a hurricane in the Lomaiviti group. His accounts describe his missionaries, Tongan teachers and converts all scudding at will and often at a moment's notice around the Lau, eastern Viti Levu and Kadavu spreading the gospel on a variety of large and small *camakau* and *drua*.

Drua were multifunctional vessels. Primarily the naval attack weapon of choice, they saw service as blockade-runners and enforcers, landing craft, fleet battleships, troop and supply transporters and deadly effective rammers. There are graphic descriptions of the naval battles fought (e.g. Clunie, 1987). In times of peace they performed as diplomatic missions and passenger/cargo traders. They were used extensively in the service of the new Christian religion as essential transport for both European and local missionaries, especially by the Tongan teachers who used massive *kalia* on regular conversion voyages from Tonga to Fiji

via the Lau. The missionaries Lawry, Thomas, and Williams reported regularly travelling by *drua*, often in extremely rough weather and sea conditions.

The majority, if not all the vessels described above were constructed in the southern Lau. "The Fiji islanders make their canoes principally of a hard firm wood, called *fehi*, which is not liable to become worm-eaten; and as the Tonga Islands do not produce this wood, the natives are not able to build canoes so large or so strong as those of their instructors. All their large canoes, therefore, are either purchased or taken by force from the natives of Fiji" (Mariner, 1827:359). The translocation of *mataitoga* craftsmen from Tonga and descendants of Lemaki, a Samoan plank-building specialist, to the Lau in temporary and permanent settlements is well recorded by, amongst others, Thompson (1940, 1970), Tippet (1968), and Reid (1990) and the unique mixed cultural legacy is clearly evident today.

***Drua* were comparable in size and superior in speed and windward capability than equivalent European designs of the contact period.** They were bluewater, long-range capable and superior to any other vessel seen by early European explorers, of a comparable length to the *Endeavour*, with a larger complement, three times faster and capable of sailing three points closer to the wind. It is worth noting that even the earlier *tongiaki* (Tongan) vessel classes seen by the Dutch in the 17th century were considered by them to sail "so swiftly that there are few ships in Holland that would outdo them". The *drua* by comparison was in a class above. And this was all the more remarkable in that it was achieved without recourse to metals (and arguably because of a lack of metals). The comparison is not a fair one. European deep-draught displacement monohulls were built to a totally different design paradigm that required vessels to carry extreme loads and keep to sea for months at a time. The *Endeavour* was a converted collier, chosen for her durability not her speed.

All commentators refer to the *drua* as a recent (mid to late 18th century) design evolution. Although there is universal consensus in the literature on this point, it is not necessarily conclusively proved. *Drua* are increasingly reported from the Viti Levu seaboard to the extremities of the recorded 18th century Tongan sphere of influence (with a later introduction to New Caledonia from Tonga around 1900) from at least[133] the time of Cook onward (1770's). But, if the hull innovations had a Melanesian origin not a Tongan one, as

[133] All historical commentators refer to Cook arriving *during* a period of transition, not at or immediately prior to its commencement.

Haddon and others suggest, and/or the *drua* existed in Fiji prior to eastward expansion from Bau to an already populated Lau (Reid, 1990 suggests this as circa 1750) it could be reasonable to assume the 'Levukans' (Williams, 1870; Reid, 1990) travelled to Lau in *drua* to get there. If this is held to be true then the subsequent transfer of technology to Tonga is easily explained and agreed. It would leave unanswered the questions of whether the *drua* originated in Bau or west of there; how long the *drua* was known west of Bau; and whether the original *drua* was only built shortly before the 'Levukan' expansion or at some undetermined point between the original Fijian settlement and 1750.

The *Drua* evolution did not move east of West Polynesia. Again, this is agreed by all commentators reviewed. How far east it travelled is unproven but Niue and Tokelau are probably the eastern most points with the northern Cooks an outside possibility.

If *drua* were not a Tongan invention and migrated from west of Bau eastward circa 1750 then the technological innovation is almost certainly pre-European contact and indigenous in origin. It is only possible to speculate what effect a further expansion of *drua* culture might have meant to the wider region if its migration further into Oceania had not been impeded by European arrival. Given the speed at which the previously dominant *tongiaki* class was replaced by *drua*, (presumably no *tongiaki* were commissioned post *drua* knowledge being introduced to Tonga although existing vessels were almost certainly retro-fitted with *drua* rig), it is arguable that *drua* could have effected a revolution in canoe technology elsewhere in Oceania with similar speed of uptake as witnessed in Tonga (Dale, 1996; Lawry, 1851; Wilkes, 1845) which saw near total displacement of the earlier designs within a generation.

There is no record of the Fijian predecessor to the *Drua*. It is highly improbable that the ancestors of the Fijians arrived in Fiji 3,000 or more years ago aboard *drua*. Irwin (2006:79) considers the traditional three-spar-rig appeared in Fiji and West Polynesia long after initial settlement. It follows then that they came in another class of vessel. There is no available evidence as to this craft and what its contribution, if any, to the design of the later *drua* was, although Hornell (1975:334) holds the primitive New Caledonia hull to be the *drua*'s closest relative. Nor is there available evidence for any design or technology transition of Fijian nautical craft from the time of first settlement and the arrival of the *drua*.

Clunie (1987:11), who strongly favours a Tongan designer for the *drua*, describes the Fijians, prior to them being educated in *drua* culture by the Tongans, as a "rather lubberly people"

implying their pre-*drua* maritime capacity was limited. Against this must be argued the extent of the Fiji islands group (400+ islands covering 6 degrees of latitude and 5 of longitude with numerous bluewater passages between islands), the oral record of inter-island contact within this group prior to this period and the speed at which Fijians adopted a *drua* culture. From the records of most commentators by the early to mid-19th century (see Dale, 1996; Erskine, 1858; Wall, 1916), Fijians were widespread owners and consummate handlers of their craft. This would be a startling short period of technology transfer and uptake for a culture that displayed minimal capacity prior to the 1770's.

Based on the oral evidence of inter-archipelago connections between the groups (see for example Fison, 1904) it appears reasonable to speculate that Fijians had at least access to or knowledge of Tongan *tongiaki* class vessels within their home waters, if not ownership and management. Whether they also had an indigenous design of double-hulled canoe, presumably either descended from the Melanesian/New Caledonia design or a descendant of earlier Fijian double-hulled evolution (Irwin, 2006:76 considers "the historic distribution of canoe types suggests the double-hulled canoe developed in Fiji and West Polynesia and there is linguistic support for this") is unkown.

The sail and rig of the *drua* and *camakau*[134] are identical designs and originated from Micronesia[135]. The Oceanic lateen rig is unknown elsewhere in Polynesia. The literature is divided as to whether it was Fijian or Tongan or Micronesian-initiated contact that provided the sail and rig technology transfer. It is also not known whether the *camakau* led to the *drua* (or vice versa) or whether they evolved contemporaneously. The large *camakau* recorded in Fiji post-1800 were certainly bluewater capable. It is reasonable to assume that the outrigger and the double hull have a common geographical origin and technology transfer route.

Alternatives include a c*amakau* origin with Fiji or Tongan-initiated contact, a *camakau* origin with Micronesia-initiated contact, a *drua/kalia* origin with Fiji or Tongan-initiated contact, a *drua* origin with Micronesia-initiated contact, and a contemporaneous evolution with three possible routes. Answering this conundrum is probably the key to determining whether the *drua* hulls were modified *tongiaki* or expanded outriggers of Micronesian or Fijian origin. The possibility that the transfer went the other way, to Micronesia from either Tonga or Fiji is

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[134] *Camakau* are the outrigger version of drua, also built to large size.

[135] Clunie (1987) considers it most likely of Kiribati origin.

not considered by any commentator reviewed in this research but is not totally implausible.

Oceanic sea-transport technology in the Fiji/Tonga/Samoa region was in a progressive (and aggressive) expansion phase at the time of European contact. This is the opposite to that reported for much of the rest of Oceania inter-archipelago contact where double-hulled voyaging was in decline at this time (e.g. Howe, 2006). It is uncertain to what extent this progressive phase may have preceded sustained European contact. "This wider development of the *kalia, `alia* and *ndrua* type of canoe in the later decades of the 1700's was instrumental in changing the balance of power in the Tonga, Samoa, and Fiji area. With their superior sail rigs and mostly manned by Tongans, these canoes could beat into the wind, allowing closer trade and political relations between Tonga, Samoa and Fiji" (Neich, 2006:234).

The introduction of European ship designs and technology did not immediately displace local craft. *Drua* remained the vessel of choice for Fijian chiefs until the end of the 19th century and vessel construction remained a vital component of inter-island and interstate trade into the 20th century. "The increasing presence of Westerners did little to influence Fijian maritime technology. Fijians learnt to use oars from observing Europeans, but most inter-island traffic continued to be carried on *drua and camakau* ... Although Cakobau ordered a schooner built overseas to enhance his *mana*, Fijians generally did not take to western vessels. Owning a schooner did not engender the same pride as the construction of a great *drua*" (D'Arcy, 2006:142).

Foye was an English geologist who travelled through Lau in 1912, initially on a missionary cutter and then on local *camakau*. By this time Cakobau's sons are reported as having cut up his great *drua* after his death in the 1890's. Foye (1917:384) found: "The canoes [*camakau*] are much swifter than the cutters, and natives often prefer to sail from island to island or even from Fiji to Tonga in their canoes rather than to depend on the slower passage of a cutter".

Thompson (1940) reported a resurgence in building and use of traditional craft during the pre-war depression, largely as a result of the crash of the copra market and a lack of any income, for other means of transport. Gillett (1993) found that by the 1990's only very small-scale use was evident with passages between Lau and Suva almost non-existent. Two important trips were well remembered. In 1953 a fleet of two *camakau* from Ogea and four from Fulaga sailed to Suva for the arrival of Queen Elizabeth, sailing through the Lau and Lomaiviti groups en route. In 1964 four Kabara canoes sailed to Suva for a Methodist

conference (Gillett, 1993:64). Since then there have been only sporadic reports, including the *drua Tabu Soro* and the *drua* of Simione Paki.

***Drua* were high value assets and had greater function than just vessels of burden.** *Drua* were arguably the most valuable and expensive asset a chief could possess. Construction could take up to seven years during which a skilled workforce would be employed and paid. Only a man of means could afford both the initial outlay and the continual maintenance a lashed vessel built of organic materials would require. These were more than mere assets. A warship capable of slight extra speed or agility could be the difference between life and death, not only for the crew but also the community it protected. Vessel cost could be measured in the number of lives sacrificed in its construction and operation that could run into scores. Toganivalu (1915) and Thompson (1940) in particular discuss ritual and protocol associated with *drua* culture. They were "sacred canoes" in all aspects of the term.

The analysis of Tippet is particularly important in understanding the role and function of *drua* in more than morphological terms and reminds us that *drua* were not simply the conveyer of goods and gifts on which the whole kinship and allegiance based networks of this region rest, often they were the artefact and object of exchange itself.

> "The process of building and launching the sacred canoe provides a focal point for the study of communal cooperation … The canoe is an artefact of artefacts: (1) The resultant canoe is the symbol of group achievement; (2) The project reinforces group solidarity; (3) The building and eventual use of the canoe provide a continuity of communal activity; (4) The resultant prestige for the whole group strengthens the authority pattern; (5) The cultural inter-responsibilities are reapproved and reinforced by a continuum of ceremonial activity that is religiously based; (6) The canoe provides group satisfaction in strong naval defence, or did so if this was the purpose of the project. In peace the satisfaction is in having a good canoe for public purposes; (7) If the canoe was made for extra-community presentation, then foreign relations were strengthened for the benefit of the whole group – either economic or military … This function of a complex artefact is a mechanism for assuring the perpetuity of society in the face of danger or threat" (Tippet, 1968:84).

Although built primarily as a weapon of war, the peacetime function of *drua* as the mechanism for economic activity and inter-island and international relations and, in particular

its function within the tribute system, were critically important. "The services rendered to Fijian communities by the giant sacred canoes were not confined to war and economic configurations. They figured in the political patterns of honorific presentations, not as the carrier or transporter of the presentations, but as the object of them. [Tippet describes the function of the *Musu Waqa*] a canoe built, not as a memorial, but as a gift and symbol or pledge of loyalty from one kingdom to a more powerful one" (Tippet, 1968:104).

Hage and Harary (1996) used both mathematical and anthropological tools to model and explain the complex exchange network that linked the differing islands of the Lau and to understand the means by which differing islands obtained dominant or subservient positions in this network. Bayliss-Smith et al (1988) discuss this network in terms of relationships between Lau and Viti and Tonga. *Drua* and *drua* culture is, in my opinion, the fulcrum of these networks, with *vesi loa* as the pivot pin. "In a sense the floristic resources of Kabara are an analogue of modern day strategic minerals. Just as the possession of titanium resources – important in aircraft construction – bestows strategic importance on the country possessing them, possession of large trees of *Intsia bijuga* [*vesi*] useful in canoe construction conferred a political advantage on Kabara" (Banack and Cox, 1987:161).

6.3. Areas of Divergence in the Literature

While there is consensus on the above, there are some aspects of the literature where the commentators are strongly in contention, in particular the route of technology transfer that led to the evolution of the *drua* and the origin of the distinctive hulls, the role of Fijian and other Melanesian cultures in that evolution, the capacity of Fijian sailing culture prior to Tongan 18th century influence, and the role of introduced iron technology in the creation of a *drua* prototype.

6.3.1. The Route of Technology Transfer and the Origin of the *Drua* Hull Form

There is agreement amongst commentators that the sail and rig of the *drua* class are Micronesian in origin[136] although it is not known if this was a result of the technology being brought to Fiji by Fijians, Micronesians or some other intermediary or Tongans obtaining it from Micronesia. There is divergence on where the distinctive *drua* hull form comes from. There are a number of theories.

[136] Although, as previously stated, this is not proven and could have been to not from Micronesia.

Finney considers that they are adapted Polynesian hulls and the route of transfer was from Micronesia to Tonga. "Apparently, the Tongans had been in contact with sailors from Micronesia, where a breakthrough in canoe design had occurred. The sailors had developed a double-ended craft with a moveable sail that allowed them to sail more efficiently to windward .... Tongans adapted this moveable-sail/double-ended configuration, coming up with the *kalia*, a racehorse of a double canoe that could sail circles around the ships of Cook and the other European navigators" (Finney, 1994:234). In this he has the support of D'Arcy. "*Drua* were only developed in Fiji in the late 18th century. Although made in Fiji their appearance owed much to skills and ideas developed elsewhere" (D'Arcy, 2006:141).

Clunie (1986:15) is more adamant. "Given long cherished, myths regarding 'Fijian' origins for *Camakau* outriggers and *Drua*, it must be emphasised that while made of Vitian timber, their design and handling and hulls came from Tonga and Uvea ... and their builders from Tonga and Samoa". In his 1987 article he argues "voyaging canoes clearly ancestral to the *kalia* once abounded in Tonga. As early as 1616, the "Eendracht" encountered many *tongiaki* [137] double canoes including one standing far to the north, bound for Samoa … the hulls of the *drua* originate in the hulls of the earlier *tongiaki* and that the distinctive opposing ends, one a vertical cutwater, the other an ovulated truncate is further proof of the design originating from Samoan Lemaki craftsmen" (p.11). Reid's (1990:21) comments the meaning of the derivative Fijian word *karia* can, however, be read either way in support of this claim. "The *drua* in Tonga acquired the name *kalia* which would appear to be derived from the Fijian *karia*. This word described the certain shape of canoe end, no doubt contrasting in Tongan eyes with the fixed bows of the *tongiaki*, the original double canoe of the Tongans".

In contrast to these, Hornell (1975:334) argued it "is probable that each of these two classes of double canoe had an independent origin, the Fijian type from an outrigger ancestor, the Polynesian from the connection of two equal or twin hulls after the fashion which persisted to the last in designs of the double canoes of the Hawaii and the Society Islands". Hornell considers that the *tongiaki* could not have been the originator and argues that there "is little doubt that the modern Fijian double canoe is a hybrid between this old [New Caledonian] type and the large sailing outrigger of Micronesia. The design may be described as a

[137] The *tongiaki* with two true hulls of equal length and a more primitive tacking rig were durable if somewhat clumsy and with no windward performance. They did sterling service back to at least the early 17th century and potentially for at least centuries if not millennia prior to this.

compromise in which the sailing advantages of the single outrigger canoe have been adapted to and combined with the cargo-carrying capacity of the double canoe" (1975:334).

The Tongan route has also been disputed on linguistic evidence. "Pacific Islanders experienced and innovated, and quickly assimilated innovations they perceived as being to their advantage. This is particularly clear in the area of canoe construction. Accounts of early explorers tell us, and linguistics confirms that the Tongans and Samoans borrowed the double canoe and I have argued here that the shunting technology followed the same route" (Geraghty, 1994:64).

Reid (1990:8) offers a potential explanation for a west to east transfer of *drua* design. "It was during the reign of Ginigini also that Lakeban traditions place the arrival on the island of the Levuka people, first indication of those stirrings in the west that were to have such consequence in Fiji's history. A seafaring folk, they had been the original inhabitants of Korolevu, the small isle off the south east coast of Viti Levu which the Bauan chiefs took over as their base. The date of this occupation has been suggested as 1760, and the removal of the former incumbents may therefore be regarded as mid-eighteenth century event. The account of their exodus and migration from island to island until they reached Lakeba has been told in many ways". If these Levukans, also referred to by Williams (1870) and Wilkes (1845), arrived on *drua* then it is possible these would have been the vessels seen by visiting Tongans on inferior *tongiaki* class vessels.

Reid (1990:12) concurs with Clunie in regard to the Lemaki chronology and influence but describes the transition thus: "[t]he first permanent settlers from the east [Tongans settling in the Lau] appear to have been shipwrights. Tongans had recognised the double-hulled *drua* as superior to their own sea-going craft in speed and handling, and even more important, they had seen the hardwood resources of the Lau limestone belt which were incomparably superior to the timber available in Tonga". This explanation is consistent with Williams (1870:76): "The well built and excellently designed canoes of the Fijians were for a long time superior to those of any other islanders in the Pacific. Their neighbours, the Friendly Islanders, are more finished carpenters and bolder sailors, and used to build large canoes, but not equal to those of Fiji. Though considering the Fijians as their inferiors, yet the Tongans have adopted their canoes, and imitate them even in the make of their sails".

Thomas (1908:293) concurred. "And now we come to a remarkable paradox. The Tongans

were the great navigators of the Pacific; the Fijians are not known to have voyaged beyond their own group. The Tongans were so expert with the adze that they rapidly displaced the Fijian canoe-builder in his own country. And yet the Tongan counterpart to the *ndrua* was the *tongiaki*, a craft so clumsy and ill-finished that it did not survive the eighteenth century, when the Tongans learned the art of canoe sailing from Fijians."

6.3.2. Fijian Voyaging Ability and History

The second major point of dissention, and related to the first, is the capability of Fijian sailors and shipwrights prior to the 18th century. The range of opinion on Fijian sailing capability prior to European contact ranges from "rather lubberly" (Clunie 1987:11), to capable but restricted to their home waters (Thomson, 1908:294), to bluewater and long-range capable and experienced (Lawry, 1850:270; Wilkes 1845:366). Clunie (1987:11) maintains "it has been firmly established that Fiji's indigenous craftsmen could not have built the canoe; while Tongans were still teaching Fijians to sail it in the 1840's, several generations after they had supposedly developed it". Clunie, in this article at least, does not evidence this claim and it since been quoted uncontested by Finney, D'Arcy, Neich and others.

The counter argument comes from numerous sources. Hornell (1936:344) concludes "how the Fijians came to seize upon the Micronesian design and modify an outrigger type into a double canoe one we shall never know, but they certainly did accomplish this feat ... The voyaging of the Marshall and Gilbert Islanders, noted navigators and confirmed wanderers, almost certainly went as far south as Fiji, and it was in all probability from these people that the Fijians gained the knowledge which led to the designing of that magnificent vessel the *ndrua*". "It is unquestionable that the Fijians were notably the superiors of the Tongans and the Samoans in the art of canoe designing, although the Tongans could claim the credit of being the more skilful carpenters and the more daring and experienced navigators" (Hornell, 1975:264).

The shipwrecked sailors Mariner (Dale, 1996) in the first decade of the 19th century and Twyning in 1829 (Twyning, 1850) witnessed large scale deployment of multi-vessel fleets at Bau and Laucala (Mariner) and throughout Fiji (Twyning) being expertly handled by Fijian crews. If south-eastern Fiji was "virtual Tongan colonies", (Finney, 1994:295) at this time and if *drua* were only introduced to Fijians by Tongans at the end of the 18th century (Clunie, 1987:12) they would appear to have gained access to a considerable number of high value

craft (which would presumably all have gone direct to Tonga if Fiji were only a vassal state) and have mastered the seamanship necessary to operate them effectively in large fleet formations in less than a single generation. Certainly by the time of Williams and Wilkes (circa 1840's) Fijians were acknowledged masters of their seafaring craft and use of *drua* and *camakau* was widespread in Fijian waters.

Although (Williams 1858:85) assumed that the Fijians never ventured beyond the limits of their own archipelago, Lawry (1850:270) considered that Fijians were "bold navigators, and make somewhat distant voyages". Wilkes (1845, Vol.3:366) described Fijians making "very long voyages – to Tonga, Rotuma, and the Samoan islands". Speiser (1923:250) refers to Fijian voyages to the New Hebrides and commented that "the Tongans, conversely, have been lauded as bolder navigators and the presence of Tongan settlements and culture in far distant islands of Melanesia is instanced in support. Without calling into question the seafaring intrepidity of the Tongans, it must be pointed out that much of this seeming activity was involuntary and due as much to the inferiority of their sailing craft as to their innate enterprise and skill. Their sailing double canoe, the *tongiaki*, was a craft so clumsy and ill-designed that it could not beat to windward; when a favourable wind failed, there was no alternative but to change course or drift with the sail down".

Hornell (1975:305) also considers that "[t]he possession of fine sailing canoes suitable for long voyages rendered inter-communication between the islands [of Fiji] so easy and frequent that there are no local variations of any consequence in the design of the various types; the description of the Mbau and Rewa canoes serves equally well for those of all other localities".

Commenting more recently, Rayawa (2001:31) is also of the opinion that there was a Fijian origin for *drua* and notes that "[t]he Tongans were especially daring sailors who prized the superior Fijian canoes, often coming to Fiji to learn how to sail them ... A study of canoes circa 1830 shows a wide range of specialised craft indicating a long and complex history. The [Fijian] hereditary canoe building class had thousands of years of skills and experience at their command and the vessels they produced reflect this". This, of course, can be equally applied to the *mataitoga*.

D'Arcy (2006:114-115) summarises Fijian seafaring clans active in Fiji in the 18th and 19th century:

> "the fragmentation of power meant that quite small polities with naval capacity could

> exercise significant influence. They were often based on small islands off large islands, and included groups distinguished as 'sea people' ... The tiny island of Bau was the *vanua* most clearly associated with sea people. Half a mile off the east coast of Viti Levu, Bau is only twenty acres in extent. It was founded in the 1750's, and rose to become Fiji's leading naval power by the 1840's ... Bau's initial strength was based on an alliance between the founding chiefly line from the interior of Viti Levu and the seafaring inhabitants of Bau - the Butoni. Other seafaring people joined later. When disputes arose, the Butoni and Soso migrated to various localities around the eastern islands of Fiji. Bau was not alone on relying on sea people as the nucleus of its naval and military forces. Groups such as the Macui of Verata, the Vutia, Nukui and Nasilai fishermen of Rewa, and the Navatu people of Cakaudrove filled similar roles".

Even if the Fijian sailing culture was limited or in some form of limbo prior to the *drua*, Fijian ancestors must have sailed at some point in their history and sail appears regularly in the heritage record. For example Tippet (1968:105) records "[t]he great canoes are featured in many of the Fijian migration myths, especially those of the dispersion of the Nakauvadra people. Many of these vessels, like the *Kaunitoni* are remembered in name in the local traditions … in many villages in Kadavu the people know the names of the crafts that brought them to their current locations, and something of the routes taken".

There are some intriguing references from early historians of Fijian voyaging connections. The following references are all from Goetzfridt's 1992 review. In 1891 the New Zealand ethnographer Percy Smith referred to an indigenous navigational chart of Fiji whose "parallel strings stretched on a frame" illustrated the "constant movements of the sea driven before the trade-winds". He also discussed "... traditional indications of Maori familiarity with Samoa and Fiji" (quoted in Goefridzt, 1992:184). Burrows (1936) notes Futuna contact with Fiji which he maintains must have existed before European contact (p.75). Macgregor (1937) writing in Tokelau noted that voyages to Tonga and Samoa were common as were "marauding expeditions to Fiji" (p.157). De Bisschop (1939) was informed by Futunan sources that two-way voyages to Fiji were being made 50 years previously with other canoes coming from Wallis (p.82). Lewis (1977) emphasizes evidence which points to extensive voyaging of the Lapita people, particularly the passage through the Melanesian Trench to Fiji … and examines the ethnological and traditional evidence which indicates deliberate and

extensive Melanesian voyaging into Micronesia including Fijian voyages to Kiribati and Nukuaro (Pohnpei State) and their subsequent adaption of principles of Micronesian canoe design (p.31). Koch (1983) noted that large sailing canoes, which ceased to exist during the 19th century, were used for voyages to Samoa with elders maintaining that voyages were also made to the Solomon Islands, Kiribati, Fiji, and Tonga (p.146). Finally, Neyret (1985) notes that the northern two-mast double canoe of New Caledonia was developed with sailing influence from Wallis and Fiji via Micronesia (p.274).

In addition to the Goetzfridt sourced material above, Green, (1975) considered that shards of Fijian pottery found in the Marquesas Archipelago represent pots brought by founding people before 300 A.D. whereas Western Samoan shards point to evidence of two-way voyaging between Tonga, Futuna, Tuvalu, and Fiji since settlement nearly 3000 years ago (Green doesn't say whether it was Fijians doing the voyaging). Neich (2006:230) advises that "most accounts consider the Tongan empire reached its greatest complexity and geographic spread between AD1200 and AD1500" with Fiji as part of this 'empire'.

Hage and Harary (1996:17) examine previous literature on the 'Tonga-Fiji-Samoa network' through anthropological and mathematical lenses and argue that instead of viewing Tonga as the 'apex of a three-cornered network' as seen by Kaeppler (1978), a more global model linking Tonga, Fiji, and Samoa in a single directed cycle of exchange can be discerned by considering the most valued prestige good each society obtained from one other society. Each island society, therefore, provided one other society's most valued marriage (and, more generally, prestige) good, joining all three societies in a direct cycle analogous to a system of generalized exchange. This cycle suggests that the Tongan monopoly on voyaging and trade may have been historically recent and Tonga, Fiji, and Samoa were originally directly linked. This would be consistent with the findings of Barnes and Hunt (2005).

Some confirmation of this comes from the Polynesian-speaking island of Nukuoro in the southern Carolines where Eilers (1934:179) cited traditions of canoes from "Hiti" (Fiji) visiting or being driven to the island on several occasions. As Lewis (1972:262) pointed out, this "lies more than 1800 miles north-west of Fiji and neither winds nor currents would favour drift".

The collective quoted oral and linguistic evidence from central Oceania also appears to strongly favour a long Fijian sailing history and cross-cultural influences. Taonui (2006:32-

38) offers: "Rata is the second most well known demi-god in the Pacific after Maui ... Samoan narratives say Lata was a Fijian canoe builder who taught the Samoans and Tongans how to construct large double-hulled canoes. Tongan traditions say the guardian of the forests prevented Lasa from felling a tree to build a great canoe. During a subsequent struggle, Lasa caught the chief guardian, Ha-ele-feke, who agreed to help Lasa build the canoe and navigate it to Fiji." He goes on to note that "[t]raditions concerning the history of ruling dynasties reflect frequent contact throughout West Polynesia ... Other traditions describe contact with Niue and Fiji. A married couple expelled from Manu'a [Samoa] escaped to Niue. Their son Fitiaumua later conquered Fiji and Tonga ... Recorded intermarriages reinforce this issue. One Tu'i Tonga married a daughter of the Tu'i Fiti (Fiji). His daughter, Laufafaetonga married Tupainatuna, a Samoan. She later gave birth to her son in Fiji, with whom she returned to Samoa".

6.3.3. Was the *Drua* a Purely Indigenous Evolution or was Iron a Catalytic Factor?

Clunie (1987:16) argues that the earliest metal introduction to Tonga by European sailors was potentially a catalytic factor in the evolution of the *drua* class. "The introduction of iron and steel tools stimulated the development of the canoe by encouraging the use of *vesi* and the production of much larger vessels. In Cook's time a spectacular *tongiaki* was some seventy feet long and bore perhaps 80 men. By the 1820's when Lemaki's grandson Maopo built the *Draunivia* for Tanoa of Bau, winning his umpteenth wife, canoes had grown markedly in size and - despite the proportionally smaller deck of the *kalia* – in carrying capacity, the *Draunivia* being 105 feet long and transporting several hundred passengers". It maybe of course that the 70' *tongiaki* was only the biggest Cook saw and not the biggest there was. If Clunie is correct (and the *drua* was not therefore a purely indigenous design) then it would greatly strengthen the case for a Tongan designers claim. Against this is the continued use of largely unchanged *tongiaki* for at least 150 years (and potentially millennia) prior to the *kalia* revolution. If the *kalia* was a product, to some degree, of the influence of iron technology it would make it, arguably, the earliest industrial cultural hybrid application in Oceania post contact. In any culture's context, applying newly acquired technology to upgrading naval capacity will be the highest priority of any maritime dominated decision-maker.

Finney (1994:49) is amongst a number of commentators who notes that "at the time of European contact the Tongans were adopting a double-ended hull design and movable lateen-like sail pioneered by Micronesian sailors that provided superior performance to their

traditional canoe" and also "when Cook visited Tonga in 1774 on his second voyage into the Pacific, a new type of double canoe called the *kalia* was gaining popularity as the favoured voyaging craft". If this is correct then the iron 'catalyst' must have arrived pre-Cook as the first *kalia* were by then already in production.

If iron was in use at this time it presumably came from contact with the earlier Dutch explorers, Schouten and Le Marie in 1616 or Tasman in 1643. But Cook makes no reference to Tongans using iron prior to his arrival, and King recorded no metal tools in the Tongan carpenters' toolbox (see below). Williams (1870:83) claims that the "first iron goods [in Fiji] were introduced among the Somosomoans. The first article of steel owned by them seems to have been the half of a ship-carpenter's draw-knife, ground to an edge at the broken end. This was fixed as an adze, and greatly prized, receiving the name of *Fulifuli* after the chief who brought it to Fiji. One of their first hatchets came through the Tongans, and was named *Sitia"*.

Finney discussed the extensiveness of Tongan voyaging, including their established contact with Fiji and Melanesia, yet infers no role of non-Polynesians in canoe design or evolution from outside of Tonga. Cook's comment of the outstanding capacity of Tongan canoe builders in his earliest contact was discussed above. This level of craftsmanship was presumably achieved without influence of iron and can also be presumed to be of a level capable of producing a *drua* without iron. In King's Journal from Cook's voyage he describes the *tongiaki* hulls he witnessed as being built using only "a stone hatchet, an Augur made of Sharks teeth & rasp made of rough fish skin" (Beaglehole, 1967:1367). Anderson recorded in his Journal that "each plank is fitted with such nicety that they would do credit to an expert European artist, the only joining to be seen on the outside being a line not more open than some in our common Cabinet work" (Beaglehole, 1967: 936). There is no mention of the use of metal tools here.

Participants at the 1996 'Waka Moana Symposium' in Auckland were treated to "a carving demonstration by acknowledged Maori master carvers Dante Bonica and Charles Koro Nehu using stone adzes. The speed and precision of the removal of the wood was comparable to that of a steel adze, given sufficient technique, and that was a revelation to most of the people there" (Bader and McCurdle, 1999:70). I have also witnessed similar displays by acknowledged carvers in Te Tai Tokerau.

Shineberg (1971) and D'Arcy (2000) are amongst authorities on Oceanic history who have questioned the scale and extent that musket technology had in these islands and found its historically vaunted capacity to change history as limited and overstated. A similar argument could also be explored for the assumed influence of iron on the scale and speed at which Oceanic craftsmen could construct naval hardware.

6.4. Assembling the Cultural Record

My initial collation of the written record and analysis was largely completed by the end of 2011[138]. As discussed above, almost all of this knowledge has been reported through a Western lens. The Gillett et al (1993) field study of *camakau* and the ethno-botanical study by Bannack and Cox (1987) on Kabara are believed to be the last times that a study of the surviving cultural record related to *camakau* in the Southern Lau was undertaken. The Gillett study was particularly instructive in that the majority of the research team were native Lauans and the result was published in both Fijian and English. It was not known what cultural record of *drua* still existed in those islands or elsewhere in Fiji. Toward the end of 2011 a number of events conspired to allow a field trip to the southern Lau to assess the status.

The exploits of *Uto ni Yalo* had reignited public interest in Fiji in their sailing heritage. Feature articles on the *vaka* and the exploits of its crew were appearing regularly in the Fiji media. Coincidentally, in October 2011, Professor Hereniko, Director of OCACPS, was advised the Centre was awarded the role of the UNESCO Heritage Hub for the Pacific.

Following discussions between key stakeholders, Colin Philp (FIVS) and I approached OCACPS who agreed that the next research priority was to ascertain the status of the cultural knowledge held by the descendants of the *mataisau*, the hereditary boat building clans, of Fiji[139]. Discussion amongst key informants and members of the Lemaki and *mataisau* communities living in Suva, identified that any traditional knowledge still held was likely to

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[138] Drafts were circulated to any in my networks I thought might be able to provide constructive comment or provide sources and I have continued to update the compendium and revise the review of that information accordingly up until the time of drafting this section in October 2012.

[139] In addition to the *mataisau*, *drua* were built by descendants of Lemaki (a specialist Samoan canoe craftsman brought to live in the Lau by Tongans) and descendants of the *mataitoga* (Tongan shipwrights who established temporary and permanent settlements in the Lau). The descendants of these families are now heavily interrelated and connected.

be concentrated in a small group of island communities, primarily on the southern Lauan islands of Kabara, Fulaga, Ogea, Moce, Nayau, and Cicia, where *camakau* are still a living tradition. It was also identified that the key informants were likely to be limited to a small core of elders, a significant proportion of whom were now residing in and around Suva. USP agreed to resource an initial collection of oral record from these informants including a field trip by a research team to the identified islands to be followed by an in-depth *talanoa* of Suva-based key informants[140]. My captain volunteered our own vessel as transport. Timeframes were exceptionally tight, the cyclone season was already on us.

The research team for the task was unique. Although backed by academic knowledge and method, the field team had no formal social science academic training. It comprised two respected elders, Paula Liga from Fulaga, Fijian master carver and artist in residence at OCACPS, and Semiti Cama from Moce, an acknowledged expert *camakau* builder and sailor. Two 'youth'[141] from FIVS; Kaiafa Ledua from Nayau (traditional navigator)[142], and Peni Vunaki from Solodamu, (trainee navigator and cameraman) rounded out the team with myself and my captain, providing transport, logistics and wordsmithing support. Colin Philp and the FIVS/IUCN team took care of the financial and logistical arrangements.

I organised for the team to take instruction from USP academics with expertise in oral history recording. Pre-trip workshops were held with key stakeholders including Fiji Arts Council, Fiji Museum, and *iTaukei* Affairs prior to departure, both to inform them of the project and to seek their input and guidance. *Talanoa* was identified as the primary research method with the results, assuming the informants' agreement, to be visually and orally recorded on video and tape. *Talanoa* was, of course, a process intimately familiar to the research team.

We sailed from Suva on 5 November 2011[143] and were enthusiastically met by the inhabitants of Kabara, Fulaga, and Ogea with multiple *talanoa* being conducted at each island followed

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[140] This project was the first approved under USP's 'Research Cluster' programme and was sponsored by Prof. Hereniko as the Cluster leader with myself as the Project team leader.

[141] Which in Fiji (and much of the Pacific) can include anyone who is not an elder and some elders are still 'youth', personal observation.

[142] Kaiafa had travelled to Suva when he was 10 years old in a *drua* built on Nayau from *damanu* by his father.

[143] In keeping with the nature of research, the field trip was undertaken aboard a sail-powered ship that used less than 4 litres of diesel during the trip.

by selected interviews with key informants. We were advised it was not necessary to visit Moce as key informants had either already passed away or were in Suva. Whilst the research team was en-route to Nayau and Cicia a deepening tropical depression forced that part of the itinerary to be cancelled. Fortunately both communities were represented at the subsequent Suva *talanoa* hosted at USP on 30 November 2011.

Collectively, the field research and the Suva *talanoa* resulted in the collation of a series of *talanoa* and interviews with the last known holders of cultural knowledge recorded in raw form on digital audio and video recorders. While we cannot claim that the record collected is the sum total of knowledge held by cultural informants, we are confident that it covers the great majority. A project report has been prepared for OCACPS and two master CD's of indexed copies of all collected audio, video and still photograph records to be lodged in USP Library's South Pacific Collection and in *iTaukei* Affairs' National Heritage Database.

Our intention in undertaking this part of the research was to identify whether cultural knowledge still existed and, in the event that this proved positive, to ensure a permanent record was made while key informants were still alive to do so. In this we have been successful. The research found that a vibrant and proud cultural knowledge exists, albeit in a few isolated communities and with only a small number of individuals (many of whom who are elderly); and that there is a strong desire by the surviving *mataisau* to see their knowledge, skills, and heritage reclaimed and invigorated. Some aspects of knowledge, in particular pertaining to *tabetebete* construction and sail technology and operation, is not described elsewhere and confirms that the level of technology achieved in the construction and operation of the *drua* was highly complex and technologically advanced. In addition there was a 'by-catch' of additional and related information, for example about the building of the *Tai Kabara* by the shipwrights of Kabara in the 1980's.[144]

The research also highlighted matters of oral knowledge collection process and intellectual/traditional knowledge protection. Both matters are complex and need to be addressed carefully. At the time of writing the raw data has not been edited or translated in any way. The findings from the research presented in this section are those matters the Suva *talanoa* agreed should be presented in English at the 30 November 2011 *talanoa*. I do not profess any expertise in *Lauan* or *Bauan* and so I cannot claim to know any of the detail or

[144] See case study Section 5.1.1.

much of the substance of what was discussed in that remarkable series of *talanoa* to which I was a deaf witness. This is of no importance, what is critical is that the raw data is now held for and by future generations of *mataisau*. Although I was not privy to the detailed content of the *talanoa*, I found the project a powerful experience. All participants were overjoyed that the opportunity had arrived and hugely appreciated the process being conducted by their own researchers, according to protocol and only in local dialect.

One Kabaran listed the number of countries from which researchers had come to study his island and his culture. This was the first time he could recall a team of *Lauans* coming to learn and exchange with *Lauans* on this central icon, the *drua*. In one *talanoa* on Fulaga I looked up partway through proceedings to see our two young *bati* with tears of shame streaming down their cheeks, an extremely stern looking *Tui Vulaga,* and huge grins on the faces of our two 'kava warriors'. Only much later did I learn the story. The *Tui* had told of a dream he'd had 30 years ago where young men came to ask him the secrets of the *tabetebete drua* in his own language. Our 'lads' were being admonished for the lateness of the hour, given he was now 84.

Figure 52 FIVS Researchers Recording Traditional Knowledge, Kabara, 2011

On Kabara we were setting up the equipment in preparation for the *talanoa* that was to commence that morning when the *turaganikoro* arrived. Suddenly all preparations ceased and we were being ushered off for another cup of tea. I was sure we had breached protocol of

some sort. Sure enough the chief had stopped the *talanoa*. But only while he sent messengers to all the other villages on Kabara so that all could sit and share together rather than have us go from village to village.

In terms of cultural knowledge collection, the *talanoa* sessions followed customary protocol and were facilitated by the FIVS' researchers. Although there were minor differences with each session, the basic interview format was the same. Key informants were identified through use of existing networks prior to leaving Suva and advance notice of the research team's itinerary and purpose were sent to the island communities via the Lau Provincial Council. Upon arrival on each island, the research team presented *sevusevu* in accordance with the *mana* of the project to the highest ranking chief and discussed the purpose of the research and the *talanoa*. Following protocol, the process of conducting the *talanoa* was agreed, the ranking local chief having the final say on all matters.

Once the *talanoa* was convened, the research team gave a presentation using PowerPoint and video aids on the activities of FIVS and the voyages of *Uto ni Yalo* and the current Pacific voyaging fleet, an overview of the knowledge accrued from reviewing the previously recorded historical information on *drua* and related ship construction and voyaging across the Pacific; and issues of TK/IPR associated with the knowledge to be discussed in the *talanoa*. This was accompanied with a request to record the *talanoa* and subsequent interviews, rounding off with a summary of matters raised in previous *talanoa*.

Using leading questions, FIVS researchers facilitated the subsequent discussion. During the *talanoa* participants were asked to help identify those with the most knowledge for subsequent interview. These were conducted in smaller group sessions facilitated by Kaiafa and recorded by Peni. Following each *talanoa*, the research team debriefed and discussed the outcome, with Kaiafa and Peni interviewing Paula and Semiti on camera and asking them to summarize the learnings from the preceding *talanoa*.

On return to Suva, FIVS, on behalf of OCACPS, organized and facilitated an all-day *talanoa* at USP. This *talanoa* included those *mataisau* and Lemaki resident in Suva as well as observers from relevant agencies and ministries such as FNU, *iTaukei* Affairs, and the Fiji Arts Council. Participants were given the same background presentations used on the field trip and a summary of the *talanoa* from the Lau. A public lecture was held at the end of the Suva *talanoa* which was opened by the Vice Chancellor of USP and the Director of

OCACPS. The lecture was well attended and generously covered by local media. This lecture was the only part of the research programme which was not conducted exclusively in Lauan dialect.

To date the *talanoa*, interviews and consequent recordings have been in the vernacular, primarily Lauan dialect. It is intended that this material will only be available for translation with the permission of the *mataisau*. For this reason, the project report contains only general statements of the information recorded, as set out below.

- The *talanoa* and interview process undertaken is the most comprehensive exercise of this nature undertaken, at least since the field research undertaken by Laura Thompson (1940). It is believed to be the first time such research has been undertaken by a Lauan research team speaking in their own dialect.

- There is intense interest in preserving and enhancing knowledge of *drua* and the practical building of such vessels by the descendants of *mataisau* and Lemaki.

- Cultural memory of *drua* construction and sailing exists. This includes knowledge of rig construction and sail making. Sailing knowledge includes methods of sail reefing not previously recorded in the literature. The knowledge holders are now a small group of possibly no more than a few score, many of them of advanced age.

- The distinction between *saucoko* and *tabetebete drua* is well-known amongst *talanoa* participants. No participant had ever built a *tabetebete drua*, although the Tui Vulaga recalled being told by his uncles in his early *drua* building career how to build a *tabetebete drua*. The Tui may be the only living person with this knowledge.

- There are women who have been taught by their elders who can still build the sails for *drua*. The only literature available on this subject refers to "matting" sails. The descriptions of sails collected by the research team detail advanced technological designs and construction of great ingenuity and sophistication.

- There are memories of women *camakau* sailors and of women's *camakau* races being held in Fulaga lagoon.

- The carpenters from the various islands all agreed that each island had its own style of *drua* and that *drua* could consequently be recognised as being from a particular island.

- The last *drua* built was a *saucoko* type built for an American "Vince" in the late 1980's on the instruction of Ratu Kamisese Mara. It was called *Tabu Soro*, commenced on Ogea and completed on Fulaga before being sailed to Suva. The *drua* operated for a few years as a tourist venture in Suva, Pacific Harbour, and Denerau.

- There was repeated reference to *tabetebete drua* being used as crypts for Tui and knowledge of the site of at least one.

- In the main, the cultural knowledge collected confirms and, in some critical areas (particularly sail-making and *tabetebete* construction), extends the written record of drua construction. Some aspects of *drua* culture in the literature, such as the cultural processes recorded by Toganivalu in 1915, are no longer known by the informants in this research.

- The knowledge of *camakau* building and sailing is still practiced on Fulaga and Ogea although there were fewer craft than reported by Gillett et al (1993). It was reported that there is only one *camakau* still active on Moce. It is not known if others are still active in other parts of the Lau. Children were observed practicing *bakanawa* (racing model canoes) as an everyday activity on Fulaga.

- Building a *drua* took a community. While there was segregation of roles (e.g. men making the hulls and rigs, women making the sails), all the community, men, women, elders, and youths, came together to make the *magimagi* (the ropes and cord that bind the craft together and make it whole).

The research undertaken to date is a work in progress and only the start of what is envisaged as an ongoing and expanding programme needed to ensure the cultural heritage of *drua* is maintained as "living" tradition. The data held is still in a raw, unedited state. At the very least, a snapshot has been preserved and held for the benefit of future generations of *mataisau* and a wide ranging discussion between key stakeholders initiated situated on a comprehensive research platform.

6.5. Outcomes of the Heritage Research Programme

The research undertaken to date has achieved a range of results. Firstly, it is arguably the first time that the disparate written information relating to *drua* culture has been assembled in a single place and the data subjected to analysis and delineation of the various areas that are

agreed or disagreed in the historic record.

Secondly, and possibly most importantly, it has demonstrated that cultural knowledge of *drua* held by descendants of those that built and operated the great *drua* is not lost. That knowledge is in a fragile and vulnerable state given the highly limited number of and age of traditional knowledge holders. The cultural record now strongly indicates that archaeological remains of *tabetebete drua* may exist. Given their *tabu* status as crypts, further examination of such sites will need careful consideration before it is known whether archaeology should be pursued to confirm the knowledge of *tabetebete* construction. The report on the research undertaken (Nuttall, et al, 2012b) has been lodged with *iTaukei* Affairs and has received interest from Pacific history and archaeology expertise in Fiji, Australia, and Hawaii.

Thirdly, the process of undertaking the collection and review of data has resulted in, and contributed to, a growing awareness of the critical place *drua* culture holds in Fijian society. This is captured in the thoughts of Kabara elders whose stated vision is to see the "sleeping adzes" of Kabara reawakened to once again swing in unison in building new *drua* in the future. When aligned with other critical developments in this area, particularly the return of *Uto ni Yalo* to Fiji, the Pacific Blue sponsored annual *camakau* races, FNU's *camakau* building programme and the expanding use of *drua* and related culture in performances and other activities of OCACPS, this has the potential to lead to widespread resurgence in cultural pride and expression by Fijians and related central Oceanic cultures of their unique maritime heritage. External specialist support is needed to expand on and maximise this window of opportunity, as 'experts on tap not on top'.

The Suva *mataisau talanoa* saw the establishment of a critical network of traditional knowledge holders, *mataisau*, and Lemaki descendants linked to a wide range of key partners; in particular FIVS, USP and OCACPS, FNU, *iTaukei* Affairs, Fiji Arts Council, Fiji Museum, and Pacific Blue Foundation. The *mataisau* have called for this network to be regularly convened to ensure the momentum is maintained.

The research into cultural knowledge has demonstrated and highlighted the importance for such research to be conducted by local researchers (in this case descendants of the historic boat builders themselves) using local and culturally appropriate methodologies (in this case Lauan dialect and *talanoa*). *Talanoa* has shown itself to be a highly effective and efficient method of discussing, truthing, and recording data of this kind. In particular the research has

had the active support and participation of the *mataisau* and the Lemaki.

6.6. Applying the Lessons of the Past to the Challenges of the Future

In terms of the potential application of this knowledge from the past to future applications, fleets of indigenously owned and operated vessels, locally built from renewable resources, capable of carrying large payloads at speed over bluewater passages without use of fossil fuels appears an alluring alternative to today's expensive and unsustainable sea-transport options. That of course will not happen tomorrow with traditionally built or designed *drua*. Such ships were dangerous to operate and would certainly never pass any form of commercial survey or meet any commercial insurance test. But there is obviously a wealth of critical lessons to be learnt through examination of the past.

I was initially surprised at the lack of compiled research on *drua* given its obvious and acknowledged status and the technological level of its design capacity (the *drua* is arguably highly competitive against any other Oceanic design on all points: speed, windward performance, size, construction, sail technology). Regardless of its design origin, the *drua* was the finest technological development of Oceania and its finished form was the product of a unique and indigenous cross-cultural collaboration.

The literature on the voyaging and canoe culture of Oceania is heavily biased toward Polynesian and, to a lesser extent, Micronesian contribution, and activity. This may be explained by a number of factors including the origin of the current voyaging revival in disputing claims that Polynesians settled eastern Polynesia by drift not design, the centres of research being largely Polynesian orientated (Hawai'i and NZ in particular), a focus on long-range navigational ability, and possibly a preoccupation of researchers about where people ended up rather than with what they did within and on the Ocean.

The greatly increased windward capability of the *drua* immediately reduced the uncertainty of return voyaging capacity (assuming the vessel itself withstood the rigours of the voyage), as well as giving increased speed and performance. Within the sphere of Tongan influence this capacity was exploited to great advantage as evidenced by the complexity of the inter-island exchange and trade networks that followed in its wake, including increased martial and religious (more latterly especially Christo-Judaic) exchange as occurred with every sea-going power in the world at this time. At the height of drua culture, small remote islands were

assets and conduits to travel and commerce, not liabilities and uneconomic sources of burden as currently perceived.

Although only alluded to peripherally in this research, the 'Tongan maritime empire' appears to have been in an expansive and prosperous phase at the time European intrusion disrupted the local Oceanic evolutionary undulations. The vessel movements between Fiji and Tonga in particular were almost certainly at their highest historical levels ever in the mid 19th century, used for military and naval operations, diplomacy, trade and religious conversion and practice. Given the historical extent of the 'empire' using *tongiaki* class technology and the immensely increased capacity, especially to windward, that *drua* technology provided, it is interesting to speculate the extent it could have expanded if Europeans hadn't probed into central Oceania when they did. Would drua have reached Hawai'i and Aotearoa? Would they have displaced the local designs as quickly as they did *tongiaki?* What would have been the result to design and performance under the influence of new cultures and access to materials such as *Harakeke* (flax), *Totora,* and *Kauri*?

Critical lessons from the past that must be considered in any future application are many. Of particular importance is the learning that, regardless of the state of Fijian sailing culture pre-*drua*, post-*drua* it was exemplary and widespread throughout the archipelago. There is a demonstrated historical capacity to adapt to, develop, and exploit evolving vessel technology. Regardless of the origin of the *drua,* whichever technology transfer route was followed, the result was an inter-archipelago Oceanic collaboration where different but related cultures exploited their unique attributes (Fijian timber and technicians, Micronesian sail and design innovation, Samoan and Tongan craftsmanship, and Tongan seamanship) to produce a superior class of vessel of extreme adaptability. Just as importantly, the rapid demise of *drua* culture across central Oceania by the start of the 20th century underscores that such technological capacity, even dominance, can be lost as quickly as gained.

It is also important to recognise that Fiji has had a flourishing shipping industry of some scale providing quantity and quality high performance ships at the leading edge of local and regional market demand, even if there is dispute about whether the workforce and management were indigenous or imported. Future sustainable solutions for Fijian sea-transport are likely to be best addressed if viewed in the context of networks of related islands and archipelagos, in particular those of the old Tongan 'empire'.

In the past, indigenously managed, sail-powered fleets capable of bluewater transport of large quantities of passengers and cargo were viable before fuel-powered vessels dominated. Such fleets employed technology and materials that were largely renewable. What the long-term effect on *vesi loa* ecosystems would have been of continued exploitation due to ever-increasing demand can only be speculated on. The status of *vesi loa* reserves at the end of the 19th century is unknown. At the start of the 21st century WWF-SP determined the extent and impact of the local woodcarving industry on Kabara's local forests, specifically on *vesi*. The results indicated heavy household dependency (96%) on *vesi* for carving as their main or only source of income with poorly developed alternatives to ease pressure on *vesi* harvest. As the tree is slow growing (80+ years to mature) and with increased demand, stock on the island has been greatly diminished. Of the islands 28 km sq forested area only 8% was calculated as remaining in natural strands in 2004 (WWF-SP website).

The *drua* era was a positive and progressive one for sea-transport in the region and for the ship building industry of eastern Fiji in particular. Although it is unfair to consider the complex exchange network in such terms, ship building was arguably the biggest foreign exchange and investment earner for the indigenous governments' prior to conversion to colonially-administered economies.

Chapter 7. Charting a Course for the Future

This thesis has documented an action research process, an inquiry into the potential for alternative energy options, in particular wind power, to provide a sustainable adaptation intervention in regards to sea-transport for Oceanic communities. Just as the inquiry has been shaped and influenced by the broad *talanoa* within which it has emerged, so the research process itself has influenced and impacted that *talanoa*. In 2009, when the inquiry was centred in one remote Fijian village it was difficult to see that there was any sympathy or wider context available. As the research agenda has emerged, refocused, and widened, it has engaged with a wider audience and a slowly growing pool of participants and collaborators. Some have been eager and fully convinced of the merits and priority of the inquiry, others more hesitant and cautious, and some openly sceptical and critical.

One key underlying assumption of this inquiry, that there is a natural and fundamental interrelationship between Oceania's seafaring heritage and future sea-transport, has not been accepted by a minority, mostly non-indigenous commentators. To date no-one has questioned that sea-transport is a critical and increasing issue to the region for which it is poorly prepared and the debate inadequately characterized. It has also been generally recognised that the research agenda of this thesis has been catalytic to illuminating the issues and options available and stimulating a growing network of stakeholders toward committing to a wider research agenda. Uptake and participation has not been even across stakeholders, with key regional agencies and the existing commercial sector noticeable in their hesitation, reflecting, in my view, the conservative nature of both industries.

Like any other emerging technology or adaptation, all assumptions and findings, no matter how substantively backed by theoretical research, are going to remain tentative until trialled and proven in the field. Further uptake and extension of the agenda pursued by this thesis will always be conditional on this. By 2012 it was increasingly obvious that if the learnings indicated in this thesis are to be heeded, especially that investment in a long-term and broad programme is required, then a more formal and coordinated approach is needed than can be provided by a single thesis. In essence the research agenda had reached a stage it needed to be placed openly on the mat for critical examination from multiple perspectives and a consensus on whether and how to proceed formed.

Serendipitously USP responded favouarably to my request to host a stakeholder workshop at

the end of November 2012, in essence to truth the result of the inquiry thus far, to plan its future development and to expand the growing network. Initially we began to prepare for a largely Fijian focused event with some regional participation. Greenheart and B9 Shipping asked to participate and offered to coordinate their European and Japanese collaborators. The workshop quickly ballooned into a three-day Sustainable Sea-transport *Talanoa* (SSTT) with support and participation from a broad range of expertise, including innovators and researchers in alternative energy ship design from Europe and Japan, and universities in UK, Germany, Japan, and Australia. Local, national, and regional stakeholders were well represented, including key Fijian government ministries, SPC, bilateral and NGO agencies, cultural and voyaging societies, traditional boat builders, navigators and sailors, USP, and FNU. Senior staff from organisations such as UNESCAP, UNESCO, the International Seafarers Research Institute, and Germanischer Lloyd joined electronically. Elder statesmen such as Alastair Couper, Winston Halapua, and the *Tui Vulaga* brought dignity, *mana*, and pearls of wisdom. The gathering was a first for the region and arguably the world in bringing together such a diverse range of perspective, opinion, and expertise. The short notice of the SSTT meant some could not attend and apologies came from several stakeholders with their commitment to joining a larger event in 2013.

Section 7.1 summarizes the discussion and outcomes of the SSTT and considers the priorities needed for a future action blueprint. Information presented at the SSTT largely supports and extends the tentative *verstehen* I had already reached in this thesis. In keeping with the action research modus of the thesis, this section is intended to form the basis of a white paper from the SSTT as a basis for future discussion between key stakeholders and partners.

The SSTT did confirm that the priorities are multiple and that progressing this agenda will require an integrated approach between multiple and diverse stakeholders. An agreed framework for achieving collaboration in what is ultimately likely to be a competitive field is needed. As reported at the SSTT there is progress internationally towards forming an "International Windship Association" being led by European stakeholders. It is unlikely to be the only example of this type of initiative. Such association offers an entry point for Oceanian interests to access support and partnerships with the emerging global industry.

Over the course of this thesis I have become convinced that the interwoven issue of how relationships, collaboration, and competition between key stakeholders are now managed is the most critical priority to be addressed and will greatly affect both the efficiency and level

of future development and therefore its potential to deliver real benefit to Oceanic communities, however that may be defined. Open and honest sharing of intelligence and data, and of mistakes as much as successes, to the greatest extent possible is required. The emerging stakeholder network is embryonic. In Section 7.2 I seek to illuminate critical lessons from another Oceanic *talanoa*, that surrounding local community management of marine ecosystems that has preceded this research by more than a decade. While the subject and focus is different there are marked similarities in organisational and research issues, stakeholder groupings, and locale of the FLMMA and LMMA discourses that I contend offer some guidance for the relationship matters now surrounding the sustainable sea-transport *talanoa*.

7.1. Port of Arrival: the Sustainable Sea-Transport Talanoa, 28-30 Nov 2012[145]

The SSTT 2012 was held with the objectives of: (1) initiating a conversation between key stakeholders; (2) to canvas support for a larger, more formal conference in 2013; and, (3) to identify the key action areas needed to progress this critical debate. The *talanoa* looked both forward to the future of Pacific sea-transport in a 'climate change' and fossil-fuel scarce future and to the past, when Oceanian vessels and peoples voyaged sustainably at will. Participation, presentations, and subsequent discussion came from across the breadth of the debate, locally to internationally.

There was general agreement that the event was timely and the issue worthy of increased priority, further research, and investigation and that there is strong potential to achieve multiple benefits for Pacific Island communities. There was affirmation for the general conclusions of this research, for example that the Pacific shipping scenario is unique, that the priority is domestic shipping, and that progressing this agenda will require both a long-term programme and collaboration between multiple stakeholders. There was strong support from participants for a major conference in 2013. Working from the outcomes from the final *talanoa* sessions, I have suggested a five-strand work programme for collective action for the development of a long-term integrated programme (summarised in Table 11)

[145] The SSTT 2012 programme, presenter biographies, and presentations are available from the USP website. https://www.usp.ac.fj/index.php?id=12456. 104 people particapted with a further 14 presenting electronically.

Table 11: Work-Stream Priorities

	Work Stream	Keywords	Themes
1	**Heritage**	Drua, Vaka, Waka, Iconic, Culture, Tradition. Excellence in seafaring and vessel design/construction. Ocean as highway not barrier.	Cultural history, Archaeology, Traditional revival Carving, Weaving, Navigation, Seafaring, Voyaging
2	**SSTT 2013**	International Symposium and Drua Festival	Celebrate the Past, Prepare the Future
3	**Strategic Blueprint**	Policy Frameworks Regulatory Frameworks Economic Analysis Quadruple Bottom-line Reporting Industry-wide Assessment Integrated Approach Route Identification and Wind-Route Planning Collaborative Relationships – locally, regionally, internationally	Carbon Credits Cost/Benefit Project v Programme Bio and/or Solar and/or Wind and/or Other Owner/Operator Option Analysis Private/Public Market/Uneconomic
4	**Demonstration Models**	USP Research Vessels. An initial trial of Sustainable Village Vessels (SVV) and Greenheart (GH) type designs under a controlled programme to trial the technology, management/ ownership models and integrated trading networks	Intra-island e.g. SVVs Inter-island e.g. GH , Barges, Fishing Vessels Inter-state e.g. B9 Disaster Relief
5	**Gender & Youth**	Leadership, Capacity Building, Skill Development, Business Opportunities, Community Focus	Training, Mentoring, Team-building

The SSTT 2012 was broad ranging. The first day focussed on the lessons offered by the past, the second day on the potential solutions available or emerging locally and internationally, and the final day at what was needed to progress. A number of key themes, additional to those summarised elsewhere in this thesis, emerged over the course of the *talanoa* that are particularly worthy of highlighting.

There was further evidence that Oceania's seafaring and ship design/building heritage are extremely strong traditional and cultural icons. Revival of this provides a 'soft' entry point in garnering local community interest in and recognition of alternative energy based shipping options, particularly sail. There are numerous lessons from Oceania's unique maritime past that provide guidance for the future. Francis Hickey's presentation on Vanuatu canoe heritage reminded that Oceania's maritime heritage and innovation is extremely diverse. The voyaging revival that began in Hawaii in the 1970's is now visible across the Pacific. However, the initial emphasis on long-distance Polynesian voyaging has tended to over-shadow other aspects of this heritage across Oceania, including the still living practice found in many parts of Melanesia and Micronesia. Of particular interest to the debate on future sea-transport options is the traditional role of ships and shipping in the various complex inter-archipelagic trade networks that developed.

The urgency of the global need to move toward carbon neutral technologies was underscored by Mark Trexler's presentation that provided a sobering synopsis of future global scenarios if major reductions (of the order of 70%) in overall GHG emissions are not made immediately. For Oceania, shipping is one area where there is strong potential to achieve reductions for a relatively minimal investment.

The majority of interest and programmes aimed at advancing alternative energy shipping is currently orientated to developed world needs. There is limited activity focussed on SIS or developing nations. Di Gilpin's presentation, based on UCL analysis, showed that small-scale (less than 10,000dwt) and domestic shipping, much of it centred in developing countries, contributes a disproportionate share of the global emissions profile (4% of global cargo but 26% of all shipping emissions or approximately 1% of global totals). Shipping at this scale is excluded under the IMO's Energy Efficiency Design Index programme. There was also confirmation of likely cost increases for Pacific marine fuel under the MARPOL Annex 6 (see footnote 120, p.201).

A key lesson from European contributors is the strong trend toward research partnerships between universities, governments, and industry networks. Progressing a sustainable sea-transport agenda for Oceania will require a strong research base into the unique issues facing the region, it will need to be multi-disciplinary in nature, and alliances between local research providers and those at the cutting edge internationally need to be fostered as an early priority. There is strong interest from the international community that participated, in particular European agencies, in the situation here in Oceania and the SSTT 2012 has already led to initial discussions on future collaboration between USP, UK and Australian universities.

There is a need to take heed of the lessons learnt from past experiments. New technology and approaches must be appropriate to the Pacific settings in which they will be employed. European innovators agreed that development and asset procurement costs of the new technologies on their drawing boards would be a major barrier to the Pacific. The presentations from Mike Savins in Kiribati were particularly illuminating. There is a history of well-intentioned but ultimately unsuccessful projects to introduce alternative technologies, particularly small sailing vessels. The key message here is that simply providing vessels is not the answer unless they are entirely appropriate to the local setting, affordable, and supported across the life-cycle of the operation with special attention to the socio-cultural environment in which they will operate. All such attempts need to be well documented so that, succeed or fail, the lessons learnt are available to others in the field, and there needs to be greater linking of experiences.

There was consensus the issue is far broader than technology. Economic analysis at both macro and micro levels are a critical priority as are consideration and understanding of the socio-economic, socio-cultural and political factors. Policy and regulatory frameworks at regional and national levels need to be assessed. Given that shipping has yet to make the 'cut' in terms of identified climate change adaptation and related policy and frameworks of PICs, and regional and bilateral agencies, there is a priority need to review such forward planning to ensure the current invisibility of shipping and potential for renewables is reversed. Theoretical research must be balanced with trialling of practical demonstration models. There is sufficient background research and design now completed to justify moving to practical implementation. Access to resourcing aside, there is no compelling reason why the Pacific should not be a proving ground in this emerging field, a point made by a number of international commentators.

Captain Rounds of SPC was particularly supportive of a sea-change, pointing to current and rising local fuel costs now comprising ~40-60% of total ship operating costs, depending on the type of ship and service. Summarising the general discussion, his advice was that PIC national policy must be evolving, and "should be regularly revised to effectively support shipping and new technology especially that which has major socio-economic benefits, i.e. wind/solar/biofuel powered vessels". Such policy must capture the entire shipping sector, from build to break and all related industries. Training needs to begin at cadet level.

Rounds also opened the debate on the role of governments in providing access to vessel and industry financing through various mechanisms, potentially including providing loan security and preferred operator status for alternatively powered or retrofitted vessels. Sean Weaver introduced the potential of carbon trading to offset future shipping costs, drawing on recent experience within the Pacific forestry sector. While this will require sufficient scale to justify the cost of establishing the trading framework there is potential at least for a future scenario where not using fuel generates income as opposed to the BAU reality of ever increasing expenditure. Scoping this potential will require a higher standard of data than currently exists. The paucity and unreliability of current data for the sector was an oft-repeated issue, especially by government and regional policy-makers and researchers.

SPC's Katerina Syngellakis drew on the lessons from other Pacific alternative energy initiatives and talked about the need for planning to be critical and provide full assessment of all costs. Although there have been advances in solar, wind, and biogas/mass for electricity generation, the installation costs can be several times the cost of diesel generation. While diversification of energy supplies is a priority for PICs, time must be taken to plan strategically. International commentators, in particular Dykstra (the designers of *Ecoliner)*, Tristan Smith (UCL) and Gavin Allwright (Greenheart) all highlighted recent work looking to establish baselines of "cradle to break" and even "cradle to cradle" carbon costs across the total operating life of vessels.

For full benefit from sustainable sea-transport for Oceania to be realised, the programme needs to be driven from within the region. Having said this, a particularly encouraging trend from several international commentators was their desire to support and collaborate with Pacific partners, not because of any economic potential for their products or their research but because they recognise the scale, significance, and urgency of the problems in this region. It is too early to fully assess whether the SSTT has generated sufficient momentum and critical

mass to be self-sustaining, although there are encouraging signs to this effect. At least, the case made at the outset of this thesis, that the issue of sustainable sea-transport and alternative energy shipping is largely invisible within the region, is no longer a tenable argument and the subject now has some profile across the broader regional development agenda.

7.2 The FLMMA Example: Lessons from another *talanoa*

> *FLMMA has been working with their partners in the communities to formulate ways of addressing their marine resource management problems. Its experiences are unique and provide useful lessons that must be understood by those who are dealing with similar situations. The point to remember is that to involve people in community-based resources management requires a great deal of consultative work, goodwill, trust and commitment. The process cannot be shortened and requires patience and understanding* (Veitayaki et al, 2003:5).

Sea-transport in Oceania, whether viewed within the current frame of high overheads, low-returns and old assets or within more traditional contexts, is essentially a high-risk, marginal, and intensively competitive commercial activity. At a global level the industry is even more competitive and market driven. In an alternative energy or low carbon shipping future, competition in the market place, once alternative energy shipping is proven and embedded, is likely and presumably to be encouraged. But at this embryonic stage, where the need is still at the research and prototype phase of development, especially given the limited resources and expertise that can be expected to be brought to bear within the region, competition, unless the market chooses to invest heavily, is likely to prove an impediment.

If external assistance is requested, at least initially, then enabling coordination and complementarity of resources and skills with donors, bi-lateral partners and/or NGOs - all of whom may have differing perspectives and agendas in terms of priorities, capacity building, technical assistance, and other adaptation activities and initiatives - will be required. And determining a working programme for assessing sustainability in future sea-transport initiatives will require collaboration between multiple stakeholders. How then is this to be achieved and how can we determine if such development is, in actuality, sustainable? In closing I seek to highlight several critical lessons learnt from the FLMMA programme, an example of expanding and successful collaboration across a broad range of stakeholders and now in its second decade of operation.

The Local Marine Management Area (LMMA) programme was an outcome of various global coral reef awareness and action campaigns during the 1990's. It is an evolving network consisting of multiple stakeholders in the Pacific and Asian region (Parks and Salafsky, 2001; LMMA Network, 2002). In Fiji some parts of the programme approach resonated strongly with a number of local initiatives at local, district, research, NGO, and government agency levels. LMMA was brought home and 'Fijianised'- moulded and adapted to allow for a distinct culturally situated delivery. "Although these locally managed marine areas (LMMAs) are an innovation of the last decade, they call on a rich tradition of village management of ocean resources" (Aalbersberg et al, 2005:144). The FLMMA model is now well recognized nationally, regionally, and internationally (Veitayaki et al 2003[146]) and is being increasingly adopted across the region and in other SIS in other oceans. The Fiji LMMA programme started at a humble scale, a small handful of coastal village-based pilot projects. Despite initial scepticism of its longevity (pers. ob.) the effectiveness of its formulae spread quickly, especially after FLMMA received the Equator Award in 2002 and began to attract regular international donor funding to backstop activities.

To improve the success of conservation in the communities and attract attention to its approach FLMMA formed a learning portfolio; "a network of projects that use a common strategy to achieve a common end and agree to work together to collect, test and communicate information about the conditions under which the strategy works to enable the partners to exchange ideas and experiences. The learning portfolio enhances collaboration and also ensures lessons learnt are shared widely with people in the network" (Veitayaki et al, 2003:3). By 2009, the network had increased to include some 250 LMMA, covering some 10,745 square kilometres of coastal fisheries, or more than 25% of Fiji's inshore area[147].

Staff from various organizations working across Southeast Asia and the Pacific had recognized that although there were many initiatives involving community-based marine conservation taking place, and that many of them overlapped, they were not necessarily sharing resources or information, and thus not learning as much as they could from each

[146] There is extensive literature on this model, its PLA origins and evolving methodological and philosophical frameworks. In addition to the references quoted numerous authors have now commented, see in particular South, Aalbersberg, Tawake, Bogiva, Thaman, Veitayaki, Meo, Bogiva, Gowan and Parras.

[147] http://www.equatorinitiative.org/index.php?option=com_winners&view=winner_detail&id=73&Itemid=683

others' successes and shortcomings[148]. Initial success brought with it a range of problems, not least of which was a burgeoning number of stakeholder partners, often competing for a limited pool of external resourcing. Such competition posed a threat to the overall philosophy of the underlying PLA methodological approach underpinned by an ethos of 'experts on tap not on top'. The LMMA focus broadened by necessity to include aspects of national and international policy and regulation. There was increasing cross-country interaction including multiple and international research agents, some with greater understanding and cognisance of local situations than others. Although the network looked initially at various options for self-regulation, including formal and/or legal agreements or MOU, essentially these were judged to be self-defeating. A collaborative approach hinged on the threat of legal enforcement is unlikely to be satisfactory. While none would claim the progression has always been positive or seamless, its overall success cannot be denied. There are elements of the (F)LMMA 'recipe' that warrant cognisance for a future sustainable sea-transport agenda.

Ultimately the basis for collaboration "came from a 'Social Contract' [a mutually agreed framework governing the relationship between the collaborators] as the means of providing this agreement on operating principles, recognising the internal differences between partners and allowing for this diversity to support the common objective at village level" (Tawake, A. pers. com. 2010). The Social Contract set out a common vision and emphasised values of commitment, teamwork, objectivity, transparency, empowerment, respect, fun, and quality (Veitayaki et al, 2003:4). Today, with the LMMA network expanding across the Pacific/Asia region, a Council – consisting of representatives from each country network – governs the overall network, while a Network Support Team – consisting of a management unit, technical advisors, and country network coordinators – carries out administration and implementation of activities.

Another critical learning from FLMMA is the role that USP has played as a coordinating and mentoring agent, bringing together community, government agencies and decision-makers, NGOs and international partners, and acting as clearing house and disseminator of information and academic analysis to underpin 'on-the-ground' activity at community level. USP is uniquely positioned to do this, given its regional status and profile, strong history of proactive and community-based research, and connectivity with the international academy.

[148] http://www.lmmanetwork.org/whoweare/history accessed 2 July 2013.

Finally, I wish to underline the capacity of the LMMA agenda to adapt to its own critical learnings. In doing such it has proved a true example of PLA in practice. In its earliest genus, LMMA was a conservation and western science driven intervention, spawned as it was from a Biodiversity Conservation Network project arising in turn largely from growing global concern over threats to coral ecosystems. Part of the 'Fijianising' of the FLMMA evolution was a progressive push into social (leading directly to economic) and cultural drivers. Conservation imperatives were edged out by a community-orientated 'food security' bootstrap, the need for conservation outcomes to be matched by local and sustainable economic development ones and each in turn increasingly challenged to be situated more directly within a broader heading of (re)building or empowering community resilience.

One of the hallmarks of the FLMMA experience has been its emphasis on embracing elements of traditional knowledge and cultural institutions, initially as an adjunct or support player to western science and increasingly as a partner, perchance a dominate one. The importance of the 'science' of data collection and monitoring the changing physical characteristics of reef ecosystems, an early dominant debate, has now paled against more intricate discussion on cultural, traditional, economic and social aspects of the agenda[149].

I find parallels and relevance in all these lessons for the now emergent debate on sustainable sea-transport. For example there are parallels between the initial FLMMA prioritisation of science and the current focus on technology for sea-transport. As stressed previously, seeking alternative means of propelling vessels requires more than just alternative technology. It offers opportunity to explore other potential paradigms in which such vessels might operate and other benefits than greater profitability or reduced fossil fuel dependence. These include the potential for alternative sea-transport paradigms to better service community development with increased control over transport at more local or dissipated levels. With regard to the FLMMA experience there is definitely the potential for the same issues of competition versus collaboration, for whether the focus should be at community or national or international level, for whether research or practical demonstration should lead and whether policy should follow, that FLMMA has grappled with since its inception.

Progressing the sustainable sea-transport agenda could be about much more than just

[149] See for example Aalbersberg et al 2005 and Veitayaki et al 2011. Also the numerous papers and reports at http://www.lmmanetwork.org/resourcecenter

technological progression within an industry. But unlocking such potential will require dedicated and focussed discussion. It will require a shift in paradigm as to how such conversations are conducted. As Elliot and Fagan (2010:82) have already signalled, "many current adaptation programmes are being conducted in similar ways to most development work (that is, top down with limited community engagement) ... A crucial task is to create better mechanisms to allow communication and decision making among donors, governments, and affected communities".

Assuming the debate can be progressed satisfactory to the point of introducing new craft and approaches to sea-transport, how then to determine its sustainability? Providing an alternative to fossil fuel does not necessarily equate to real savings of energy or cost and, as Syngellakis underlined at the SSTT 2012, the whole of the technology needs to be evaluated on a life-cycle basis, not just the fuel, to determining real carbon footprints of assets and operation. But sustainability is about much more than developing or introducing new technology or reduction in fuel dependency and carbon emissions. And to determine the sustainability of any new adaption over time a comprehensive framework is required.

Since the introduction of 'sustainability' in the 1980's, versions of a 'triple value baseline' (e.g. Barbier, 1987) have been suggested, often illustrated by the Venn diagram in Figure 53.

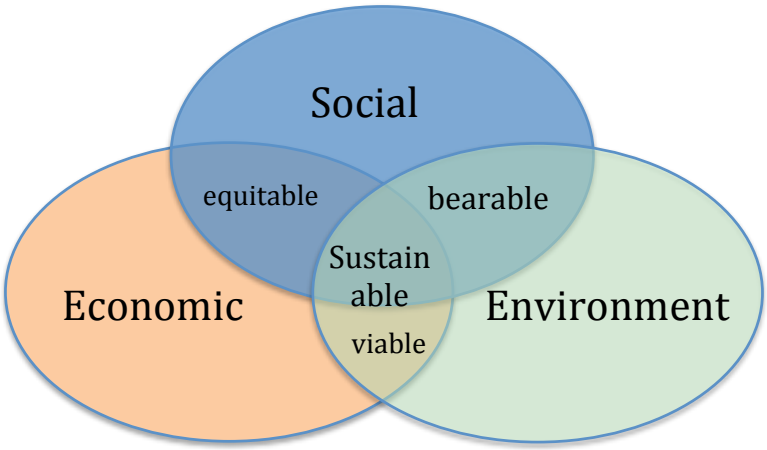

Figure 53 A Triple Baseline Approach to Sustainable Development
Source: after Barbier (1987)

This concept of sustainable development involves three equivalent components: environmental, economic, and social development; as well as three dimensions of wellbeing, i.e. economic, ecological, and social, and their complex interrelations (Ciegis et al, 2009).

There are many variations. Ghosh (2008) for example presents the concept of sustainable development as a geometric shape, a triangle.

The Oceanic perspective highlights a critical issue – the recent debate about sustainability has struggled to include cultural dimensions. However, culture is now being viewed by a number of commentators as the fourth pillar of sustainability and the need to integrate the four fundamentals of environment, culture, economy and society is seen as an imperative if people and communities are to address their present and future in a meaningful way (see for example Duxbury and Gillette (2007) for a summary of this area). Figure 43 (p.204) illustrated how a quadruple bottom-line was used in Solodamu in this research programme to attempt to capture the aspect of culture within an assessment of effect on well-beings.

The increasingly extensive global literature being spawned as a result of international assessments on climate change are quickly adding to tools and analyses of participatory processes and assessments. The idea of usable knowledge in climate assessments stems from the experiences of national and international bodies that offer credible and legitimate information to policymakers through transparent multi-disciplinary processes (Lemos and Morehouse, 2005). It requires the inclusion of local knowledge, including indigenous knowledge, to complement technical understanding generated through scientific research and the consideration of the role that institutions and governance play in the translation of scientific information into effective action.

Culture is a glue of similarity and sociability that grounds people's society and identity. It has a pluralistic base, communities and people can each have their own ways of seeing, thinking, meaning, relating, and connecting to nature. Cultural sustainability includes all these elements as well as belonging; community and identity as sources of resilience; self-governance, self-management and cultural autonomy; and indigenous knowledge and traditional practices of sustainability that broaden the scope of valid knowledge.

Regardless of whether three well-beings are identified or four, and the models become ever more sophisticated[150], they share the commonality of a concept of overlapping but somehow comparable or equitable classifications of values.

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[150] For example strategic planning assessments for Melbourne in 2011 use a multi-dissected compass rose identifying the cardinal points as Economics, Ecology, Culture, and Politics. http://citiesprogramme.com/aboutus/our-approach/circles-of-sustainability accessed 2 July 2013.

To return full circle to the Oceanic perspective described as the lens of this inquiry in Section 2.1. Ultimately Hau'ofa concluded that it was in culture, not just as tradition but the expression of a people in its fullest flower, that ultimate direction lay. If this is correct then he may have considered a more appropriate framework than those discussed above to be illustrated by Figure 54, although Diaz may prefer the rendition in Figure 55.

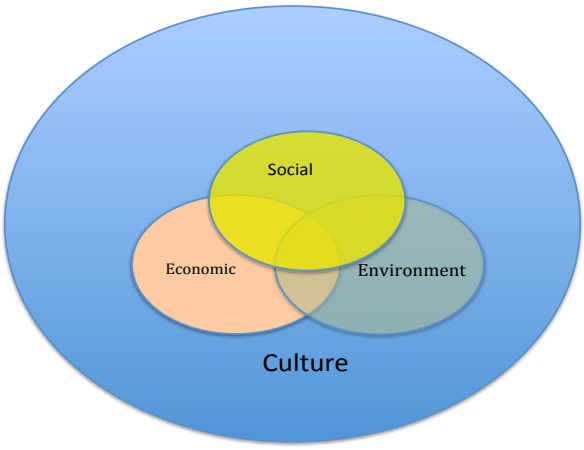

Figure 54 Conceptualisation of Sustainable Development from an Oceanic Perspective, with All Other Well-Beings Situated in an Ocean of Culture (after Hau'ofa)

Figure 55 Conceptualisation of Sustainable Development from an Oceanic Perspective, with All Other Well-Beings Situated in an Ocean of Canoe Derived Culture (after Diaz)

Today in Oceania sea-transport is primarily a commercial and economic activity. And it is to detailed economic analysis that this inquiry needs to now turn. But for alternative options to demonstrate sustainability, economic viability ultimately must be considered within its broader social and cultural context. "Since not all economic development is alike in its ability to benefit those in poverty and in its impact on society, it is useful to derive principles that can guide the development priorities. These may differ across different Pacific societies and contexts" (Coates, 2009:32). Coates offers the following principles that present as a valid starting point for future discourse

- Sustainable – environmentally, socially, culturally; economically and financially,
- Broad based – with equitable distribution of the benefits, including for women and disadvantaged groups,
- Appropriate – to the culture and situation (no 'one size fits all' approaches), and
- Scaleable – to the Pacific's resources and needs.

This inquiry into the potential application of sail technology in Oceania has been an action-research one. This written thesis contains the results of the 'research' side of that equation. Encrypted into the sub-text throughout are the results of the 'action'. Although the information, data and experiences that were brought by participating parties to the SSTT 2012 are vitally important, arguably more so is the networking, relationships and understandings reached between the human agents to whom responsibility falls to now prosecute or not further interrogation, research and action. The process of the inquiry itself has proved catalytic in provoking and fuelling the growing discourse on this agenda. This has been visible in both heritage research as was discussed in Chapter 6 and in discussion on future application of alternative sea-transport as evidenced in the response to the SSTT 2012. The role it has played in stimulating and informing exchange and analysis between often disparate players that has taken place in numerous conversations, large and small, has been a largely social and oral process that is not so easily captured in pages of text. For my own part as researcher and recorder they have been the most influential and I suspect, will be the more enduring.

As I have alluded throughout, the findings of this research process can only be considered as tentative at this stage, although I argue strongly that sufficient evidence has been presented

here to support the overall case that there is sufficient potential to warrant further investigation and prioritisation of this agenda. The empirical case for now moving practically toward a low carbon shipping profile for Oceania must be backed by both hard economic analysis of the sector and the options that alternative vessels and operations might offer Oceanic communities at all levels, from individual villages to nation states and regional trading networks. Such analysis must be conducted at both micro and macro levels and must fully consider the potential for secondary and tertiary costs and benefits while being cognisant of the issues Coates underscores above. Regardless of all other factors, financiers, governments and the commercial industry will ultimately only respond and embrace change if the end balance sheet shows a stronger financial position to current options. And, as underlined throughout this thesis, acquiring such knowledge will need a collaborative and coordinated push from across a spectrum of interests.

Data to support such analysis is the potential nemesis of such inquiry. Hard figures and statistics are always a potential bugbear in SIS and developing world situations and in the arena of domestic sea-transport this is particularly true. Real-world data for passenger numbers, cargo quantities, actual fuel usages, vessel performance and trips is often either simply not recorded or accessible, missing, fabricated or totally unreliable. Improving the quality and quantity of data and the ability to access or share data between relevant operational, regulatory and research agencies is essential if any economic analysis is to be possible.

Even with the economic analysis, the case must finally be proven practically through the physical demonstration of pilot vessels and operational structures. Such modelling needs also to be sufficiently diverse to include a number of vessel types and scales and arguably more importantly an emphasis on the operational, ownership and management models needed to use such technology. Again, as I have discussed elsewhere, this will require a comprehensive, long-term and broad research programme; individual, one-off, short-term projects, no matter how well intentioned, have as much potential to damage or impair the overall outcome as they have to provide benefit.

And, ultimately the results of such analysis must be assessed to understand its potential for transferability or replication in other Oceanic settings. The assumption and tentative finding of my research programme is that the illumination provided here from a Fiji based focus on an issue of extreme importance for all Oceania will have relevance to other Oceanic

communities needs to be tested more rigorously than I have done. Unfortunately, achieving this outcome was beyond the scope of this thesis although it now looms large on my future horizons.

Malo.

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